YSSP2024

A new generation of scientists

Participants and calendar overview

Young Scientists Summer Program

International Institute for Applied Systems Analysis

YSSP Summer Calendar

JUNE 2024

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
					1	2
3 Opening day Dinner at local wine tavern	4 Briefings with ICT	5 1st Tick vaccination YSSP Weekly Exchange	6	7 Introduction presentations	8	9 Guided tour through Vienna
10 Individual meetings with the YSSP Dean	11 Individual meetings with the YSSP Dean	12 YSSP weekly exchange	13	14	15 YSSP Trip to Schneeberg	16 YSSP Trip to Schneeberg
17	18 Lunch with Council	19 YSSP weekly exchange	20 IIASA Interaction Festival	21	22	23
24 Group photo	25	26 YSSP weekly Exchange Movie night	27	28	29	30

JULY 2024

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1 Systems analysis reading group	2	3 2nd Tick vaccination YSSP weekly exchange	4	5	6	7
8	9	10 Manuscript WS YSSP weekly exchange & Movie night	11	12	13	14
15	16 Zenodo/Open data talk followed by joint mingling with ISMOSYS participants	17 YSSP weekly Exchange	18 AEMS visit	19	20	21
22	23	24 YSSP weekly exchange Movie night	25	26	27	28
29	30	31 YSSP weekly exchange				

AUGUST 2024

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
			1	2	3	4
5 Systems analysis reading group	6	7 Manuscript review WS YSSP weekly exchange	8	9	10	11
12	13	14 YSSP weekly exchange	15 Holiday - IIASA is closed	16	17	18
19	20	21 YSSP weekly exchange	22	23 Final presentations	24	25
26	27	28 Negotiation WS YSSP weekly exchange	29 Farewell banquet	30 Wrap up day	31 Departure day	

Biographical sketches & abstracts

Table of Contents

Linara Arslanova

Mentors: **Ian McCallum, Milutin Milenković**

Research Project: **Disentangling Complexities and Interactions of Multiple Ecosystem Services Using Functional Connectivity at Small Landscape Scale**

Abstract: The research proposal aims to develop an algorithm for mapping small-scale agricultural patterns using Synthetic Aperture Radar (SAR) data. To achieve this goal, the plan is to extract the signals of these patterns, conduct system identification, and signal decomposition. This proposal aims to enable the development of a mathematical model that describes how signals from sub-pixel level patterns contribute to the overall composition of the pixel-level SAR signals acquired by Sentinel-1 satellites. Methodologically, the project plans to utilize a combination of data-driven approaches and signal-processing methods. This research holds the potential for significant impact in both academic and practical areas of food security. Successfully addressing the proposal's aim, the expected outcomes will include a robust mathematical model for SAR signal decomposition and a scalable mapping tool for agricultural monitoring, addressing global food production challenges and sustainable land management.

Biographical sketch: Linara Arslanova, a Ph.D. student at Friedrich-Schiller University Jena. Her work focuses on using Synthetic Aperture Radar (SAR) time series and spatial analysis to develop mapping applications. She is particularly interested in using optical and radar remote sensing in precision farming and crop monitoring. She has contributed significantly to the Radar-Crop-Monitor project, utilizing Copernicus Sentinel-Satellite data to enhance agricultural monitoring.

Ted Buskop

Mentors: **Stefan Hochrainer-Stigler, Robert Sakic Trogrlic**

Research Project: **Plausibilistic Climate Impact Storylines: Managing Climate Risk Uncertainty at the Regional Scale to Foster Robust, Equitable, And Effective Adaptation Measures**

Abstract: Bringing information on changing climate risks to the regional level is essential to accelerate adaptation processes and facilitate risk-informed decision-making. However, uncertainties in climate projections and socio-economic changes complicate the creation of actionable information. Rather than being paralysed by uncertainty, decision-relevant scenarios that highlight the range of plausible futures and associated climate risks need to be created.

This research aims to develop a methodology for 'plausibilistic storylines' to create decision-relevant top-down storylines. These storylines are plausible realisations of the future that highlight the range of future risk. These can help identify distributional impacts and inform robust adaptation options across potential futures. In these plausibilistic storylines, we integrate plausible socioeconomic changes with probabilistic flood hazard information for various climate storylines. Using plausibilistic impact storylines, we can explore if, when and how these impact different parts of society. This information will form the basis for finding adaptation options at a regional level to obtain robust and equitable risk management plans in the region facing large uncertainties. We highlight the method using a riverine flood risk case in Latvia and utilising a combination of hazard modelling through a statistical weather generator, hydrological, flood, and impact models. We then identify scenarios of interest using analysis tools for scenario discovery from which we find who is affected, how often and adaptation effectiveness for the different groups. The method should improve risk-informed decision-making by reducing future scenarios to ones that are decision-relevant and represent the envelope of risk mechanisms.

Biographical sketch: Ted Buskop is a second-year PhD candidate at VU Amsterdam's Water and Climate Risk group, with a strong collaborative role at Deltares's Climate Adaptation department in The Netherlands. He works on bringing climate change risk information down to the regional level and helping them gain insight into a range of future scenarios so adaptation planning can be enhanced. His journey began with an MSc at TU Delft in Policy Analysis and Engineering, specialising in water management, positioning him at the interface of science and policy.

Merav Cohen

Mentors: **Brian Fath, Elena Rovenskaya**

Research Project: **Covid-19 As A Major Global Disruption to Examine Social-Ecological Systems Resilience Theory**

Abstract: What prepared some communities for the Covid-19 pandemic more than others? The complex impacts of Covid-19, resulting from direct and indirect interactions between the social and biophysical world, occurring globally practically simultaneously, provide a rare opportunity to explore how such interactions affect societal resilience. We examine whether generalized principles, which have been associated with SE systems resilience (e.g., diversity, redundancy, modularity, social capital), actually contributed to their capacity to endure and manage the Covid-19 crisis. The project compares three regions in Europe, in collaboration with eLTER RI. We identified the major Covid-19 impacts through an extensive literature review complemented with a localized case analyzing >900 publications by media, government, and NGOs. We then established indicators and are currently collecting available information for these impacts, for each study site (e.g., morbidity, excess mortality, bankruptcy, unemployment, school days lost, inequality rise). Additionally, we are collecting background socio-economical and spatial-environmental site characteristics which relate to the resilience principles (e.g., demographic diversity, diversity of employment/business, connectivity/remoteness of population and employment, healthcare capacity). These two sets of data will serve as a foundation for interviews and group conversations with stakeholders in which we will use fuzzy cognitive mapping to build mental models of impacts, contributing factors, and the relationships between them. Results will be compared to identify correlations between site characteristics and the impact it endured from Covid-19. This study will provide a nuanced understanding of societal resilience factors to guide future research, governance, and eLTER RI data collection standards.

Biographical sketch: Merav is a doctoral candidate in the Faculty of Architecture and Town Planning at the Technion - Israel Institute of Technology. Her research, conducted in Assoc. Prof. Daniel Orenstein's Social Ecology Research Group, explores socio-ecological resilience with a focus on the Covid-19 pandemic as a case study. Previously, Merav was a corporate attorney in the field of energy and infrastructure (Tel-Aviv), worked on a collaborative EU-China environmental governance project (Beijing), and managed a non-profit sustainability program (New York). Merev holds an MPA in environmental science and policy from Columbia University, and an LLB (law) from the Hebrew University of Jerusalem.

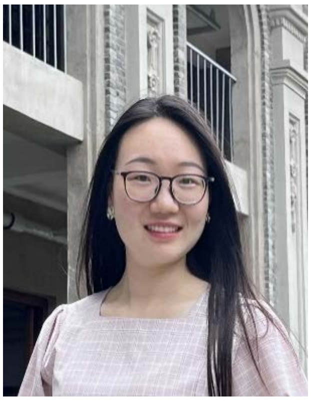
Todd Davies

Mentors: **Gergely Boza, Elena Rovenskaya**
Research Project: **Population Ecology as Lens for Competition Law**

Abstract: Competition law is replete with ecological metaphors. Yet despite the parallels between markets and living systems being well recognised, competition law analyses commerce almost exclusively through the lens of neoclassical economic theory. This *economic style of reasoning* is common in contemporary law and regulation, yet it is used particularly heavily within competition law. Indeed, the discipline insists on fitting markets into the "procrustean iron bed" of economic models, which focus almost exclusively on the outcomes of competition instead of the process by which that outcome is achieved.

Dissatisfied with the status quo, scholars have long called for an approach to competition law which draws from other disciplines, particularly ecology and evolutionary biology, in the hope of providing a more realistic view onto the dynamic and messy reality of markets. Yet attempts to build a bridge between competition law and the world of empirically grounded and mathematically rigorous ecological theory are sparse. This research project goes beyond the ecological metaphor, and takes the link between market competition and ecological competition seriously. It seeks to exploit the fact that ecology places a greater analytical focus on aspects of competition which economics has tended to overlook, including the structure, heterogeneity and process of competition. The project seeks to build the foundation for a bridge between competition law and ecology, by showing how concepts from ecological science can be applied within competition law analysis.

Biographical sketch: Todd is a 2nd year PhD candidate in competition law at University College London. His research focuses on the process of competition, particularly in digital markets characterized by Big Tech "ecosystems". Drawing from theoretical ecology, his project develops new theories of harm to motivate legal interventions that safeguard the process of competition. He is also interested in leveraging competition law to promote democracy and economic plurality. Todd holds a Bachelor's degree in computer science from the University of Manchester and a Master's degree in political science from the Technical University of Munich. Prior to starting his PhD, he worked as a software engineer at Google.



Siyu Gao

Mentors: **Georg Pflug, Stefan Hochrainer-Stigler**

Research Project: **Evaluating Multi-Hazard Resilience of Urban Multi-Modal Transportation Networks**

Abstract: Urban multi-modal transportation networks (e.g., interconnected metro, bus, tram) are vital for socio-economic development and citizens' well-being. However, they face susceptibility to natural hazards such as extreme rainfall, storms, and floods, exemplified by Budapest's river floods in 2013, 2020, and 2021, disrupting urban transportation. This threat extends to other Danube cities, necessitating further research on how multi-hazards can impact the performance of urban transportation networks, aiming to mitigate infrastructure malfunctions and societal disruptions in this important area of the EU. An in-depth exploration of urban transportation resilience must consider the direct aftermath of the event and its reconstruction period. Disruptions due to multi-hazards not only cause socio-economic losses during the event and directly after, but also amplify losses with a prolonged recovery period.

To bridge this gap, this study scrutinizes the resilience of urban multi-modal transportation under multi-hazards, simulating frequent regional hazards. The focus will especially be on the interdependent relationships among urban transportation, recognizing potential cascading failures and focusing on urban areas within the Danube Region. The study assesses system risks, considering both direct and indirect influences during vulnerability and recovery. System resilience is analyzed by integrating vulnerability, recovery, and risks, enhancing complex system risk management decision-making processes. The results should be beneficial not only for policy making for the specific case study but also can provide a way forward within the broader context of urban resilience in regard to multi-hazard events.

Biographical sketch: Siyu Gao is a second-year PhD Candidate in the Department of Water and Climate Risk at the Institute for Environmental Studies at Vrije Universiteit Amsterdam. Prior to this, Siyu earned her Bachelor’s degree in Construction Cost from the Civil Engineering School, Chang’ an University, China, in 2019 and obtained her Master’s degree in Management Science and Engineering from Northwestern Polytechnical University, in 2022. Her PhD project focuses on revealing the evolution process of resilience of urban multi-modal transportation networks under extreme weather as well as the development of practical adaptation strategies.

Benjamin Goffin

Mentors: **Juan Carlos Laso Bayas, Ian McCallum, Fernando Orduña Cabrera**

Research Project: **Mobilizing Crowd-Sourced Data and Earth Observations from the International Space Station to Capture Climate-Induced Patterns in Crop-Water Stress**

Abstract: Driven by climate change, agroecosystems are expected to be facing more weather extremes and water scarcity in the coming years. In this context, monitoring crop-water stress through time and space is critical. The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) was launched in 2018 to capture heterogeneous patterns in crop-water dynamics with an unprecedented spatial, temporal, and spectral resolution. However, ECOSTRESS observations have only been corroborated over localized study sites and limited climate zones. Therefore, I propose to leverage the latest crowdsourced inputs together with authoritative data to better explain variability in remotely sensed crop water stress. Specifically, I am interested in harnessing information on agricultural parcels from crowdsourced mapping systems like CropObserve (previously developed by IIASA as part of the E-Shape project from the European Union's Horizon 2020 program) and other sources, to examine spatial variations in ECOSTRESS against different crop types (RO-1) in across certain regions (e.g., Belgium, Kenya, Mexico). Ideally, the data will also enable tracking changes in reported phenological stages against temporal fluctuations in ECOSTRESS signal (RO-2). The main expected outcome of this project is a dual proof of concept, demonstrating that (1) Citizen science and crowdsourced data are useful tools to validate ECOSTRESS observations, and (2) ECOSTRESS data can accurately capture areas of sub-optimal crop productivity in support of agricultural management and more broadly, global food security.

