UNNC-IGSNRR, CAS Doctoral Training Partnership

It's essential that you have contacted the UNNC and/or IGSNRR supervisors before applying.

Formal applications should follow the instructions in 'How to apply' section.

Research areas

- Environmental Sciences
- Geography

Available PhD topics

PhD topic	**Plant Responses to Climate Change and Vegetation Adaptive Strategies in Alpine Ecosystems**
IGSNRR Supervisor	Erfu Dai
UNNC Supervisor(s)	Tengwen Long
Short introduction & description of the PhD project	Understanding how climate change reshapes alpine ecosystems is essential for predicting future vegetation dynamics and guiding effective conservation. This PhD project will reconstruct past extreme climate events using multi-source records of temperature and precipitation, providing a long-term perspective on high-elevation climate variability. We will investigate three interconnected themes: (1) how historical fluctuations in temperature and precipitation have shaped the spatiotemporal patterns and phenology of alpine ecosystems; (2) the threshold responses of different vegetation types to climate change; and (3) the ecological consequences of asymmetric warming—both diurnal and seasonal—on plant community structure and functional traits. By combining extensive field observations, advanced remote-sensing data, and ecological modelling, this research aims to reveal the mechanisms by which alpine vegetation adapts to ongoing and future climate change, delivering a robust scientific foundation for ecosystem management and biodiversity conservation in high-altitude regions.
Contact points	Informal inquiries may be addressed to Dr. Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof. Erfu Dai (daief@igsnrr.ac.cn).
PhD topic	**Integrated multi-scale management of greenhouse gas emission reductions from agricultural land-use systems**
IGSNRR Supervisor	Prof. Xiangzheng DENG

UNNC Supervisor(s)	Dr Meili FENG
Short introduction & description of the PhD project	The primary research focus of the PhD is on the multi-scale integrated management of greenhouse gas (GHG) mitigation in agricultural land-use systems. This includes estimating the emission efficiency of carbon dioxide and non-carbon greenhouse gases at global, national, and regional scales, as well as assessing the mitigation potential of agricultural land use. The research aims to reveal the spatial variations in future non-carbon greenhouse gas emissions across the globe, China, and typical regions, and to analyze their impacts on critical resources such as water and soil. Additionally, it evaluates the mitigation potential of non-carbon greenhouse gas reduction measures in crop farming and livestock sectors.
Contact points	Informal inquiries may be addressed to Dr Meili FENG (meili.feng@nottingham.edu.cn) and Prof. Xiangzheng DENG (dengxz@igsnrr.ac.cn).
PhD topic	**Risk Analysis of Multiple Hazards for Rural Settlements in China**
IGSNRR Supervisor	Prof. Wang Jieyong
UNNC Supervisor(s)	Prof. Faith Chan
Short introduction & description of PhD project	With the comprehensive promotion of China's rural revitalization strategy, rural settlements, as the core space for rural production and life, play a crucial role in the sustainable development of rural areas, necessitating rational planning and safety guarantees. Given China's vast territory, rural settlements face multiple disaster risks such as landslides, floods, droughts, and tropical cyclones. Meanwhile, intensified global climate change has led to frequent extreme weather events, with uneven precipitation distribution and abnormal temperature changes, making the disaster risks faced by rural settlements complex, variable, and difficult to predict. Against this backdrop, it is urgent and necessary to conduct research on multi-hazard risk analysis for rural settlements. This study aims to comprehensively and accurately identify the multi-hazard risks faced by rural settlements, precisely quantify their exposure to various disasters, establish a scientific, reasonable, and practical multi-hazard risk assessment model, explore the evolution trends of disaster risks in Chinese rural settlements under future climate change scenarios, and provide a scientific basis for forward-thinking rural settlement layout planning and disaster prevention.
Contact points	Informal inquiries may be addressed to Prof. Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof Wang Jieyong (wjy@igsnrr.ac.cn).
PhD topic	**Integrating Computer Vision and Large Models for Real-Time Decision Support in Flash Flood Management**
IGSNRR Supervisor	Prof. Feng Wu
UNNC Supervisor(s)	Dr. Heshan Du
Short introduction & description of PhD project	Flash flood events are characterized by rapid, unpredictable dynamics, which pose significant challenges to traditional flood management systems. These conventional systems often fail to adequately address the complex environmental and infrastructural variables unique to mountainous regions. This project would develop a data assimilation algorithm for rainfall data from meteorological satellites, video surveillance, and rain gauge stations. By integrating computer vision techniques with Large Language Models (LLMs)-driven AI models, this project aims to enhance real-time flood monitoring, adaptive decision-making, and efficient resource management, providing a more adaptive and context-aware solution for flash flood management.

