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

Potential 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	**Research on the Impact and Mechanism of Plant Root-Microbe-Soil Interactions on Soil Carbon Sequestration**
IGSNRR Supervisor	Prof. Zeqing Ma

UNNC Supervisor(s)	Dr. Tengwen Long
Short introduction & description of the 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	**Unlocking Remediation Resources from Historical Pollution Sites**
IGSNRR Supervisor	Dr. Xiaoming Wan
UNNC Supervisor(s)	Dr. Tengwen Long
Short introduction & description of the PhD project	Ancient metallurgical activities along the Silk Road and Eurasian continent have left a significant environmental footprint over millennia, and provide a unique opportunity to investigate long-term ecological adaptation under persistent anthropogenic stress. These historical sites represent unintentional long-term experiments that contrast with the short-term timescales typically seen in modern remediation studies. Understanding the trajectory of vegetation and soil microbiome evolution at these sites is crucial for addressing current environmental challenges, including heavy metal pollution, soil degradation, and ecosystem resilience in the face of anthropogenic disturbance. Exploring these palaeo-polluted environments offers a holistic approach to understanding the natural mechanisms of tolerance and detoxification that have evolved over centuries. This project will focus on two major dimensions on (i) historical environmental reconstruction (using palaeo-ecological indicators and dating to map the pollution history and human-environment interaction) and (ii) biological remediation potential (analyzing the specific adaptive mechanisms of current plant-microbe systems at these sites to identify novel genetic resources for sustainable soil restoration).
Contact points	Informal inquiries may be addressed to Dr Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof Xiaoming Wan (wanxm.06s@igsnrr.ac.cn).
PhD topic	**Climate change on infrastructure vulnerability in Africa**

IGSNRR Supervisor	Prof. Jiaoe Wang
UNNC Supervisor(s)	Prof. Faith Chan
Short introduction & description of PhD project	Climate change intensifies extreme events in Africa, severely threatening infrastructure resilience. This project focuses on the vulnerability of transport, energy, and water infrastructure in Africa. It will analyse climate-induced risks (droughts, floods) and their impacts on infrastructure functionality and accessibility. Using survey data, remote sensing data, quantitative models and simulation approaches, the project aims to propose tailored strategies for enhancing infrastructure resilience thereby supporting African sustainable development. This project includes two major work packages: (1) assessing vulnerability across different infrastructure categories and identifying their critical sections and major influencing factors; (2) analysing the transmission mechanisms of climate risks on infrastructure functionality and accessibility.
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	**Integrating Multi-Source Data and Machine Learning techniques for Flash-Flood Early Warning in Complex Mountainous Catchments**
IGSNRR Supervisor	Prof. Feng Wu
UNNC Supervisor(s)	Dr Meili Feng
Short introduction & description of PhD project	Flash floods in mountainous catchments are among the most destructive hydrometeorological hazards in China, characterised by rapid onset, strong spatial heterogeneity, and cascading impacts on settlements, transport networks, and critical infrastructure. While monitoring and warning capabilities are improving, current systems often suffer from data gaps, scale mismatch, and limited ability to translate forecasts into actionable, location-specific defence decisions. This PhD project will develop a dynamic flash-flood early warning and decision-support framework by integrating multi-source observations (e.g., satellite/radar rainfall, in-situ gauges and IoT sensors, DEM and land-surface properties, land-use/land-cover change, and socio-economic exposure) with machine learning and process understanding. Key tasks include: (i) multi-source data fusion and uncertainty quantification for near-real-time rainfall–runoff drivers; (ii) machine-learning models (e.g., deep learning and spatiotemporal/graph approaches) for short lead-time hazard prediction and impact-based warning. We seek highly motivated candidates with a strong background in geography, hydrology, remote sensing, environmental science, or a related field. Essential skills include quantitative data analysis, geospatial processing (GIS), and programming (Python/R). Experience with machine learning/deep learning, time-series modelling, and/or hydrological modelling is highly valued.
Contact points	Informal inquiries may be addressed to Prof. Feng Wu (wufeng@igsnrr.ac.cn) and Dr Meili Feng (Meili.Feng@nottingham.edu.cn).
PhD topic	**Mechanisms and Risk Assessment of Socioeconomic and Health Impacts of Flood Disasters under Climate Change**
IGSNRR Supervisor	Prof. Jiangbo GAO
UNNC Supervisor(s)	Prof Faith CHAN

Short introduction & description of PhD project	Under the context of global warming exacerbating extreme precipitation, floods have become a major natural disaster posing severe challenges to sustainable development. However, the impacts of flood are complex and multifaceted, extending beyond direct socio-economic losses to include indirect effects such as exacerbated human health consequences. Significant gaps remain in the quantitative understanding of the integrated mechanisms of these effects and their disparities across different regions and socio-economic groups. This project aims to systematically uncover the formation mechanisms and spatio-temporal evolution of integrated risks of flood under climate change, with a particular focus on the socio-economic and human health dimensions. The research will establish a novel, integrated assessment framework that moves beyond traditional single-discipline approaches by synthesizing knowledge from climate science, hydrology, economics, and public health. Specifically, the project will focus on three major dimensions: (1) socio-economic exposure and vulnerability to flood; (2) quantitative pathways of flood affect human health; and (3) a systematic, integrated risk assessment. The findings will provide crucial scientific evidence for formulating targeted climate adaptation strategies, resilient urban planning, and public health policies.
Contact points	Informal inquiries may be addressed to Prof Faith Chan (Faith.Chan@nottingham.edu.cn) and Prof Jiangbo GAO (gaojiangbo@igsnrr.ac.cn).
PhD topic	**Coastal environment changes**
IGSNRR Supervisor	Prof. Fenzhen Su
UNNC Supervisor(s)	Dr. Fangfang Zhu
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 Dr. Fangfang Zhu (Fangfang.ZHU@nottingham.edu.cn) and Dr. Dongjie Fu (fudj@lreis.ac.cn).
PhD topic	**Sustainable agricultural systems within the context of global change and the Anthropocene**
IGSNRR Supervisor	Prof. Wenjiao Shi
UNNC Supervisor(s)	Dr. Tengwen Long

Short introduction & description of PhD project	The research focuses on sustainable agricultural systems within the context of global change and the Anthropocene, addressing three core questions: • climate-resilient agriculture; • the effects of agricultural production on resources and the environment; • adaptation and optimization strategies for sustainable agricultural systems. These studies advance national food and water security, climate-change mitigation and adaptation, and the sustainable development of high-quality agriculture, and align with United Nations Sustainable Development Goals, notably SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), and SDG 13 (Climate Action).
Contact points	Informal inquiries may be addressed to Dr. Tengwen Long (Tengwen.Long@nottingham.edu.cn) and Prof. Wenjiao Shi (shiwj@lreis.ac.cn).

Other potential supervisors

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