Biographical sketch: A native from Belgium, Benjamin Goffin completed his undergraduate studies at Bluefield State University in West Virginia (2016) and earned a Master of Science in Civil Engineering from the University of Virginia (2018). After working in industry for several years, Benjamin returned to the University of Virginia to pursue doctoral research under the mentorship of Prof. Venkataraman Lakshmi. Benjamin was recently part of NASA Applied Science' Capacity Building Program where he applied the lens of NASA satellites to capture plant water demand and increased wildfire risk in the face of a megadrought. Ultimately, Benjamin's Ph.D. dissertation aims to gain new insight into water-related issues on the ground by leveraging information from various sensors in space.

Teresa Lackner

Mentors: **Sebastian Poledna, Luca Fierro**

Research Project: **Retrofit To Prosper? Macroeconomic Effects of Accelerating the Energy Efficiency Renovation of Residential Buildings**

Abstract: Accounting for 50% of final energy consumption and one third of energy-related emissions, the building sector holds considerable potential for climate change mitigation in the European Union (EU). Due to the longevity of the building stock, the phase-out of fossil heating systems and increased thermal renovation of existing buildings constitute major levers. Studies for the EU estimate that annual investment needs to increase by a factor of 2-3 to comply with climate targets. Such large-scale investment, which involves a majority of national households, raises many questions regarding macroeconomic and distributional effects. However, the economy-wide assessment of energy efficiency investment in the building sector remains a considerable gap in the literature. The proposed work aims to provide a novel quantitative economic assessment of accelerating the energy efficiency renovation of residential buildings in Austria and investigate different ways to fund the transition. Based on the macroeconomic agent-based model by Poledna et al. (2023), which considers detailed inter-industry linkages and out-of-equilibrium dynamics, the analysis quantifies the immediate economic stimulus via increased demand for building systems and services as well as ripple-through effects to other parts of the economy such as labor or material shortages, balance of trade effects and changes in private consumption due to energy cost savings. Results of this project thus contribute to a better understanding of risks and opportunities as well as the role of institutions which is pivotal to provide agile advice for policymakers on viable measures to foster the green transition of the building sector.

Biographical sketch: Teresa Lackner is a third year PhD student in Economics at the University of Graz where she is affiliated with the Graz Schumpeter Centre and the Wegener Center for Climate and Global Change. She obtained her master’s degree in Political and Empirical Economics from the University of Graz in 2021 and her bachelor’s degree in Economics in 2019. Her research interests include the political economy of climate change, macroeconomics of the green transition, distributional effects of climate policy and agent-based models.

Akaraseth Puranasamriddhi

Mentors: **Reinhard Mechler, Muneta Yokomatsu**

Research Project: **The Fiscal Implications of Climate Risks to Critical Infrastructure: A Cross-Country Analysis**

Abstract: Climate change leads to an increase in both the frequency and intensity of extreme weather events. They pose substantial risks to critical infrastructure and can cause major societal and economic disruption, which can lead to severe, long-lasting effects on fiscal stability. Governments are central in responding to the consequences of climate risks, yet there are relatively limited studies that focus on the impacts of climate risks to critical infrastructure on fiscal resilience. The research therefore aims to understand and quantify the fiscal implications of climate risks to critical infrastructure. It has two main objectives: (1) producing a cross-country analysis on the fiscal implications of climate risks to critical infrastructure from a bottom-up perspective, and (2) quantifying the fiscal benefits of adaptation for resilient infrastructure. The research will produce climate and adaptation scenarios and estimate the fiscal outcomes across multiple climate hazard types and levels of occurrence probability. The results of this research will help recognising specific variables, trends, and relationships that are most influential in enhancing fiscal resilience, as well as identifying countries that require the most financial support, and at which extent, to deal with potential large-scale climate shocks.

Biographical sketch: Akaraseth is a DPhil Candidate at the Environmental Change Institute, University of Oxford. His research focuses on quantifying the fiscal implications of climate risks and the benefits of infrastructure adaptation on enhancing fiscal resilience. Akaraseth holds an MSc (Distinction) in Engineering for International Development from University College London and a BEng in Electrical Engineering with minors in Economics and Anthropology from McGill University. His main fields of research interest include climate, nature, and systemic risks, climate adaptation, disaster risk financing, and their implications on public finance and sustainable development.

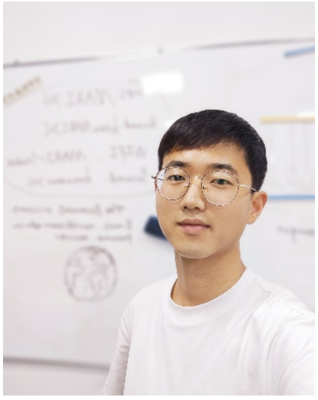
Oleg Sviridov

Mentors: **Artem Baklanov, Johannes Bednar**

Research Project: **Defining Carbon Responsibility: A Review of Emission Allocation Methods**

Abstract: Since the beginning of the industrial revolution, CO2 emissions have been accumulating in the atmosphere. With the carbon budget for limiting warming below 1.5°C almost depleted, the question of who is responsible for this emission stock and its detrimental impacts becomes increasingly pertinent. Emitting entities are beginning to be held liable for their emissions, yet there is no unique way of determining what emissions an entity should be responsible for, nor what these entities are (companies, consumers, whole countries, etc.). There are many different approaches by which these emissions can be allocated to agents and "fairness" rules that are supported by these approaches. In the literature, one can find both corner cases of two opposite approaches like 'production-based' and 'consumption-based' rules with their various combinations, and some alternatives ways such as 'investment-based' rules focusing on capital for production. Our study is a review of existing methods for allocating emissions between agents. Moreover, we propose a simple dynamic supply chain model, where at each step we detect emissions, by whom they are produced and who is the beneficiary of these emissions. We use this model to structure different approaches of emissions attribution and the "fairness" rules on which they are based. The model clearly shows not only which parties pay, but also which parties are exempted from paying in each allocation rule. Our research helps answer questions such as 'What are the implications of allocating emissions to countries producing goods, consuming goods, or companies owning and generating capital in the production process?' or 'Should fossil fuel companies be responsible for emissions arising from the use of their goods, utility companies burning those fossil fuels, or energy consumers?'.

Biographical sketch: Oleg is the 1st year PhD student at "Regional and Industrial Economics" program and research assistant at International Laboratory of Game Theory and Decision Making of HSE University in St. Petersburg. He is mainly interested in game theory, microeconomics and decision theory. His research focuses on foundations of different solution concepts and rationality of players. Oleg received his Bachelor's and Master's degrees in Applied Economics from the HSE University in St. Petersburg.



Haodong Wei

Mentors: **Milutin Milenkovic, Ian McCallum, Steffen Fritz, Linda See**

Research Project: **Exploitation Of Optical and Radar Data for Mapping Diverse Cropping Patterns of Paddy and Upland Fields in South China**

Abstract: Due to superior hydro-thermal conditions, there are remarkably diverse intra-annual cropping patterns of paddy and upland fields (CPPUs) in South China, e.g., single/double-cropping paddy fields and paddy-upland rotations. However, due to urbanization, industrialization, and climate change, CPPUs in South China have undergone drastic changes in the past decades. It is noteworthy that crop types and agricultural management practices vary greatly between paddy fields and upland fields. Therefore, significant changes in CPPUs may have potential impacts on food security and the ecological environment, which need to be further investigated. To address these knowledge gaps, accurate spatial distribution information on CPPUs is essential. Here, we aim to develop a method to integrate Sentinel-2 (S-2) optical images and Sentinel-1 (S-1) synthetic aperture radar (SAR) images to map CPPUs in South China, where cloudy and rainy weather is frequent. Specifically, we will first map the cropping intensity by extracting complete crop growth cycles using time-series vegetation index data from S-1 and S-2 images. Then, in each cropping intensity layer, time-series optical- and SAR-based features related to rice flooding signals will be individually input into the Gaussian mixture model at the pixel level to derive the count of rice transplantation periods and its probability for each pixel. Finally, the probabilities of optical- and SAR-based classifications of various cropping patterns will be fused using a Bayesian method to generate the final CPPUs identification results. The CPPUs map can provide critical information for supporting agricultural decisions regarding water management and crop planting structure adjustment at large scales.

Biographical sketch: Haodong Wei is a second-year PhD student at the College of Plant Science and Technology, Huazhong Agricultural University, China. His research interests include land use/cover mapping, machine and deep learning models, and agricultural sustainability. Currently, he focuses on mapping crop types/cropping patterns with high-resolution imagery and on using agro-ecosystem models to assess the impacts of cropland changes on agricultural sustainability. He received his Bachelor's degree in Geographic Information Science (GIS) from the College of Resources and Environment, Huazhong Agricultural University, China in 2020.

Wen Yi

Mentors: **Nikita Strelkovskii, Elena Rovenskaya**

Research Project: **Arctic Shipping Emissions Projections Under Multiple Global-Arctic Coupled Scenarios**

Abstract: The increasing importance of the Arctic region in global maritime trade and the need to address all sources of emissions for effective climate change mitigation underline the significance of shipping emission projections in the Arctic. To address the intricate challenges of scientifically predicting future Arctic shipping emissions, it is imperative to develop interdisciplinary methods that integrate complex multidimensional factors. However, existing studies exhibit a limited understanding of the driving factors behind Arctic shipping emissions, often overlooking the complex interplay between Arctic socio-economic scenarios and maritime decarbonization trends. This oversight results in a significant disparity in the current scientific understanding of future shipping emissions in the Arctic.

This study aims to address this gap by developing an interdisciplinary approach that couples Global-Arctic socio-economic scenarios and establishes a comprehensive prediction model for Arctic shipping emissions. The research will employ a Computable General Equilibrium (CGE) model to predict future maritime transport volume and use least-cost minimization to establish emission reduction pathways for international shipping. Based on Representative Concentration Pathway (RCP) scenarios and quantified Arctic socio-economic scenarios, this study will establish Global-Arctic coupled scenarios, under which Arctic shipping emissions will be projected. This study is expected to offer scientifically informed recommendations that contribute to developing Arctic shipping and environmental policies. The findings will also support collaborative international regulatory initiatives in this region, promoting sustainable exploitation of the Arctic while mitigating the impact of shipping emissions on the Arctic climate system.

Biographical sketch: Yi Wen is from Henan Province, China. She attended Renmin University of China and earned a Bachelor of Engineering in Environmental Engineering. She was interested in the field of air pollution control as an undergraduate student. After graduation, she applied for Tsinghua University and now she is a third-year Ph. D student under Dr. Liu Huan. Her main focus lies in shipping emissions and their future trends and effects on the atmospheric environment.

Ling Zhang

Mentors: **Brian Fath, Ali Kharrazi**

Research Project: **Tele-Coupled Biodiversity Loss in China: From A Perspective of Input-Output Analysis and Network Analysis**

Abstract: In today's increasingly globalized activities, international trade chains accelerate the degradation of habitats and biodiversity loss far from where they are consumed. This tele-coupled influence increases socio-ecological risks. Several researches have confirmed that the international trade deepens the transfer and loss of global biodiversity, such as the impact of international demand for palm oil on the destruction of tropical rainforest habitats. As a major manufacturing and agricultural producer, China's role in the gains and losses of biodiversity through tele-coupling is not yet fully understood. My proposal aims at analyzing China's tele-coupled biodiversity loss in the context of global trade. Specifically, I will focus on threats to endangered species that are closely associated with specific industrial sectors, as indicated by the IUCN Red List of Threatened Species. The use of multi-regional input-output (MRIO) analysis will provide a broader understanding of the economic drivers behind biodiversity loss. In addition to MRIO, network analysis will be used to detect biodiversity conservation communities which can enhance biodiversity conservation policy making in China To delve deeper, spatial mapping will be used to examine the distribution of tele-coupled biodiversity loss. As tele-coupling research holds the potential to inform more effective and sustainable policy decisions in biodiversity conservation, we try to provide further insights from our studies to better realize this potential.

Biographical sketch:
Ling Zhang is a second-year PhD student majoring in physical geography at Peking University, China. She earned her Master's degree in Natural Resources from the Faculty of Geographical Science at Beijing Normal University, China, in 2022. She's interested in exploring how adopting a tele-coupling perspective can provide insights into environmental and ecological issues, by uncovering intricate relationships that are not directly apparent, such as the connection between trade and habitat loss. Her previous study included embedded carbon emission and ecosystem services assessment, laid the foundation for her interest in tele-coupled biodiversity loss.