	By processing real-time video and imagery data, computer vision will identify critical flood indicators such as rainfall, flood flow, peak discharge, and damage to critical infrastructure. This data will be processed through LLM-based AI systems to enable intelligent decision-making regarding resource allocation, evacuation planning, and infrastructure management. The system's efficacy will be validated through case studies of flash flood events, demonstrating its potential to significantly improve disaster response, preparedness, and long-term resilience in flood-prone mountainous regions.
Contact points	Informal inquiries may be addressed to Prof Feng Wu (wufeng@igsnrr.ac.cn) and Dr Heshan Du (Heshan.Du@nottingham.edu.cn).
PhD topic	**China's aviation network resilience in the context of climate change**
IGSNRR Supervisor	Prof. Jiaoe Wang
UNNC Supervisor(s)	Prof Faith CHAN
Short introduction & description of PhD project	The aviation industry plays an essential role in the economic development of regions and nations, and its stable and effective operations have been given significant attention. However, the aviation network consisting of interconnected and interacted subnetworks is highly vulnerable to disruptive events, e.g., the capacity reduction or closure of a single airport due to extreme weather events can have widespread systemic effects. The intensity and frequency of extreme weather events (heavy thunderstorms, typhoons, snowstorms, etc.) are expected to increase as the climate changes, bringing aviation networks more uncertainty about flight delays and cancellations that affects the operations on aviation transport includes freight logistics and passengers. Assessing the aviation network's resilience against various extreme weather events contributes to a better understanding of the best business practices and industry policies in a dynamic aviation environment and facilitates the sustainable growth of the aviation industry. This project will focus on two major dimensions on (i) exploring the performance of airport resilience to various extreme weather events and (ii) measuring the aviation network resilience to climate change from both structural and dynamic aspects. The candidate expects to have excellent English and Chinse language ability plus have passed the requirement of the English test (exclude the graduates from the UK and Recognised countries – US, Oz, NZ, Canada, etc.) and have got substantial knowledge and background on urban geography, transport studies, climate change, complex system research.
Contact points	Informal inquiries may be addressed to Prof Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof Jiaoe Wang (wangje@igsnrr.ac.cn).
PhD topic	**Water resource monitoring and management for climate change adaptation and disaster risk reduction in Central or Southern Asia**
IGSNRR Supervisor	Prof. Juanle WANG
UNNC Supervisor(s)	Prof Faith CHAN
Short introduction & description of PhD project	Central and Southern Asia, as a crucial component of the Belt and Road Initiative, is witnessing an increasingly pronounced vulnerability in its ecological environment. Rational management of water resources emerges as a pivotal factor in ensuring ecological balance. Conducting comprehensive research on water resource monitoring and management is of paramount importance in addressing the challenges of climate change and reducing disaster risks. It holds significant implications for ecological