Chloe Dawson

Mentor: **Piero Visconti**

Research Project: **Exploring Biodiversity Impacts Under Future Mining Land Use Scenarios**

Abstract: An expansion in mineral extraction is required to meet the growing demand for battery metals, but a comprehensive global scale assessment of how this will impact biodiversity is currently absent. Quantifying these impacts is needed to determine whether incorporating spatial planning of mining into metal sourcing decisions will produce improved outcomes for biodiversity. A key commodity essential for the production of renewable energy technologies is nickel, yet the impacts of opening new mines to increase its supply, to meet 2050 demand scenarios, remain unknown.

This research will examine the potential impacts and compromises for conserving biodiversity and maximising ore grade with spatially explicit modelling and scenario analysis of future nickel extraction at globally known exploration sites. Metrics such as rarity-weighted richness and species threat abatement (STAR) will be used, derived from the area of species habitat maps produced using the integrated model for biodiversity distribution projections (ibis.iSDM), to determine potential global biodiversity losses from future nickel extraction. Additionally, ore grade data from the S&P Global metals and mining database will be used to identify future mining areas that contain high ore-grade, required to meet future nickel demand. These findings can contribute to sustainable land management, supporting biodiversity conservation and green energy goals.

Biographical sketch: Chloe is a second year PhD candidate at The University of Queensland in Australia. She is working on understanding where best to source energy transition metals for biodiversity conservation, climate change mitigation and sustainable development in the mining industry. Chloe is supervised by Dr Laura Sonter and Professor Eve McDonald-Madden in the School of Environment and is part of the Centre for Biodiversity and Conservation Science.

Chloe holds a Master of Environmental Management from The University of Queensland and a Bachelor of Science in Marine Science from The Australian National University.

Daniel Escobar Carbonari

Mentor: **Oskar Franklin**

Research Project: **Assessing Climate Impact Through ForSAFE - Peat: Boreal Peatland Management Strategies**

Abstract: The Paris Agreement's objectives could be more attainable with strengthened carbon sinks. Certain ecosystems, like boreal peatlands, have removed atmospheric carbon for millennia and stored it as soil organic carbon. However, human activities can disrupt the carbon cycle of these ecosystems. For example, drainage of peatlands for forestry in Fennoscandia increases soil greenhouse gas emissions via higher decomposition, while afforestation enhances carbon capture in tree biomass, resulting in a complex net climate impact. To address this complexity, my research utilizes biogeochemical modeling, specifically the ForSAFE-Peat dynamic ecosystem model, to assess the optimal management strategies for drained and afforested boreal peatlands in the context of climate change. By simulating various scenarios, including forestry, paludiculture, and ecological restoration over a long time series, this study evaluates their overall climate consequences. The findings aim to inform land use policies in northern Europe by providing a climate ranking of different management practices.

Biographical sketch: Daniel is currently a 3rd-year Ph.D. student at the Department of Physical Geography at Stockholm University. His research focuses on quantifying the climate effects of land use management on boreal peatlands. His main fields of scientific interest include biogeochemistry, ecology, climate change, system analysis, and numerical modeling. Prior to his doctoral studies, Daniel worked at the Consultative Group on International Agricultural Research (CGIAR), analyzing the climate effects of land-use policies in tropical countries.

Zhonghao Fu

Mentors: **Mikhail Smilovic, Dor Fridman**

Research Project: **Developing the Global Cwatm-Pyaez Coupled Model to Reveal the Impacts of Climate Extremes on Global Agricultural Production and Water Scarcity**

Abstract: Exploring the impacts of increasing climate extremes on agroecosystems remains a prominent scientific and sustainability question. Climate extremes primarily affect agroecosystems by altering the water cycle, which in turn leads to agricultural instability. This instability within agricultural ecosystems then creates feedback that further influences the water cycle, highlighting the necessity for an integrated examination of the interactions between water cycles and farming ecosystems. Traditional research methodologies typically utilize separate crop and hydrological models to study the impacts of climate extremes either on agricultural ecosystems or on the water cycle. Such approaches often overlook the complex interplay among atmospheric, water, and soil processes, as well as their collective impact on crop productivity.
This project aims to continue the development of a global-scale CWatM-PyAEZ coupled model to simulate the crop-water relation, based on the Community Water Model (CWatM) and the Python Agricultural Ecological Zone System (PyAEZ). This coupled model can overcome the limitations of individual models, enabling more accurate simulations of water cycles and crop yields. Further, a climate extreme analysis module will be incorporated into CWatM-PyAEZ coupled model to specifically address how climate extremes can affect agricultural production and contribute to water scarcity. This project could provide better water resource management measures to ensure water and food security, as well as enhance the application prospects of the CWatM-PyAEZ coupled model under climate extremes.

Biographical sketch: Zhonghao graduated from Sichuan Agricultural University, China, in 2021 with a degree in Water Resources and Hydropower Engineering. In 2023, he completed his Master degree at China Agricultural University. Currently, he is a first year phD candidate at China Agricultural University in Water Conservancy Engineering. His thesis is titled “Global Multidimensional Water Scarcity and Sustainable Irrigation”. Zhonghao’s primary scientific interests include Modeling Global Water-Crop Coupling Relationships and Exploring the Potential for Increased Food Production Under Water Scarcity

Josh Gilman

Mentors: **Sylvia Tramberend, Emilio Politti**

Research Project: **The Interactive Influences of Climate Change, Water Availability, and Policy on Dryland Urbanization**

Abstract: Assessing the impacts of climate change and land use policy on water security is critical for achieving a long-term balance between water supply and demand in dryland urban areas. Yet, we still lack an adequate understanding of how climate change, water availability, regional water policy, and urbanization interactively shape sustainable development. Focusing on the Phoenix Metropolitan Area (PMA), the study addresses a central research question: How will the interplay of climate change, water availability, and land use policies impact urban expansion?

I will simulate urban expansion under future scenarios of climate change, regional water policy, and population growth, which are the primary drivers of urban expansion in the PMA. Changes in climate and population will be downscaled from the IPCC's global scenarios and regional policies will include water use efficiency, groundwater pumping regulations, and whether urban development replaces agricultural land or desert. The scenarios will force the Phoenix WaterSim model and the Future Land Use Simulation model to determine spatially explicit maps of future urban and agricultural areas. By comparing the total area of urban and agricultural land use for each scenario with their impact on regional water sustainability indicators (e.g., total aquifer storage) and selected ecosystem services (e.g., regulation of extreme heat), we can improve our understanding of how climate change, water, and policy affect urbanization and regional sustainability in the PMA and beyond.

Biographical sketch: Josh graduated from Brigham Young University in Utah, USA in 2020 with a BsC in Molecular Biology and an MS in Biology. Currently, he is a fourth-year PhD candidate in the School of Life Sciences at Arizona State University, USA. He is interested in studying the interactions among water availability, climate change, and urbanization, in drylands, with the end goal of improving regional sustainability.

Bingyi (Alex) Hou

Mentors: **Andrey Lessa Derci Augustynczik, Pekka Lauri**

Research Project: **Analysis of the Mass Timber and Solid Wood Demand in Ontario Under RCP-SSP Scenarios**

Abstract: Decarbonization has been given high priority in the context of increasingly severe climate change. As Canada has pledged to achieve net zero carbon emissions by 2050, lowering greenhouse gas emissions is more crucial than ever before. Mass timber has great potential in reducing carbon emissions in the construction sector due to its carbon capture ability and pre-fabrication features. However, the development of the mass timber industry in Ontario is hindered by the limited market size and the imbalance between supply and demand. This research investigates the future demand for mass timber and solid wood in Ontario under climate change scenarios (RCPs), socioeconomic development pathways (SSPs), and alternative scenarios of mass timber use in the construction sector. We use an advanced global forest and land use model GLOBIOM to analyze the consumption, production, and trade of wood products that affect market values. As GLOBIOM is usually operate at national levels, we innovatively isolate Ontario from the rest of Canada and make it to be an independent economic region to produce more accurate results compared to downscaling from the nation. In addition, we discover the possibility of using cross-laminated timber (CLT) and various fiberboards in construction to utilize more low-quality wood. Our results should demonstrate the bottleneck of the mass timber industry (lack of supply/lack of demand) and serve as a basis for future policymaking and optimization.

Biographical sketch: Alex is a first-year PhD student in the Department of Forestry at the University of Toronto, where he earned a Master of Forest Conservation. Among the various aspects of forestry studies, he is particularly interested in forest economics, combining ecology and quantitative analysis. His current research focuses on predicting the demand for mass timber in Ontario under future RCP-SSP scenarios. He is passionate about optimizing current policies and promoting the development of the mass timber industry in Ontario to achieve carbon emissions goals.

Youngjin Ko

Mentors: **Andrey Krasovskiy, Hyun-Woo Jo, Pekka Lauri, Dmitry Shchepashchenko, Florian Kraxner**

Research Project: **Development of the Harvested Wood Product Model to Support The "New Bauhaus" Concept in South Korea**

Abstract: The forests of South Korea span 6.3 million hectares (ha), covering approximately 60% of the country's land area. More than 50% of these forests comprise old trees that have surpassed the optimal rotation age. This highlights the importance of timber utilization as a strategic approach to address climate change. The Harvested Wood Products (HWPs) emerge as pivotal components of climate change mitigation, playing a crucial role in storing carbon as opposite to carbon emissions. HWPs are getting a lot of attention in research and innovation with ongoing global efforts focused on exploring diverse applications. This study aims at developing the HWP model for South Korea using the most detailed local datasets and exploring innovative applications such as the "New Bauhaus" concept promoting transformation of buildings and human settlements to mitigate global climate change impacts. Through a comprehensive examination of socio-economic and environmental factors, such as timber supply and demand and the extent of timber utilization by industries, the study will assess HWPs and their role in sustainable forest management practices. Furthermore, the HWP carbon model will be tailored to meet the specific needs of industries, and pave a way for policies and industry practices towards transition to a more climate-friendly development in South Korea. The Korean Forest Service (KFS) provides data on the usage of wood products from 2011 to current time. Using the Korean datasets including the export and import, timber volumes will be quantified and utilized to estimate the carbon storage considering the decay rate related to the timber usage. In particular, the carbon storage in sawnwood, serving multiple industrial purposes, will be assessed by applying distinct capacities dependent on the industry. The study will be based on development of scenarios, considering population dynamics and urbanization, usage of biomass for heat power plants, and construction of wooden buildings (Bauhäuser). Eventually, this study will provide insights of potential climate change impacts of HWPs and inform decision-makers about sustainable forest management practices in South Korea.

Biographical sketch: Youngjin Ko is a PhD candidate at Korea University, specializing in Environmental Science and Ecological Engineering. With a bachelor's degree in Wood Science and Engineering from Chonnam National University, his research interests include forest growth under climate change, optimization of forest management, and carbon storage estimation in harvested wood products for carbon neutrality. Through the YSSP, he seeks to broaden his expertise in forest circular management and wood product utilization.

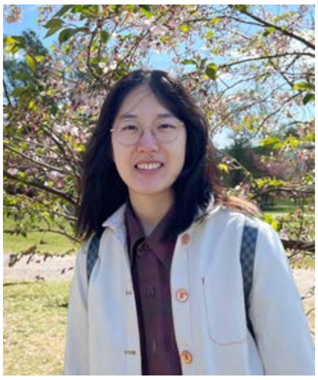
Taha Loghmani

Mentors: **Barbara Willaarts, Dor Fridman, Gerid Hager (ASA)**

Research Project: **Implementation Driver and Barrier Analysis of a Coupled Citizen Science and Nature-Based Solutions (CS-NBS) Approach: Resource Nexus Perspective in the Case of Tevaps in Iran and Brazil**

Abstract: In an era in which water and food security are increasingly threatened, recycling water and nutrients in wastewater through transformative processes can play a crucial role. Characterized with transformative potential, Nature-based Solutions are cost-effective approaches that utilize natural processes to tackle societal challenges, e.g., domestic wastewater treatment in the absence of grey infrastructure. However, any transformative process requires the inclusion of informed stakeholders. Respectively, Citizen Science (CS) and Nature-Based Solutions (NBS) have been highlighted in literature and practice as elements that can deliver the required input for triggering systemic change by promoting and providing sustainable attitudes and contexts. Following a series of papers justifying and designing a coupled CS-NBS approach, this research investigates implementation drivers and barriers of CS-NBS Evapotranspiration Tank (TEvap) projects in Brazil and Iran. TEvaps are cost-effective and small-scale, receive domestically produced black and greywater as input, use recycled construction and demolition waste and natural processes, and create agri-food products as output. A mixed-method approach will analyze and compare implementation processes in Brazil and Iran. Furthermore, it will lay the groundwork for future upscaling scenario building and tracking CS-NBS diffusion in decision-making processes. As output, a report can be expected that provides a context-specific understanding of how the various transdisciplinary processes designed to implement the CS-NBS TEvap have overcome potential barriers and driven its adoption. The project aims for small-scaled and decentralized applications within less developed communities and spatial scales, e.g., rural/ peri-urban communities in the global south. In line with the Inclusive Green Recovery report, which emphasizes harmonized relationships between human and natural systems, the results can showcase evidence of the transformative capacities of CS-NBS while bridging gaps at the science-policy-society interface.