	conversation and the sustainable utilization and management of natural resources. Climate change has influenced Central in various aspects such as agricultural production, dust storms, desertification, and more. This study encompasses the monitoring of surface water, estimation of groundwater, and water resource management. This PhD project focuses on the enhancement of monitoring of surface water allows for timely access to dynamic water information and the monitoring of water quality, providing foundational data for scientifically informed ecological decisions. Estimating groundwater contributes to a comprehensive understanding of the distribution and trends in underground water resources, serving as a scientific basis for sustainable water resource management. In particular, we look at the sustainable water resource management and large-scale water footprint and potentially the water nexus, in the context of agricultural utilization, the judicious use of water resources can improve irrigation efficiency in farmlands, enhance the sustainability of agricultural production, and drive the overall development of the sustainable agricultural and circular economy. In the prevention of dust storms and the mitigation of desertification, providing necessary moisture conditions helps prevent land degradation and the further expansion of deserts. Candidates to have an excellent basic knowledge of the soil-water interactions, and processes, with an understanding of water footprint and life-cycle assessment and the techniques on geo-spatial and basic skills in modelling with software such as Python will be an advantage. Candidates also expect needs to conduct fieldwork in C Asia and China for outdoor activities. We expect candidates to have fluent English and Chinese language on oral, listening and writing ability.
Contact points	Informal inquiries may be addressed to Dr Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof Juanle WANG (wangjl@igsnrr.ac.cn).
PhD topic	**Integrating AI-Augmented Agent-Based Modeling with Video Behavior Analysis for Adaptive Strategies in Urban Flood Management**
IGSNRR Supervisor	Prof. Feng Wu
UNNC Supervisor(s)	Dr Meili Feng & Prof. Faith Chan
Short introduction & description of PhD project	Urban flood disasters require a deep understanding of individual and group behaviors to develop effective management strategies. Traditional Agent-Based Modeling (ABM) often struggles to capture realistic human responses. By integrating video-based behavior analysis through deep learning (DL) and AI-driven agents powered by large language model (LLM), this research breathes new life into ABM, making it more practical and impactful for urban flood management. This project integrates real-time video analysis and AI agent into ABM to better model adaptive behaviors during urban flood disasters. DL will analyze video data to detect and classify behaviors, providing real-time insights into individual and collective actions. AI agents, enriched by LLM, will simulate realistic decision-making processes, such as risk perception and responses to dynamic flood conditions. The enhanced ABM framework will be validated in urban flood scenarios, demonstrating its ability to improve evacuation planning, traffic management, and resource allocation, ultimately strengthening disaster response and preparedness.

Contact points	Informal inquiries may be addressed to Prof. Feng WU (wufeng@igsnrr.ac.cn), Dr Meili Feng (meili.Feng@nottingham.edu.cn) and Prof. Faith Chan (Faith.Chan@nottingham.edu.cn).
PhD topic	**Evaluation of hydro-climatic effects of the "Sponge City" program for urban water sustainable management in China**
IGSNRR Supervisor	Prof. Yanfang Sang
UNNC Supervisor(s)	Prof. Faith CHAN
Short introduction & description of PhD project	How to evaluate the risks of urban water disasters and further mitigate them is one key topic for urban stormwater management, which is also the foremost challenge for sustainable urban development. The Chinese government proposed the concept of "Sponge City" in 2013 to handle the aggravating urban water disasters (i.e. urban surface water floods/waterlogging) in China. Over the last decade, many measures and technologies have been developed to guide the designs and implementation of the "Sponge City" program (SCP) in the 30 pilot cities and also many other cities. However, there are still many challenges that prevent the positive feedback of the SCP, questioning its functions and effects. This project will focus on three major dimensions (i) solve the key hydrology-related issues (e.g. estimation of proper rainfall threshold in the various magnitudes of rainfall) for guiding the design of the SCP; (ii) evaluate the effects of SCP by considering the trade-off between the investment and its potential benefits and (iii) explore the projected changes of the SCP effects by considering the climate change impacts. The candidate is expected to have an excellent language skill (English and Chinese) and technical skills in handling big data and relevant geospatial techniques, as well as a strong understanding of climate change, floods, droughts and urban water knowledge. We prefer candidates with a strong background in these research areas, such as finishing the relevant Bachelor's and Master's studies in GIS, Geography, Environmental Science, Urban Planning, and Computer Sciences in these research directions. Candidates are expected to have good maturity and passion to take on the research pressure and challenges, with experiences in previous research and already published (e.g. in CAS Q1 and Q2 journals as first author) that are considered prudentially advanced. We expect candidates to be independent and have a strong research interest to work with our research groups at the University of Nottingham (across campuses) and the CAS IGSNRR in Beijing by spending equity of time during the funding period of 36 months.
Contact points	Informal inquiries may be addressed to Prof. Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof. Yanfang SANG (sangyf@igsnrr.ac.cn).
PhD topic	**Future urban climate resilience systems: toward smart technologically driven and dynamical complex systems approaches**
IGSNRR Supervisor	Prof. Jianghao Wang
UNNC Supervisor(s)	Prof. Faith Chan & Dr Nick Hamm
Short introduction & description of PhD project	Urban climate resilience systems are facing increasing challenges due to the rapid, transformative, and recurrently startling, changes in the conditions under which they used to operate thus under climatic extremes, an urban flood occurs. Therefore, it is crucial to innovatively explore spatial-temporal uncertainty, for both climate and non-climate-related issues, when planning, designing, and operating such systems. The potential drivers of change are manifold and today's decision-makers struggle with the systems' complexity, particularly with possible solutions for uncertain futures. This