Biographical sketch:
Taha is a joint Doctoral Researcher at the United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES) and Dresden University of Technology (TU Dresden). His research is focused on transforming agri-food systems governance through enhanced participation at the human-nature interface. Taha has a Bachelor of Civil Engineering from Iran and a Master of Hydro Science and Engineering from TU Dresden, enabling him to cover a broad spectrum of engineering, natural, environmental, and social sciences.



Qiankun Niu

Mentors: **Christian Folberth, Nikolay Khabarov, Juraj Balkovic**

Research Project: **Evaluating Potential Contributions of Multi-Cropping to Food Security and Land Sparing**

Abstract: Increasing pressure on global food production, caused by rising demand, climate change, and a growing population, calls for innovative solutions in agricultural practices. Planting multi-cropping systems is a promising approach that can maintain or even increase current food production volumes with less cropland. However, the contributions of multi-cropping to crop production and land use have not yet been investigated globally. Here, the Environmental Policy Integrated Climate–International Institute for Applied Systems Analysis (EPIC-IIASA) and spatial optimization models will be employed to maximize calories and nutrients, identifying the most efficient multi-cropping combinations in the past and future. Global attainable crop yields and land-sparing potentials of key multi-cropping systems will be obtained by combining EPIC-IIASA, novel datasets, and machine learning algorithms. The results will provide critical insights into the efficiency and sustainability of multi-cropping systems, elucidating their potential to optimize food production and address global agricultural challenges.

Biographical sketch: Qiankun is currently a second-year PhD at Aalto University, Finland, working within the Department of Built Environment. Her primary research interests include crop intensity, food production, and agricultural adaptation to climate change. She focuses on developing productive agricultural cropping systems and advancing sustainable food production, aiming to enhance global food security while minimizing environmental costs.

Sowdamini Sesha Prasad

Mentors: **Amando Palazzo, David Leclere**

Research Project: **Integrating Fed Aquaculture into GLOBIOM to Account for Growing Global Feed Resource Competition**

Abstract: By 2050, the world's population is projected to reach 9.7 billion and food demand is expected to increase by 59-102%. Rising population and growing consumer affluence has increased demand for animal-based foods, evident by tripling of livestock production since the 1960s. Meeting the demand for animal products is a significant sustainability challenge due to the global reliance on shared feed resources for farming. Inefficient management of these shared dependencies can result in competition and shortages among food sectors. Therefore, integrated assessment models are crucial for comprehending sustainable resource management in food sectors. While agriculture and livestock are well represented in these models, fisheries and aquaculture are underrepresented. As the demand for aquaculture grows, this underrepresentation is problematic. Aquaculture now increasingly relies on terrestrial ingredients, thereby directly competing with other food production sectors for feed resources. The competition for feed resource demands and impacts between different food production systems has not yet been examined holistically- like in a GLOBIOM model. We propose to explore this by incorporating an organismal digestibility model for mariculture that draws on feed resources and projects waste similar to the existing RUMINANT model. We will then identify and quantify links and competition for feed resources between different food production systems for future feed resource demand and supply scenarios (business as usual, mixed with increased aquaculture demand and aquaculture-dominant). This will contribute towards integrative land-to-sea use change models, for assessing global impacts, scenarios, and solutions for sustainable food and ecosystems.

Biographical sketch: Sowdamini is a PhD candidate at the Institute for Marine and Antarctic Studies in Hobart, Australia. She is using an interdisciplinary approach to model the impacts of nutrient fluxes in aquaculture systems and food web interactions. She has a background in terrestrial ecology and worked on human-wildlife conflict mitigation before moving to Australia to study a master's in marine and Antarctic science in 2016. She is interested in integrating land-sea interactions in food systems and ecosystem modelling. She is a passionate advocate for climate justice and using interdisciplinary and transdisciplinary approaches to address global sustainability and food security issues.

Ruben Prütz

Mentors: **Petr Havlík, Yazhen Wu, Florian Kraxner, Andrey Lessa Derci Augustynczik**

Research Project: **Spatial Analysis of Carbon Dioxide Removal Implications Focusing on Biodiversity and Land Tenure**

Abstract: Due to the ongoing delay in decisive global emission reductions, and as more and more countries pledge net-zero CO_2 targets, carbon dioxide removal (CDR) is gaining relevance and attention. Currently, ambitious mitigation pathways produced by integrated assessment models primarily rely on removals via bioenergy with carbon capture and storage (BECCS) and afforestation, which require massive amounts of land to meet scenario-implied removal scales. This land demand could have consequences for biodiversity and conflict with land rights, limiting the sustainable scaling potential. In some cases, afforestation could benefit habitat conservation by easing the pressure from global warming and deforestation. By combining spatial data on the climatic suitability of a multi-taxa species ensemble with data from different land use models on bioenergy crop plantations for BECCS and afforestation, we can evaluate and compare warming-related and CDR-related impacts on biodiversity across scenarios and regions. We can further refine our analysis of land-related CDR implications by considering aspects of global land tenure. Ultimately, this analysis helps to inform models to better constrain the use of CDR to maximize co-benefits and minimize undesired consequences.

Biographical sketch: Ruben Prütz is a third-year PhD student at Humboldt University of Berlin and a visiting researcher at the Mercator Research Institute on Global Commons and Climate Change as well as at the Grantham Institute at Imperial College London. His research is focused on co-benefits, challenges, limits, and uncertainties of large-scale carbon dioxide removal for ambitious climate change mitigation. In his PhD project, he applies various interdisciplinary methods and approaches including scenario assessments, spatial analyses, and syntheses of literature evidence.

Daan Scheepens

Mentors:	**Richard Cornford, Piero Visconti**
Research Project:	**Predicting Biodiversity Impacts of Land Use and Climate on Pest And Pest-Controlling Insects Across Europe**

Abstract: Insects are reported to be in rapid decline worldwide, driven principally by changes in land use and climatic conditions. At the same time, insects provide many important services that benefit agriculture, including pollination and biological control of crop pests. We still have an incomplete understanding, however, of how changes in land use and climate affect insect biodiversity.

This project will investigate how changes in land use and climate affect the abundance and diversity of pest and pest-controlling insects across Europe over the course of this century, using spatially downscaled land-use predictions from IIASA's GLOBIOM model under realistic land-use scenarios with respect to EU Green Deal policies and strategies. The resulting predictions will be compared to current maps of agricultural production in Europe using the EarthStat database, to identify regions most at risk of increased crop losses as a result of a reduction in pest control services. To further quantify food production risk, I will use a family of biodiversity-ecosystem-functioning (BEF) relationships to determine how projected changes in biodiversity translate into crop losses, allowing me to identify which crops and regions are most affected. With this, the project strives for a more accurate systems model of land use and climate, biodiversity change, and agricultural production.

Biographical sketch: Daan Scheepens is a PhD candidate at the Centre for Biodiversity and Environment Research at UCL, where he works on modelling global biodiversity change. His research revolves around obtaining a better understanding of the impacts of land-use and climate change on the biodiversity of natural enemies of pests and the consequences for agricultural production and food security. Previously, Daan graduated from the University of Vienna with a bachelor’s degree in physics and a master’s degree in computational science and has extensive experience with machine learning and data science.

Joanna Simms

Mentors: **Elisa Stefaniak, Oskar Franklin**

Research Project: **What Will Control the Forest's Fate? Including Nitrogen into the Plant-FATE Model to Investigate Possible Limitations on Aboveground Productivity**

Abstract: Boreal forests are one of the largest biomes worldwide and provide major ecosystem services: including wood production and climate regulation. These forests rely on mycorrhizal fungi, which, comprising around 70% of the soil microbial biomass, facilitate the exchange of harder-to-reach nitrogen for plant-produced sugars through a symbiotic relationship with tree roots. Mycorrhizal fungi, with their ability to store or transfer large amounts of nitrogen, largely drive nitrogen dynamics in boreal forests (Meyer, 2020, Högberg, 2017, Binkley, 2016), moreover microbial composition has also been shown to have significant effects on tree growth in European forests (Anthony, 2022). As this symbiosis will affect potential growth increase, and thus prediction of carbon pools and biomass production, the increase in growth predicted by environmental changes could also be contradicted. The objective of my summer school project is to further study carbon-nitrogen dynamics in boreal forest ecosystems. Specifically, to integrate a mycorrhizal-tree carbon-nitrogen interaction model into IIASA's eco-evolutionary model, Plant-FATE. Following the integration, I will parameterise the model in the context of boreal forests and, finally, run a scenario analysis to examine the potential climate and land-use change risks for the boreal forest under varying CO2 and nitrogen concentrations.

Biographical sketch: Joanna Simms is a PhD student at the Department of Forest Science at the University of Helsinki. After studying a joint master's in operations research and system's Analysis and Forests and climate change at Aalto and Helsinki Universities she has been working with stand and tree level forest ecosystem models. Her PhD topic is *Using Game Theory, Optimisation and Known Ratios to Study the Transfer of N and C Between Mycorrhiza and Tree Roots*, which explores the modelling of the important and often neglected role of sugar and nitrogen transfer in the rhyzosphere. Beyond her PhD topic Joanna is generally interested in interactions between organisms: both in the context of organisms and their surroundings and organism-to-organism interactions.

Sophie Tudge

Mentors:	**Adrienne Etard, Martin Jung**
Research Project:	**The Threat to Biodiversity from Bioenergy Expansion in Europe**

Abstract: An expansion of bioenergy is deemed necessary to reach the climate targets of the European Climate Strategy. Yet, to align climate mitigation with biodiversity conservation goals, a better understanding of the potential impacts of bioenergy expansion on biodiversity is necessary. For example, different bioenergy feedstocks might have different impacts or co-benefits with carbon sequestration and emissions reductions. Current predictions of the ecological effects of bioenergy expansion tend to be done on a global scale; however, global analyses can ignore important regional variation. Furthermore, most previous estimations of biodiversity responses to bioenergy are based on community-level responses, ignoring species-specific impacts, vulnerabilities and threats. However, species-specific knowledge is essential for understanding the responses of individual species to land-use change. In my YSSP project, I will combine biodiversity data from European-wide monitoring projects with spatially-explicit and crop- and timber-specific estimates of bioenergy feedstocks. These data will be used in a species distribution modelling framework (ibis.iSDM) to estimate species-specific impacts from bioenergy expansion in Europe. By doing so, I am to (1) investigate where and how current land is used for bioenergy production, (2) estimate how sensitive individual species are to land-use change for bioenergy plantations in Europe within their current and future distribution, focusing on European farmland and butterfly species, and (3) identify vulnerability hotspots of European biodiversity due to bioenergy expansion. Overall, the assessment will help to identify European regions that are the most sensitive to bioenergy expansion, helping to guide decisions about where to plant bioenergy crops in the future.

Biographical sketch: Sophie Tudge is a PhD student at the University of Surrey, where she is researching the ecological effects of land-use and management changes in the agricultural and forestry sectors. She received a Bachelor’s degree in Environmental Science from the University of Birmingham in 2017 and a Master of Research degree in Ecology, Evolution and Conservation Research from Imperial College London in 2018. Her PhD research involves working with biodiversity and spatial data to model biodiversity on different spatial scales and project future changes in biodiversity.

Congrui Yi

Mentors: **Peter Burek, Mikhail Smilovic**

Research Project: **Impact of Mega Dam Construction on Watershed Carbon Balance in Future Scenarios**

Abstract: Drawdown areas due to dam construction and operation are considered hotspots of carbon emissions. However, dams can also significantly influence downstream water levels and associated carbon emissions from river floodplains, which has not been considered in previous studies. Yangtze River Basin stands as one of China's most vital river systems, with the world's largest dam-the Three Gorges Dam, being a significant hydroelectric facility within this basin. This study aims to investigate the impact of the construction and operation of the Three Gorges Dam on carbon emissions, focusing specifically on the potential effects of dam-related inundation dynamics on downstream water levels and carbon emissions from river floodplains under climate change. In contrast to previous research, I employed a calibrated regional hydrological model (CWatM), coupled with a physically-based representation of flood inundation and dam operation achieved by Cama-Flood model, to conduct a comprehensive analysis. By considering the dam's regulatory role in water dynamics, we elucidate the comprehensive impact of the dam on carbon emissions. This research not only provides a novel perspective on the environmental implications of dam construction in the Yangtze River Basin but also offers crucial insights for understanding the global impact of dams on carbon cycling, contributing to help renew the role of large dams in the carbon cycle.

Biographical sketch: Congrui Yi is a third year PhD student, candidate from the School of Geography at East China Normal University, China. His major research interest is related to climate change, Land use and Land Cover Change, hydrological models and flood process models. Research on these themes is used to investigate the future global impact of dam construction on watershed carbon balance and the global urbanization development under the backdrop of dryland expansion.