	PhD topic expects candidates to integrate human behaviour datasets (e.g. mobile phone data, satellite imagery, etc.) and dynamic system modelling approaches to escalate the understanding of static measures before improving the understanding of the single or compound urban disaster resilience processes. Contributions are expected to show how to transition from deterministic approaches to those that incorporate different levels of uncertainty. Studies should present research that contributes state-of-the-art knowledge to the development of solutions for uncertain futures, in line with the future directions of the IPCC AR7 report and post-COP 28 foci. The candidate is expected to have an excellent language skill (English and Chinese) and technical skills in handling big data and relevant geospatial techniques and preferably a solid understanding of climate change, floods, droughts and urban water knowledge. We prefer candidates with a strong background in these research areas, such as finishing the relevant Bachelor's and Master's studies in GIS, Geography, Environmental Science, Urban Planning, and Computer Sciences in these research directions. Candidates are expected to have good maturity and passion to take on the research pressure and challenges, with research experience from a Master's degree or employment. We expect candidates to be independent and have a strong research interest to work with our research groups at the University of Nottingham (across campuses) and the CAS IGSNRR in Beijing by spending equity of time during the funding period of 36 months. In particular, we welcome candidates who are willing to develop novel open-source geospatial technology in the context of urban resilience. An exact research proposal is encouraging the submission of your application that discusses concepts and presents models and methods for building strategies, plans, and actions to accomplish sustainable development of urban climatic resilience systems in an uncertain world (we are not expecting the research only focus in Chinese cities and could be focused on the global pattern).
Contact points	Informal inquiries may be addressed to Prof Jianghao Wang (wangjh@lreis.ac.cn) and Dr Faith Chan (faith.chan@nottingham.edu.cn) and Dr Nicholas Hamm (nicholas.hamm@nottingham.edu.cn).
PhD topic	**Evaluation and application of resilient cities and human settlements toward sustainable development goals**
IGSNRR Supervisor	Prof. Dr Wenhui KUANG
UNNC Supervisor(s)	Prof. Dr Faith CHAN
Short introduction & description of PhD project	In recent years, the urban population has increased rapidly, accounting for 56% of the world's population. Energy consumption in urban areas accounts for 75% of global consumption. As a complex social-ecological system, the city suffers from various shocks and disturbances from the outside and itself. These disturbances include not only natural disasters such as earthquakes and hurricanes, and man-made disasters such as terrorist attacks and disease spread but also cumulative shocks caused by factors such as energy shortages and climate change. Resilient cities have become an important research content of SDG11 goals, and their essence lies in actively exploring adaptive adjustment methods and approaches for the uncertain disturbances faced by modern cities. Despite this, most researches focus on the basic connotation and evolution mechanism of resilient cities. The widely recognized adaptive cycle theory includes the exploitation phase, the conservation phase, the release phase and the reorganization phase.