Rebekah Ash

Mentor:	**Lena Höglund-Isaksson**
Research Project:	**Greenhouse Gas Mitigation Strategies in East African Pastoral Systems: Beyond Technical Solutions**

Abstract: Livestock systems in East Africa are vital to local economies and livelihoods, with Africa hosting one-third of the global livestock population and livestock contributing 40% to agriculture GDP. The region's rangelands and drylands, typical of African livestock landscapes, are vulnerable to climate change impacts. Despite these challenges, there has been a comparative lack of research in low and middle-income countries.

In this context, the recent extreme drought in the Horn of Africa underscores the vulnerability of pastoralist communities, with mass livestock deaths and a food crisis affecting millions. Moreover, ongoing conflicts exacerbate these challenges, disrupting agricultural activities and displacing populations.

This study addresses the urgent need for context-specific greenhouse gas (GHG) mitigation strategies in East African pastoral systems. By leveraging the GAINS model from IIASA, it aims to quantify emissions and evaluate the feasibility of possible strategies. Drawing on previous stakeholder consultations and a comprehensive literature review, the research integrates technical and contextual solutions. By offering nuanced insights into region-specific mitigation possibilities, the study seeks to inform policy and promote sustainable pastoralist systems globally, safeguarding both livelihoods and environmental integrity.

Biographical sketch: Rebekah is a second-year PhD candidate at The University of Tasmania (UTAS) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) with an undergraduate in Agricultural Science from The University of Queensland, Australia. She is passionate about international development, sustainability, and policy within the agriculture sector. During her Ph.D., she concentrates on context-specific solutions for climate change mitigation and adaptation in sustainable livestock systems. Throughout her academic journey, Bek has utilized interdisciplinary approaches, employing modeling programs to evaluate regenerative agriculture scenarios in Australia. Additionally, she is investigating gender dynamics and resilience in pastoralist communities in Northern Kenya. Rebekah also works outside of academia in the environmental markets industry partnering with landholders across Australia to lead soil carbon projects.

André Baumgart

Mentors: **Volker Krey, Gamze Ünlü**

Research Project: **Prospective Scenarios for Global Mobility Infrastructure and GHG Emissions**

Abstract: Mobility infrastructure facilitates well-being and economic inclusion by providing the key service of moving people and goods. Due to population growth, increasing affluence and interconnectedness, mobility demand can be expected to grow, consequently requiring ever increasing amounts of resource use and GHG emissions for the construction, maintenance, and replacement of mobility infrastructure around the world. Currently, no global and regionally-differentiated understanding exists about the extent of future infrastructure build-up, how it can be shaped to become more sustainable, and how environmental impacts and GHG emissions could be mitigated, while still providing the material basis for sufficient mobility services, well-being, and achieving the SDGs. The herein presented research tries to investigate how much material and energy will be used by future infrastructure maintenance, build-up, and transformation, and how much of the remaining global carbon budget for limiting global climate heating to internationally agreed upon 1.5-2° of warming will be locked in. To this end, a novel stock-driven prospective scenario approach based on a recently developed spatially explicit global material stock model will be used that will compare a baseline scenario against scenarios reflecting different future pathways of infrastructure development including both supply- and demand-side transformations in the mobility sector, as well as a global convergence of stock levels.

Biographical sketch: André is a 2nd year PhD student at the Institute of Social Ecology, University of Natural Resources and Life Sciences, Vienna. By applying a bottom-up material stock modelling approach, he estimates material stocks in buildings and mobility infrastructure and investigates to what degree they drive material and energy use and consequently GHG emissions in the context of carbon budgets and resource reduction strategies. André is particularly interested in the relationship between material stocks, associated flows, and services that society derives from their usage. Furthermore, André is interested in the potentials of circular economy strategies to reduce resource use and emissions both regionally and globally.

Candelaria Bergero

Mentors: **Elina Brutschin, Matthew Gidden**

Research Project: **The Implications of Underestimating and Underdelivering Carbon Dioxide Removals**

Abstract: IPCC scenarios that meet 1.5 °C and 2 °C temperature targets rely heavily on carbon dioxide removal (CDR) in order to offset emissions from hard-to-decarbonize sectors, non-CO_2 and legacy emissions. The latest IPCC scenarios project for this century a cumulative global CDR of 20–400 $GtCO_2$ from afforestation and reforestation, 30–780 $GtCO_2$ from BECCS, and up to 310 $GtCO_2$ from DACCS. Presently, global sequestration is about 2 $GtCO_2$/yr from afforestation and reforestation, and about 0.002 $GtCO_2$/yr from novel CDR technologies. Meeting IPCC scenario projections would require CDR to grow exponentially, which raises important questions of estimation and feasibility. Concerns relate to both the non-equivalence of emissions and removals for the climate system, and the biophysical and socio-political implications of their deployment. Weakening natural carbon removal processes and socio-political dimensions may result in carbon sinks being smaller than modeled. Failure to deploy CDR at the scales projected by integrated assessment models, or miscalculating the amount of CDR needed, could potentially lock us into a high-temperature pathway. In this project we seek to analyze the implications of underestimating and underdelivering modeled CDR amounts, focusing on two main questions: what is the global mean temperature increase of not meeting the amounts of CDR modeled in AR6 scenarios? And which would be the populations affected the most?

Biographical sketch: Originally from Argentina, Candelaria went to the U.S. to continue her studies. She is currently a Ph.D. candidate in the Earth System Science program at the University of California Irvine, where she analyzes the social, political, and economic implications of net-zero targets. She passionately studies mitigation policies and tries to understand how they affect people. Before her Ph.D. studies, she worked at the Joint Global Change Research Institute, where she used the integrated assessment model GCAM to analyze climate mitigation policies. Outside of research, Candelaria goes for hikes, plans the next knitted sweater, and fights pests that attack her houseplants.

Wenxin Cao

Mentors: **Shaohui Zhang, Fabian Wagner**

Research Project: **Strategies for Region-Specific Air Quality Improvement Towards Beautiful China 2035 Target**

Abstract: Striving for the further improvement of environmental quality, China has embarked on an ambitious journey towards building a "Beautiful China" characterized by clear air before 2035. The environmental impacts caused by air pollutant emissions demonstrate spatial and temporal heterogeneity, necessitating differentiated requirements for air quality improvement targets across diverse regions and phases. However, previous studies often approached the formulation of air quality targets from a national perspective, making it challenging to achieve regional air quality targets with a cost-effective approach. Additionally, China has made commitments to peak CO_2 emissions before 2030 and attain carbon neutrality before 2060. The carbon targets will trigger substantial transformations in China's energy, industrial, and transportation structures, thus will also have positive effects on pollution abatement and air quality improvement. In this study, we will use the GAINS and CAEP models to explore the net zero pathways with regional characters, assess the air quality co-benefits of decarbonization strategies, as well as quantify the technical potential of pollution abatement through the adoption of best available end-of-pipe technologies and the carbon mitigation contribution to clean air. Finally, we will recommend the region-based cost-effective strategies under the defined carbon and air quality targets. The policy recommendations regarding air quality improvement would be directly applicable to national and regional policymakers through this research.

Biographical sketch: Wenxin Cao is currently a second-year PhD candidate through joint training between the Chinese Academy of Environmental Planning (CAEP) and Jilin University. She obtained her bachelor's degree in environmental management and environmental economics from Jilin University in 2020. Her current research focuses on exploring optimized mitigation strategies for air pollution and greenhouse gases (GHGs) co-control in China, as well as conducting assessments of air-pollution-related health impact. The core objective of her research lies in framing new policies that maximize co-benefits between air quality management, GHGs mitigation, and other policy priorities.

Yesol Cha

Mentor: **Younha Kim**

Research Project: **Assessing the Impacts of Air Quality Measures and Climate Change in Northeast Asia**

Abstract: In the Northeast Asia region, severe air pollution is caused by complex interactions between natural sources, long-range transport, and local emissions. Various air quality measures have been implemented in each country as a result. According to previous studies, implementing long-term or targeted air quality measures has been shown to significantly contribute to tangible improvements in air quality. However, it has been demonstrated that the degree of improvement can vary depending on meteorological conditions. Therefore, it is essential to distinguish between their impacts and evaluate the effectiveness of these measures while understanding their transboundary effects. To investigate each factor's contribution to air pollution in South Korea, the Community Multiscale Air Quality (CMAQ) chemical transport model will be used. We can focus on the particular transboundary region that impacts air quality in South Korea. Additionally, we can focus on specific sources in the emission inventory, such as VOCs (Volatile Organic Compounds), NO_X, SO_2, etc., to analyze the contribution of each region or source. In this study, we quantify and assess the contribution of various factors influencing $PM_{2.5}$ and O_3 concentrations. We are investigating the changes in the contribution of each factor that can be expected as a result of implementing air quality measures, specifically, due to the reduction of emissions.

Biographical sketch: Yesol Cha is a Ph.D. candidate in the Department of Civil Urban Earth and Environmental Engineering at the Ulsan National Institute of Science and Technology (UNIST), South Korea. Yesol graduated from UNIST with a bachelor's degree in Chemical Engineering and a master's degree in Urban Environmental Engineering before starting her PhD studies. Her major research interest is Air Quality Impact Assessment using Chemical Transport Model, which can contribute to a better understanding of environmental changes, as well as the development of pollution control and mitigation strategies. Additionally, she aims to extend her research to explore the interactions between climate change and air quality, providing the integrated environmental solutions.

Ziwei Chen

Mentor: **Pallav Purohit**

Research Project: **Evaluating Fluorinated Greenhouse Gas Emissions and Mitigation Potential in China**

Abstract: Fluorinated greenhouse gases (F-gases), such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), are rapidly emerging as potent contributors to global warming. F-gases contribute approximately two percent of the national greenhouse gas emissions in China. However, the escalating demand for refrigeration, air conditioning, and heat pumps poses a significant threat of increasing F-gas emissions substantially. Many F-gases have very high global warming potential (GWP) and therefore small atmospheric concentrations can have large effects on global temperatures. This study will employ the Greenhouse gas and Air pollution Interactions and Synergies (GAINS) modeling framework to assess current and future emissions of F-gases under a business-as-usual (BAU) scenario. The BAU scenario will take into account current and planned regulations/ legislations at the global (i.e., Montreal Protocol, Kigali Amendment), national (i.e., Regulation on the Administration of Ozone Depleting Substances), and regional levels aimed at controlling F-gas emissions in China. In the alternative scenarios, the mitigation potential of F-gas emissions will be assessed at both the national and provincial levels in China. Moreover, within a holistic framework that includes lifecycle refrigerant management, this research will examine energy efficiency related co-benefits in terms of indirect emissions (i.e., carbon dioxide and methane). This study, along with a socioeconomic impact assessment of proposed mitigation strategies, aims to offer valuable insights to enable informed decision-making and strengthen effective climate action.

Biographical sketch: Ziwei Chen is a PhD Candidate in Environmental Science at the College of Environmental Sciences and Engineering, Peking University. She obtained her Bachelor's degree in Environmental Science from Tongji University in July 2021. Her current research centers on modeling emissions of ozone-depleting substances (ODS) and fluorinated greenhouse gases (F-gas), with a focus on exploring their mitigation potential, climate benefits, and socio-economic impacts. She strives to devise cost-effective mitigation pathways for ODS and F-gas consuming sectors in China. Her interdisciplinary approach involves conducting comprehensive analyses, especially from a lifecycle management perspective, to inform effective environmental policies and practices.

June Choi

Mentors:	**Marina Andrijevic, Edward Byers, Adriano Vinca**
Research Project:	**Quantifying the Role of Adaptive Capacities in Moderating Climate Impacts**

Abstract: There have been increasing calls for incorporating adaptive capacities in global models to represent their uneven distribution across countries as well as their potential role in moderating future climate risk. Adaptive capacities are expected to provide the underlying conditions that enable effective adaptation implementation and reduce vulnerability. Numerous indicators of adaptive capacity have been proposed across various dimensions and spatial scales, but they have not been empirically tested with regards to their historic and potential role in moderating climate impacts. This project aims to empirically model and quantify the role that country-level adaptive capacities such as the quality of governance and institutions, socioeconomic inequities, and access to finance, have played in moderating GDP damages due to climate change. Utilizing GDP-temperature damage functions as a basis, we can test how the shape and location of these function has evolved over time after accounting for countries' differential adaptive capacities. This research will contribute to the development of heterogeneous damage functions for Integrated Assessment Modeling frameworks as well as offer policy insights regarding the effective allocation of adaptation finance for equitable transition pathways.

Biographical sketch: June Choi is a third year PhD candidate in Earth System Science at Stanford University. Her research focuses on quantifying the impacts of climate change to inform equitable adaptation financing strategies. Her previous work involved tracking global climate finance flows, setting standards for green bonds and sustainable finance integrity at Climate Policy Initiative and Climate Bonds Initiative. June holds an MA in International Relations from Johns Hopkins SAIS and BA in Sociology from Amherst College.

Shigan Liu

Mentors: **Gregor Kiesewetter, Jessica Slater**

Research Project: **Developing Machine Learning-Based $PM_{2.5}$ Source-Receptor Relationships**

Abstract: Despite a significant decrease in fine particle matter ($PM_{2.5}$) concentrations in recent years, $PM_{2.5}$ pollution remains a problem in China, causing more than one million deaths every year. To quantify $PM_{2.5}$ concentrations or the contributions of different emission sources, chemical transport models (CTMs) have been frequently used in previous studies, which need large computational resources and runtimes. To improve the availability and accessibility of air quality modeling, several models of $PM_{2.5}$ source-receptor relationships have been developed by the air quality research community. Such relationships quantify the impact of changes in emission sources on $PM_{2.5}$ concentrations, which usually serve as an alternative to CTMs to estimate air quality responses to emission changes rapidly in policy analysis models. However, many existing models of $PM_{2.5}$ source-receptor relationships are parameterized in a linear mathematical form (e.g., the GAINS model) whereas atmospheric chemistry is non-linear. Therefore, the purpose of this research is to develop $PM_{2.5}$ source-receptor relationships for China capturing both linear and nonlinear responses of $PM_{2.5}$ concentrations to emission changes at a province level based on a machine learning model. The machine learning model will be trained against a data set of $PM_{2.5}$ source-receptor relationships simulated by a CTM, the Weather Research and Forecasting−Community Multiscale Air Quality (WRF-CMAQ) model. The performance of the model of $PM_{2.5}$ source-receptor relationships will be comprehensively evaluated by comparing with WRF-CMAQ simulations and the GAINS model.

Biographical sketch: I studied at Nanjing University, China, and received the Bachelor of Science degree of Atmospheric Sciences in 2020. After graduation, I continue a PhD program in Atmospheric Sciences at the Department of Earth System Science, Tsinghua University, China. Currently, I am a 4th-year PhD student and my mentor in Tsinghua University is Prof. Qiang Zhang. I am proficient at air quality modelling tools (e.g., WRF-CMAQ), machine learning techniques, and computer programming (e.g., Linux, Python). My research interests include clean air, climate change, and artificial intelligence (AI) for science.

Naud Loomans

Mentors: **Leila Niamir**

Research Project: **Quantifying the Potential of Energy Communities in Accelerating the Energy Transition**

Abstract: The energy transition plays a critical role in limiting global warming to 1.5°C and addressing climate change by shifting towards renewable sources and reducing carbon emissions. In this research, we investigate the potential of energy communities to accelerate the energy transition. Energy communities are seen as a promising concept to accelerate this transition, as they enable citizen participation, can enhance public acceptance, and afford consumers an active role in energy markets (Lode et al., 2022). Through these mechanisms, energy communities can increase the adoption of renewable energy sources, facilitate energy balancing, and promote demand reduction.

For policymakers to formulate feasible and realistic energy transition policies, a thorough understanding of the system, its drivers, and barriers is essential. Within this research, we delve deeply into the energy community system and its potential for reducing greenhouse gas emissions and advancing the energy transition. To achieve this, we develop an empirically based agent-based model, building upon and extending the BENCH agent-based model (Niamir et al., 2020) by incorporating a second layer of collective decision-making. Initially, we calibrate the model using empirical data collected in the Netherlands, with the aim of eventually scaling up the results to the EU level. This study provides policymakers with a means to assess the effects of various policy portfolios by simulating diverse socio-demographic, behavioral, social, infrastructural, and climate scenarios within the energy transition framework.

Biographical sketch: Naud Loomans is a 4th year PhD Student at the Technology, innovation, and society group at the Eindhoven University of Technology in the Netherlands His PhD is part of the NEON research, a large interdisciplinary program aimed at accelerating the energy transition. Furthermore, he works part-time at the energy modelling company Zenmo simulations where he makes energy transition models aimed at informing local stakeholders. In his PhD Naud focusses on agent-based energy transition models aimed at transition pathways towards local renewable energy systems. Other research interests include social tipping points, socio-technical energy transition models, sustainable heating, and energy communities.

Shotaro Mori

Mentors: **Siddharth Joshi, Volker Krey, Takuya Hara, Thiago Brito**

Research Project: **Multi-Model Analysis on Energy System Achieving a Complete Phase-Out of Fossil Fuels**

Abstract: To achieve the Paris Agreement's long-term temperature goal, it is necessary to reach net-zero CO_2 emission by the mid-century. Needless to say, fossil fuel phase-out is essential to achieve net-zero CO_2 emissions, and it was agreed to "transition away from fossil fuels in energy systems" at the COP28 climate summit. In recent years, hydrogen-based energy carriers, including hydrogen itself, ammonia, and synthetic hydrocarbon fuels, have gained attention as strategies to achieve decarbonization with limited reliance on carbon dioxide removal (CDR) technologies. Hydrogen-based energy carriers, in combination with electrification and biofuels could strongly reduce residual CO_2 emissions from hard-to-abate sectors, and may theoretically enable the complete phase-out of fossil fuels. However, the feasibility of such scenarios remains unclear in previous studies, despite the growing interest in zero-fossil scenarios.

My research aims to explore achieving global carbon neutrality through a complete phase-out of fossil fuels, examining energy systems from multiple model perspectives. The research proposal compares two energy system models – the AIM-Technology model and the MESSAGEix energy system model – under a shared scenario protocol. Applying the two energy system models, I will evaluate zero-fossil scenarios across multiple timeframes and end-use sectors to explore the conditions necessary to enable zero-fossil energy systems. This research is unique as it explores scenarios that achieve complete fossil fuel phase-out by mid-century, a finding not yet revealed in any IPCC AR6 scenarios, offering new insights into feasibility of zero-fossil energy system and mitigation strategies with no or limited use of CDR technologies.

Biographical sketch: Shotaro Mori is a first-year PhD candidate in Environmental Engineering at Kyoto University (KU), Japan. He received a bachelor's degree in 2022 followed by master's degree in 2024 from KU in the field of Environmental Engineering. His current research topic is the development of a power system model and its application to national decarbonization scenarios. His past research topic was the techno-economic assessment of carbon dioxide removal and utilization technologies using a global energy system model. His main fields of scientific interest include the techno-economic assessment of mitigation measures using an energy system model or a power system model.

Sarah Schöngart

Mentors: **Zeb Nicholls, Carl Schleussner, Roman Hoffmann (POPJUS)**

Research Project: **Attributing Local Climate Extremes to Income Deciles Using a Chain of Computationally Efficient Emulators**

Abstract: A key determinant for individual contributions to climate change is wealth. While the wealthiest 10% of the world population were responsible for 48% of global emissions in 2019, the bottom 50% of the world population was responsible for only 12% of total emissions. This raises questions on how climate policies can be designed fairly, including with regard to emerging costs for adaptation or loss and damage. My YSSP research project aims at contributing to this emerging discussion on climate inequality by attributing extreme changes in monthly mean temperature and precipitation to income deciles, using a chain of computationally efficient emulators. The modeling approach includes (1) constructing greenhouse gas emission pathways with and without contributions from the wealthiest part of the population (2) translating emissions into global warming trajectories using the simple climate model MAGICC, and (3) regionalizing these global trajectories using the Earth System Model emulator MESMER(-M-TP) to generate spatially resolved, coherent monthly temperature and precipitation data. Our approach allows us to quantify how the carbon dioxide (CO2) and methane (CH4) emissions from 1990-2019 of the wealthiest 10% of the global population influenced the occurrence probabilities of present-day (2020) local temperature and precipitation related extremes.

Biographical sketch: Sarah is a 3rd-year PhD candidate at the Geography Department at Humboldt University of Berlin and a Climate Data Analyst at Climate Analytics, Berlin. Her research focuses on employing methods of statistical and machine learning to contribute to a more nuanced understanding of local climate impacts and risks for a variety of sectors. Sarah holds a BSc and a MSc in Physics from ETH Zurich.

Gang Tang

Mentors: **Zebedee Nicholls, Thomas Gasser**

Research Project: **Land Use Emission Uncertainties for Climate Projections Using the Carbon-Nitrogen Coupled MAGICC**

Abstract: Nitrogen is a crucial Earth nutrient wielding significant impact over ecosystems and human societies. While evidence at site-level is clear, the global impact of nitrogen on the carbon cycle and climate remains largely uncharted. Recent advancements in earth system models (ESMs) show that the nitrogen cycle could curtail net primary production, counterbalancing the CO_2 fertilization effect and consequently reducing the potential for carbon sequestration in terrestrial carbon pools. Yet, the diverse representations of modeled nitrogen processes impede pinpointing key impacts and yield inconsistent global nitrogen effect patterns. The demanding computational nature of complex models also restricts their applicability across scenarios.

The land use and land cover change (LULCC) introduce substantial uncertainties into the carbon budget and climate projections. OSCAR, a reduced complexity model (RCM) used in the Global Carbon Budget project, yields valuable insights into uncertainty attribution and LULCC emission estimation. MAGICC, another RCM featured in IPCC reports and now enhanced with carbon-nitrogen coupling, is poised to amalgamate the existing understanding of nitrogen's global impact. This study aims to integrate OSCAR-derived LULCC emissions into MAGICC's climate projections, enhancing the quantification of uncertainties arising from both the nitrogen cycle and land use. This synthesis harnesses the strengths of both models to advance future climate projections.

Biographical sketch: Gang Tang (he/him) is a PhD candidate at The University of Melbourne, focusing on the development of carbon-nitrogen coupling within MAGICC, one of the widely used reduced complexity models. Gang's research aims to synthesize and advance the current understanding of the carbon-nitrogen coupling effect from a global-mean, annual-mean perspective. In the near future, Gang will assess such effect on carbon cycle and climate projections, carbon budgets, and their associated uncertainties. Prior to pursuing his PhD, Gang completed a research master's degree in China, with a focus on carbon-nitrogen biogeochemical cycling in urban water, riverine, and estuary environments.

Yang Wang

Mentors: **Jihoon Min, Jarmo Kikstra**

Research Project: **Understanding and Eradicating Energy Poverty: A Supply Chain Perspective on Enhancing Energy Supply and Income Redistribution**

Abstract: Energy poverty is far more complicated than income poverty, encompassing dimensions such as availability, reliability, and affordability. The complexity of defining and measuring energy poverty has resulted in the absence of national energy poverty lines for each country and inefficient energy policies. By considering both direct household energy use and indirect energy consumption embodied in products and services through supply chains, using global energy and expenditure extended multi-regional input-output model, a holistic view of energy poverty can be provided. The research aims to identify national energy poverty thresholds where changes in per capita direct energy use are insensitive to changes in household expenditure, indicating issues of accessibility or affordability. Indirect energy use will be used to unveil hidden energy poverty by identifying the deprivation in other non-energy well-being dimensions from a supply chain perspective.

Efforts to eradicate energy poverty should address both energy supply and household consumption perspectives. The research will explore various future scenarios of the energy supply system to investigate the impacts on energy poverty, including enhancing energy accessibility, improving energy efficiency, adjusting the energy mix, changing the scale of electricity generation from different sources, etc. From the perspective of consumption affordability, simulations will be conducted to explore the effects of varying levels of household income redistribution on energy poverty at both national and global scales. The research can offer a better understanding of energy poverty and help national policymakers develop effective policy interventions to alleviate energy poverty and achieve a more equitable and sustainable society.

Biographical sketch: Yang is a second-year Ph.D. student in the Faculty of Science and Engineering at the University of Groningen in the Netherlands. She holds a Master’s degree in Land Resource Management from Renmin University of China (2022), and dual Bachelor’s degrees in Land Resource Management and Finance from China Agricultural University (2020). Her current research primarily focuses on energy inequality and poverty, aiming to understand the intricate connections between household consumption behaviors and energy use across the globe, promote equitable energy consumption, eradicate poverty, and foster socio-economic well-being. Outside of academia, she enjoys playing the piano and ukulele, as well as staying active through sports such as climbing and table tennis.