	This project will focus on two major dimensions (i) selection and empowerment of resilience factors in resilient city research and (ii) resilient city planning (practical cases guided by urban resilience).
Contact points	Informal inquiries may be addressed to Prof Dr Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof Wenhui KUANG (kuangwh@igsnrr.ac.cn).
PhD topic	**Geographical indication ecological environment protection and sustainable development**
IGSNRR Supervisor	Prof. Zhenbo Wang
UNNC Supervisor(s)	Dr. Meili FENG & Prof.Faith Chan
Short introduction & description of PhD project	The theme focuses on the role and mechanism of Geographical Indications (GIs) in ecological environment protection, regional brand value enhancement and food security, and explores how GIS can promote the realization of global sustainable development goals through interdisciplinary integration from the multi-disciplinary dimensions of geography, ecology, economy, society and culture. Core direction: Interdisciplinary theory construction: Based on modern integrated geography theories such as regional differentiation law and the integration of nature and humanity, the theoretical framework of geographical indication system is constructed.Balance between globalization and localization: explore how GI products can maintain their local identity in a globalized market (e.g., Panama coffee, Bhutan quinoa) and participate in international standards (e.g., FAO's "One Country, One Product" initiative, EU-China Agreement on GI). Technology empowerment and data-driven: Study the application of geographical big data, Internet of Things, artificial intelligence and other technologies in case research and development (such as Changbai Mountain case group and Taihang Mountain case group) to promote the synergy of scientific discovery and policy making.
Contact points	Informal inquiries may be addressed to Dr. Meili Feng (meili.feng@nottingham.edu.cn), Prof Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof. Zhenbo Wang (wangzb@igsnrr.ac.cn).
PhD topic	**Sustainable production and land use in agricultural systems**
IGSNRR Supervisor	Prof. Wenjiao SHI
UNNC Supervisor(s)	Dr. Tengwen LONG
Short introduction & description of PhD project	Global change and agricultural systems play crucial roles in achieving the Sustainable Development Goals 2 (Zero Hunger) and 13 (Climate Action) outlined by the United Nations. Investigating the impacts of global change on agricultural systems is vital for climate change mitigation and adaptation, as well as for food security and agricultural development. While previous studies have explored the effects of climate change and land use change on food security in agricultural systems, there is still a need for further investigation into agricultural land use, resource utilization, and the eco-environmental impacts arising from crop production. Additional research is necessary to delve into sustainable production and land use in agricultural systems.

Contact points	Informal inquiries may be addressed to Dr. Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof. Wenjiao Shi (shiwj@lreis.ac.cn).
PhD topic	**Balancing global urban growth and ecological conservation**
IGSNRR Supervisor	Guangdong LI
UNNC Supervisor(s)	Tengwen LONG
Short introduction & description of PhD project	The rapid expansion of urban areas worldwide has led to significant challenges in balancing urban growth with ecological preservation. Setting urban growth boundaries under ecological conservation constraints provides a potential opportunity to align urban development with sustainable land-use practices. By incorporating ecological principles into urban planning and urban land use practices, this approach seeks to mitigate habitat loss, fragmentation, and environmental degradation caused by unchecked urban sprawl. This project aims to develop strategies for defining and implementing global urban growth boundaries that prioritize ecological protection while accommodating urban expansion. The research focuses on two key dimensions: (i) understanding the long-term and multidimensional mechanisms through which urban growth has historically impacted ecosystems, including effects on biodiversity conservation, ecosystem services, and habitat connectivity; and (ii) predicting the global urban growth boundaries under various future scenarios and proposing spatial optimization solutions to balance urban expansion with ecological conservation, while minimizing environmental footprints. Through integrating high-resolution spatial data, ecological modelling, and multi-scenario analysis, this project will provide insights into how cities can grow sustainably without compromising ecological integrity, offering actionable recommendations for policymakers to balance urbanization with conservation goals globally.
Contact points	Informal inquiries may be addressed to Dr Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof Guangdong Li (ligd@igsnrr.ac.cn).
PhD topic	**Research on the Impact and Mechanism of Plant Root-Microbe-Soil Interactions on Soil Carbon Sequestration**
IGSNRR Supervisor	Zeqing MA
UNNC Supervisor(s)	Tengwen LONG
Short introduction & description of PhD project	Understanding the interactions between plants, microbes, and soil is essential for predicting soil processes and ecosystem services, and for developing strategies to mitigate climate change. Using cutting-edge approaches, we will integrate the following measurements: (1) the three-dimensional distribution of plants (including roots), soil, fungi, and microbes; (2) rates of rock weathering, elemental release, and soil formation processes; and (3) pools and fluxes of soil organic carbon (SOC), nitrogen (N), and phosphorus (P). By explicitly considering the interactions between plants, microbes, soil, and rock, we aim to identify the biological controls that govern nutrient availability, soil formation, and erosion processes in the Red Soil Hilly Critical Zone.