Qiuling Yuan

Mentors: **Giacomo Falchetta, Siddharth Joshi, Moshe Tshuva**

Research Project: **A Roadmap for Future Deployment of Urban Rooftop and Utility Scale Photovoltaics in China from Energy-Water-Land-Carbon Nexus Perspective**

Abstract: As huge energy consumption terminals, cities are one of the key drivers to promote green and low-carbon energy transformation, where photovoltaic (PV) power generation can serve as an important supply side solution. In an urban landscape, ground and roof areas often provide multiple spaces for PV deployment, thereby enabling urban communities and citizens to become energy producers and consumers. This helps in reducing various negative impacts derived from traditional electricity production and transmission processes, thus contributing to the mitigation of global climate change (SDG13) and improving human health and well-being (SDG3). However, PV power generation can also enable meaningful nexus tradeoffs with water, land, and carbon. While the nexus tradeoffs distinguish between rooftop and utility-scale PV topologies, the tradeoffs caused by regional differences may show more obvious cluster effects and heterogeneities.
Pursuant to this, my proposal will utilize MESSAGEix energy systems model to calculate China's long term provincial PV installed capacity requirements under future low carbon and net-zero scenarios, and further develops a multi-criteria downscaling approach to explore assignment of provincial PV's capacity deployment target to the city level deployment strategies for the rooftop and utility-scale PV topologies. Further, I will incorporate a full life cycle assessment to quantitatively characterize and reveal the nexus characteristics and differences resulting from PV development in Chinese cities. The research proposal will be synergistic to urban-scale PV development that meets the local conditions in China, and the findings would provide scientific reference and decision-making assistance for the sustainable development of urban PV systems and the coordinated management of resources and environment.

Biographical sketch: Qiuling Yuan is a first-year PhD candidate in the School of Environment at Beijing Normal University, China. She graduated with a master's degree in Environmental Science from Beijing Normal University in June 2023. During her master's years, she developed a great interest in food-water-energy nexus as part of the Belmont Forum's International Cooperation program entitled "Understanding Innovative Initiatives for Governing Food, Water and Energy Nexus in Cities". Her focus is on the sustainability and resilience evaluation of urban green-blue infrastructure (including roof utilization) in relation to food-water-energy nexus. Qiuling intends to investigate, beginning with energy, the cooperative deployment route of urban rooftop and ground-mounted PV in her PhD research.
.

Amrutha G. S.

Mentors: **Michael Kuhn, Omkar Patange**

Research Project: **Measuring Health and Economic Consequences of Air Pollution in India: An Empirical Study Investigating the Nexus Between Air Pollution, Health Outcomes and Multifaceted Economic Loss**

Abstract: The nexus of air pollution and adverse health outcomes is well established. WHO estimates indicate that low and middle-income countries accounted for 89% of premature deaths due to outdoor air pollution in 2019. In addition to having a negative effect on health, air pollution inflicts a substantial economic burden. Moreover, the impact of air pollution varies among different socio-economic and demographic groups. Further, India, the world's most populous emerging economy, is specifically vulnerable to air pollution due to rapid urbanisation, population density, and poor adaptive capability, among other factors. According to the World Air Quality Report (WAQR) 2022, air pollution in India is expected to have an annual economic impact of more than 150 billion USD which is channeled through negative impacts on health, consequently by education and work. In this context, this study will examine the relationship between air pollution, health outcomes and economic loss, the impact of air pollution among different socio-demographic groups, the mechanisms of air pollution and the economic loss nexus and the socio-economic and health costs of ambient air pollution. The study will employ a comprehensive approach involving the triangulation of multiple data sources: the National Family Health Survey (NFHS), the Census of India and its projections, and the Ambient Air Quality (AQ) data repository of the National Air Monitoring Program (NAMP). Dynamic panel regression models and structural equation modelling strategies will be employed to assess the objectives. Through measuring the per capita economic burden of air pollution, our study will help prioritise policies to mitigate the impact of air pollution through strict regulations, investing in clean energy and focusing more on domains, such as health, that are most affected by air pollution.

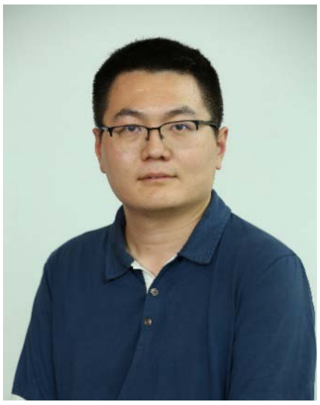
Biographical sketch: Amrutha is a doctoral student at the International Institute for Population Sciences (IIPS), Mumbai, India. Through her PhD research, Amrutha aims to measure the health and economic consequences of air pollution in India. She holds a Master's in Statistics from Pondicherry University and an M.Phil. in Population Studies from IIPS-Mumbai. Her current research interests are to explore the socio-economic and health impacts of air pollution and climate change in India, the effect of weather extremes and child vulnerabilities and the impact of changes in demographic factors on climate change.

Jinhyeok Jang

Mentors:	**Michael Freiberger, Michael Kuhn, Omkar Patange**
Research Project:	**Neighborhood Change and Well-Being Disparities: The Role of Unequal Community Infrastructure Investment**

Abstract: Achieving equity in well-being across regions is one of the major challenges of modern society. Despite substantial research on well-being, little attention has been paid to the neighborhood as a locus of impact. The causal mechanisms for the pathways between neighborhood attributes and well-being disparities are still not well explored. This research aims to understand the disparities in well-being induced by varying levels of (dis)investment in neighborhoods, with a particular emphasis on the neighborhood economic dynamics. Using a multilevel framework we propose conceptual and methodological models, based on the underlying systematic mechanism of neighborhood investment, in which a neighborhood economic change, as a sustained endogenous impact, affects subjective well-being trends over time. Thus, the models consider that neighborhood investments alter subjective well-being differentially according to neighborhood economic conditions; specifically, these shed light on the impact of unequal investments in urban community infrastructure on well-being. The expected results are projected to highlight the importance of neighborhood investment in community welfare. Additionally, it could identify patterns for well-being disparities occurring at the neighborhood level. This research promises to yield insight into the development of livable urban communities, providing innovative methodologies for mitigating social disparities and addressing multifaceted challenges.

Biographical sketch: Jinhyeok Jang is a PhD candidate in Urban Planning and Engineering at Pusan National University (Busan, South Korea), where he also earned his MSc in 2018 and BSc in 2017. His research primarily focuses on urban and spatial inequality, neighborhood dynamics, community development, and health disparities. He has been developing spatial and community-based interventions to address social vulnerabilities. He has recently been involved in two projects: ‘Housing Equality and Community Welfare’ and ‘Reducing Health Inequalities in the Region through the Community Food System.’



Kunxin Zhu

Mentors: **Stefan Wrzaczek, Michael Freiberger**

Research Project: **Waves of Change: Understanding the Impact of Natural Hazards on Housing Market Dynamics and Coastal Evolution**

Abstract: The coastal zone is highly vulnerable to climate change impacts. With simultaneous increase in natural hazards and growing coastal population, understanding the long-term effects of natural hazards on coastal communities is crucial. Developed coastlines are a striking example of the ways in which feedbacks at short timescales (months to years) can impact community resilience at longer timescales (decades). Coastal investments like vegetated dunes, beach nourishment, and road repair stabilize property values after extreme storms. High property values incentivize redevelopment, expand building footprints, and attract higher income households, while increasing vulnerability to future events. By examining endogenous amenities and residential sorting due to natural hazard-triggered renovations, this project aims to enhance understanding of the long-term impacts of natural hazards on coastal regions. Specifically, the project proposes to extend Rust model frameworks in landlord renovation decisions with endogenous amenity. The analytical model illustrates the existence of multiple equilibria and the potential for natural disaster-induced large-scale renovation to transform low-amenity, long-renovation-period neighborhoods into high-quality, short-renovation-period neighborhoods. To empirically test the ideas, we plan to calibrate the model using housing renovation data from Miami-Dade County, US. Combining these results with a housing demand model that incorporates spatial sorting based on distributions of amenities, we intend to quantify the dynamic evolution of the built environment (renovations) and community composition (homeownership rates, income) along a simulated coastline over decadal timescales. Ultimately, the project aims to explore optimal development patterns in areas facing repetitive risks, considering spatial and temporal feedbacks.

Biographical sketch: Kunxin Zhu is a PhD candidate in the Department of Agricultural, Environmental, & Development Economics at The Ohio State University. He earned an MS in Environmental Management from the Nicholas School of Environment at Duke University. His research interests are in the intersection of environmental and regional economics. Currently, his research interest focuses different adaptation strategies against climate induced natural hazard risks and their long-term implications for evolution of housing market and demographic composition.

Jennifer Bailey

Mentors: **Josephine Borghi, Roman Hoffmann**

Research Project: **Do Heat Warning Alerts Reduce Exposure? A Study of the Effectiveness of Existing Heat Warning Systems on Limiting Population Mobility in California**

Abstract: The expected increases in the frequency and intensity of extreme heat events due to climate change threaten population health, with exacerbated risk due to existing disparities in exposure. In the U.S., extreme heat is the deadliest weather hazard each year, surpassing the fatalities attributed to all other weather-related disasters combined. Land use decisions and the built environment can increase heat exposure due to the heat island effect and dictating travel behaviors, while sociodemographic factors modify the relationship between heat and health, leading to further inequity in health burdens. In response, national and local heat action plans generally incorporate alerts to notify the public of an extreme heat event and advise against exposure to avoid adverse health outcomes. While the necessity and importance of assessing the effectiveness of these heat response systems and related interventions is universally acknowledged, it is rarely done. This project will aim to address this knowledge gap by evaluating the existing policy responses to extreme heat in California using a quasi-experimental approach, historical National Weather Service (NWS) heat alerts, and capitalizing on novel smartphone mobility datasets made available because of the COVID-19 pandemic. We will use a differences-in-differences method to determine if the issuance of NWS heat alerts reduces population mobility and, thus, reduces heat exposure. Further, we will assess heterogeneity (i.e., effect modification) in policy benefits across aspects of the built environment and according to sociodemographic factors. These insights hold important adaptation policy implications as they can aid in the evaluation of existing heat warning systems and help to refine and tailor interventions to reduce population exposure to extreme temperatures, particularly for those who are most vulnerable.

Biographical sketch: Jennifer is currently a 3rd year PhD student in the Joint Doctoral Program between the University of California San Diego and San Diego State University in Global Health. As a member of the Climate Change Epidemiology Lab at Scripps Institution of Oceanography, she investigates the health impacts of air pollution and heat, with a particular focus on environmental justice, the role of built environment, and related policy implications. Her dissertation research focuses on the impacts of extreme heat on urban transportation in California as well as adaptation. Prior to her PhD, she worked to advance environmental science policy efforts for the UN Environment Programme (in Washington, D.C.) and the National Observatory of Athens (in Greece). She holds a Master's in Climate Science and Policy from Scripps Institution of Oceanography (2017) and a Bachelor's in Environmental Studies from the University of San Diego (2014).

Thomas Berger

Mentor: **Thomas Schinko**

Research Project: **Sustainable Transport Systems: From Pollution Prevention Towards Just Mobility Transitions**

Abstract: Over the past decades a steady increase of global transport demand and associated negative side-effects on sustainability, livability, and health can be observed. Implemented transport policies are not sufficient to transform current unsustainable transport systems and little attention has been given to justice aspects, such as accessibility, affordability, and inclusivity. As transition research focusing on social sustainability dimension regarding transitions of the transport sector is still underrepresented, the proposed research concentrates on developing an approach allowing a better integration of social aspects in this field. It is presumed that a systematic integration of social sustainability aspects through a justice framework allows to put more emphasis on this less-investigated area. This research project aims to investigate how justice considerations can be more effectively integrated in transport policymaking and decision-making processes. To achieve this, we are combining a holistic systems perspective, allowing a comprehensive integration of social-, economic-, and ecological sustainability aspects, with transition-oriented approaches for sustainable transport, also taking into concern justice aspects to support the further development of transport policy. The suggested approach is firstly applied to evaluate a representative set of European and Swedish local and regional transport policies and thereafter discussed in relation to policy development. Expected results would show that integrating a comprehensive sustainability perspective allows to evaluate transport policies in a more holistic way and hence enables to raise emphasis on justice aspects. This would allow to recommend policymakers to include a comprehensive integration of social-, economical-, and ecological sustainability aspects in decision-making processes to shift from pollution prevention towards more just mobility transitions.

Biographical sketch: Thomas is a 3rd year PhD candidate in Strategic Sustainable Development at the Blekinge Institute of Technology, Sweden and is passionate to work on sustainability challenges with systemic and solution-oriented approaches. In his research, Thomas is focusing on sustainable transport systems development and how to support regional and local authorities in their strategic planning and decision-making processes. Thomas is holding a master’s degree in Environmental Systems Science and Business Administration (University of Graz, Austria). Prior to his PhD studies, Thomas has worked several years as project leader and consultant of municipalities and regions in climate, energy, and sustainability matters. He gained valuable insights how regional and local authorities but also practitioners’ deal with sustainability challenges.