	Specifically, we will quantify the contributions of plant roots, fungi, and microbial communities to the dynamics of particulate organic carbon (POC) and mineral-associated organic carbon (MAOC), providing new insights into the mechanisms that drive soil carbon stabilization and storage. The integration of this research, from molecular to catchment scales, will improve our understanding of soil processes and help develop sustainable watershed management strategies in the face of climate change.
Contact points	Informal inquiries may be addressed to Dr Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof Zeqing Ma (mazq@igsnrr.ac.cn).
PhD topic	**Swidden-induced deforestation and active fires in the tropics**
IGSNRR Supervisor	Peng LI
UNNC Supervisor(s)	Tengwen LONG
Short introduction & description of PhD project	Swidden agriculture has been a controversial practice and/or farming system in the tropics for ages and is in rapid transition and transformation. However, the dynamics of swidden-induced deforestation and active fires in the tropics remains poorly studied. This project will focus on two major dimensions on (i) mapping swidden and swidden-induced deforestation in the tropics and (ii) quantifying the contribution of tropical swidden farming to active fires in the tropics.
Contact points	Informal inquiries may be addressed to Dr Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof Peng Li (lip@igsnrr.ac.cn).
PhD topic	**Research on spatiotemporal Risk Assessment and Intervention Strategies for Zoonotic Diseases under the One Health System in the Context of Climate Change**
IGSNRR Supervisor	Jinwei Dong
UNNC Supervisor(s)	Ping Fu
Short introduction & description of PhD project	Zoonotic diseases account for 60% of known human infectious diseases and 75% of emerging infectious diseases, posing a growing threat to global and national security amid global changes. Their emergence is closely tied to environmental factors like climate change, land use shifts, ecosystem services, and biodiversity loss. The “One Health” framework integrates human, animal, and environmental health, offering a holistic approach to preventing and controlling zoonotic diseases by addressing the interconnected “environment-animal-human” system. This approach enhances early warning, disease control, and transmission chain disruption, promoting sustainable coexistence of humans, animals, and ecosystems. Studying climate change’s impact on the One Health system is critical for public health, enabling earlier intervention in zoonotic disease transmission. This project, from a geographical perspective, examines spatiotemporal overlaps among hosts, vectors, and susceptible populations. It aims to develop models for quantifying zoonotic disease risks under climate change, identify future risk hotspots, and analyze optimal intervention strategies and timing to mitigate outbreaks. Applicants should hold a bachelor’s or master’s degree in Geography, Ecology, Geographic Information Systems (GIS), or related fields, with a strong background in GIS or similar disciplines. Candidates must have published at least one SCI-indexed paper as the first author in a reputable international journal or provide substantial evidence

	demonstrating advanced mathematical analysis and academic writing capabilities. Essential qualities include excellent professional ethics, a rigorous academic attitude, strong communication and teamwork skills, and the ability to conduct independent scientific research. A genuine interest in "One Health"-related fields, good physical health, and a stable psychological profile are also required.
Contact points	Informal inquiries may be addressed to Jinwei Dong (dongjw@igsnrr.ac.cn) and Ping Fu (ping.fu@nottingham.edu.cn).

Other potential supervisors

UNNC		
Profile	**Research area(s)**	**Email**
Fangfang ZHU	Environmental Sciences & Geography	Fangfang.zhu@nottingham.edu.cn
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IGSNRR, CAS		
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