Anouk Brisebois

Mentor: **Roman Hoffmann**

Research Project: **Understanding the Gendered Dimensions of Climate Resilience in Urban Destination Areas: A Case Study of a Coastal City in Bangladesh**

Abstract: In the context of climate change, an expanding body of research recognises mobility, understood as different forms of human movements, as a potential adaptive strategy to various stresses and shocks. Yet, limited research has so far explored the outcomes of mobility on gender-specific climate resilience, defined as the ability to cope with and adapt to climatic events, disasters, and changes. This is particularly true in urban destination areas. Hence, this research aims to explore women's climate resilience at their destination in a coastal city in Bangladesh, a particular hotspot for climate change. Rooted in life history interviews with women migrants, this research will investigate the gendered nature of climate resilience in urban destinations by looking into women's experiences of climatic stresses and shocks, along with the resulting challenges in their lives and their adaptive responses to various climatic events at their destination. By providing empirical evidence on the connections between mobility and gender, and their implications for climate resilience in urban destinations, this research offers valuable insights to inform policy development, advocating for more gender-sensitive and inclusive approaches to climate adaptation in high-mobility settings.

Biographical sketch: Anouk Brisebois is a second-year PhD Candidate at the Oslo Metropolitan University (OsloMet), Department of International Studies and Interpreting, in Oslo, Norway. Ms Brisebois, who is originally from Quebec, Canada, holds a master degree in international studies and a cumulative baccalaureate ès. Sciences from the University of Montreal in Canada. Before joining the Oslo Metropolitan University, Ms. Brisebois contributed her expertise to various research institutions, including CICERO Shades of Green, CICERO – Center for International Climate Research, and the Norwegian University of Life Science in Norway, as well as UNESCO in France. Her main fields of scientific interest include mobility, climate change, and gender perspectives, particularly in South Asia.

Julie Sojin Kim

Mentor: **Guillaume Marois**

Research Project: **Evaluating National Population Forecast Models for Subnational Projections in Developing Countries: A Case Study of India**

Abstract: Reliable population projections at the subnational level are crucial for effective resource allocation. Developing nations could particularly benefit from accurate population projections as demographic structures are rapidly evolving amidst multiple development agendas simultaneously. However, assumptions underlying in subnational forecasting models were primarily evaluated in developed countries, where the demographic dynamics have been relatively stable in recent decades. In this study, we assess the accuracy and predictive validity of previously proposed assumptions in population forecasting methods. We include models developed for both national and subnational levels. These include methods developed from the United Nations Population Division (UNPD), the Institute for Health Metrics and Evaluation (IHME), and the Wittgenstein Centre for Demography and Global Human Capital (WIC). In addition, we include methods that utilize the cohort-component approach applied at the first administrative level. We apply these models using state-level, age-specific fertility, mortality, and migration rates from 1950 to 2000 to project estimates from 2000 to 2020. The primary aim of this research is to test the applicability and accuracy of proposed forecasting methods in regions characterized by rapid demographic changes and substantial heterogeneity. Results from this study can provide insights into key areas where model adjustments are necessary, thereby improving their utility for policymakers in developing countries.

Biographical sketch: Julie is a third year PhD student in the Department of Health Metrics Sciences at the University of Washington and a graduate research assistant at the Institute for Health Metrics and Evaluation (IHME). Her doctoral dissertation aims to develop subnational population forecast models for countries undergoing rapid changes in population structure. She plans to use these models to evaluate their implications for healthcare systems. Julie earned her Master of Science degree from the Harvard School of Public Health and her Bachelor of Science degree from the University of Pennsylvania. Her research primarily focuses on the intersection of demographic forecasting and public health.

Kedi Liu

Mentors: **Anne Goujon, Samir K.C.**

Research Project: **Uncovering Discrepancies in Wellbeing Across SSPs With Life Satisfaction Projections**

Abstract: The Shared Socioeconomic Pathways (SSPs) are developed to portray our living towards the 22nd century and allow comparison among five distinct futures in the absence of climate policy. While considerable efforts have been devoted to exploring how climate change adaptation and mitigation could be achieved under SSPs, the wellbeing dimension has received limited attention. Anticipating the question "How will our lives be?" is imperative for understanding potential outcomes. Previous studies of wellbeing projections as SSPs extensions have often utilized Beyond-GDP metrics such as the Human Development Index and measures of inequality in income or gender. However, they frequently reveal similar or even identical levels of wellbeing development across scenarios, particularly between SSP1 (Sustainability Road) and SSP5 (Fossil-fueled Road), despite their contrary settings regarding mitigation. One potential explanation for this convergence is the absence of feedback loops from climate change impacts in current SSPs projection process. To achieve a comprehensive view and discern key determinants of future wellbeing, it is essential to employ an appropriate indicator as proxy, such as Life satisfaction (LS), which has been advocated in literature to be the only sustainable wellbeing component and represent the potential goal for sustainable development. As a subjective measurement, LS is verified to be affected by various socioeconomic and environmental factors including education, inequality, pollution among others. Based on this, we propose to project wellbeing trends by forecasting the synthesized LS through regression modeling. By further decomposing the scenarios settings and results, we aim to uncover the underlying factors and mechanisms influencing well-being discrepancies across SSPs, particularly in the context of climate change impacts. We hope this study will provide insights for refining scenarios narratives/settings and including wellbeing as an integral part of future SSPs updates and other comprehensive models.

Biographical sketch:

Kedi is a third-year Ph.D. student at the Institute of Environmental Sciences (CML) in Leiden University, the Netherlands. His doctoral thesis focuses on the Beyond-GDP metrics measuring social progress and the well-being projection. Prior to pursuing Ph.D., Kedi obtained a M.Sc. in Environmental Science with a track on Low Carbon Economy from Tsinghua University and a B.E. in Material Engineering from Northwestern Polytechnical University. Kedi's research interest lies in the field of well-being and sustainable development, especially in well-being metrics, the influencing schemes of socio-economic and climate change factors on wellbeing, and from the projection models to the pathway scenarios.

Jakob Napiontek

Mentor:	**Dilek Yildiz**
Research Project:	**Supporting Equitable Sustainability Policies with the German Synthetic Population Model**

Abstract: The socio-economic impacts of sustainability policies are crucial for their acceptance, implementation and success. This project is based on a synthetic population of Germany. This population uses machine learning algorithms to project the details of the household budget survey to all households in the census. Based on this existing current population, the project will build a high-resolution likely population of households in 2050 to support efforts to model the households affected by and influencing sustainability policies. This approach provides a granular lens to assess the impact of sustainability policies at different levels of society, with a focus on identifying and mitigating potential inequalities. While primarily focused on Germany, the methodology and findings have potential for application and extension at the European level, providing valuable insights into sustainable transition pathways and contributing to a more nuanced understanding of policy impacts.

Biographical sketch: Jakob Napiontek is a first-year PhD student at the Potsdam Institute for Climate Impact Research (PIK). He studied physics and industrial ecology in Berlin, Santa Barbara, Leiden and Delft. His research focuses on high-resolution spatial and socio-economic modelling of climate change mitigation for Germany and Europe. In his master thesis, he modelled the German housing stock and investigated construction demand and emissions in Germany until 2050. His PhD thesis is supervised by Helga Weisz (PIK) and Felix Creutzig (TU Berlin). He is currently working on extending his research beyond Germany to the whole of Europe and supporting German cities in implementing the results.

Jaewon Son

Mentors: **Joanne Linnerooth-Bayer, Juliette Martin**

Research Project: **Exploring the Role of Urban Green Spaces as Nature-Based Solutions in Korea, Germany, and Beyond**

Abstract: In the face of rapid urbanization, climate change, and escalating social-environmental challenges, cities are confronted with vulnerabilities that pose threats to both ecosystem resilience and human wellbeing. This study explores the potential of Nature-based Solutions (NbS) for addressing these multifaceted challenges and enhancing the socio-ecological resilience of cities, safeguarding the wellbeing of both the human population and nature. Urban green spaces (UGS) are critical NbS, providing diverse cultural ecosystem services (CES) that contribute to urban biodiversity, physical and psychological health, and overall urban sustainability. While diverse international agreements and conceptual frameworks have emphasized the importance of NbS, integrating local populations into the research, policy, and management of UGS still remains a challenge. Additionally, the abstract nature of CES means they are often underrepresented in co-benefit quantification and policy considerations.

Based on the insights from the questionnaire and expert interviews conducted in both Korea and Germany, this study will evaluate the integration of public perspectives into UGS and NbS management and policy decisions. Consequently, relevant policies and frameworks will be analyzed for identifying key policy drivers, potential areas of improvement and barriers in NbS and UGS management in both countries.

Biographical sketch: Jaewon is a PhD candidate in Geography at the Institute for Technology Assessment and Systems Analysis (ITAS), Karlsruhe Institute of Technology (KIT). With the support from the German Academic Exchange Service (DAAD) doctoral scholarship, her PhD project explores CES from UGS in Korea and Germany, to increase socio-ecological resilience. In her pursuit, she examines the interactions between people and urban nature by employing diverse methodologies, ranging from map-based surveys to qualitative interviews with experts and stakeholders, as well as policy analysis. Recognized as a Green Talent by the Federal Ministry of Education and Research (BMBF), She is committed to shedding light on innovative pathways towards a resilient and equitable future for all.

Crystal Yu

Mentors: **Gregor Zens, Dilek Yildiz**

Research Project: **Modeling Age-Specific Migration for United States**

Abstract: People often make moves in preparation for or in response to major life course events and transitions, such as attending higher education, obtaining a job, marriage, starting a family, and retirement. However, data about these moves, and migration data in general, are often scarce and of varying data quality. As migration becomes an increasingly important driver of population change in national and subnational settings, it is imperative to have high-quality, granular migration data for informing migration and population estimates and projections.

Drawing on previous research on model migration schedules and probabilistic migration projections, we develop a revised model for estimating age-specific migration rates, migration schedules, and estimated counts of migrants. A Bayesian framework will be utilized to help address potential concerns with migration data availability and reliability through the introduction of data- and location-specific effects. Moreover, measures of uncertainty surrounding the estimated migration rates will be produced.

Using U.S. Census Bureau American Community Survey data from 2006 to 2022, we first examine contemporary age-specific migration patterns in U.S. states, focusing on similarities and differences in the levels and timing of migration. We then use this information to estimate and produce probabilistic estimates of age-specific in- and out-migration rates and counts of migrants for U.S. states, along with prediction intervals to indicate the uncertainty inherent in modeling and predicting migration. This examination of the data and model migration estimates will allow us to obtain a more comprehensive picture of migration patterns for U.S. states and inform assessments of the impact of migration flows and patterns at the national and subnational levels. Moreover, it will help inform a methodology for estimating migration and producing subnational migration and population projections.

Biographical sketch: Crystal Yu is a PhD candidate in Sociology at the University of Washington. Her dissertation focuses on the production of subnational migration and population projections using Bayesian computational methods. Her primary research interests involve demographic methods and models, internal and secondary migration, population statistics, and data visualization.

Montserrat Koloffon Rosas

Mentors:	**Teresa Deubelli-Hwang (POPJUS/ASA), Jung-Hee Hyun (ASA), Nadejda Komendantova (ASA)**
Research Project:	**The Transformative Capacity of Partnerships for the SDGs: Opening the Black Box of Problem-Solving and Intervention-Design Tools in Nexus Governance**

Abstract: The 2030 Agenda underscores the essential role of partnerships, especially multistakeholder partnerships (MSPs), as vehicles to drive progress towards the Sustainable Development Goals (SDGs). Despite the considerable proliferation of new partnerships since the Agenda's inception, their expected transformative impact has not been reflected in tangible progress towards the SDGs, as ca. one third of the goals' targets are stagnant or even show regression below the 2015 baseline.

A possible explanation is that this paradox emerges as a result of insufficient fit-for-purpose partnerships, ie. partnerships able to deliver on their transformative ambitions by following processes that support adequate systems analysis. In my research, an original assessment framework is developed to determine the transformative capacity of MSPs by evaluating the fit between their transformative ambitions and the tools and mechanisms they employ to grasp the complex dynamics of the systems work on, as well as to design their interventions. The framework will be applied on a later stage to evaluate a sample of existing MSPs with transformative aspirations that work on the implementation of SDG nexuses.

The study's findings will advance the understanding on effective tools to accelerate the 2030 Agenda implementation in an integrated manner, addressing conflicts and trade-offs. Understanding transformative governance through SDG partnerships has implications for effective partnership brokering and meta-governance strategies. Ultimately, this research aims to provide insights and guidance to enhance partnership effectiveness in achieving the 2030 Agenda and fostering sustainability transformations.

Biographical sketch: Montserrat Koloffon Rosas is a PhD candidate within the TransformativePartnerships2030 project, and is based at the Department of Environmental Policy Analysis of the VU Amsterdam's Institute for Environmental Studies (IVM). In her research, she takes a systems-thinking approach to study the transformative potential of partnerships as a vehicle for integrated implementation of SDGs (nexus governance). Montserrat holds a master's degree in Political Science with a specialization in Global Environmental Governance from the VU Amsterdam and a BA in Political Science from the University of Mannheim. Currently, she co-leads the National Integration Working Group of the Earth System Governance SDG Taskforce.