Upcoming research opportunities

Here are the current research project opportunities with the ASE faculty. If you would like to follow up with any, please contact the professor directly (unless stated otherwise) to set up a meeting where you can discuss the requirements of the project further.

Faculty member name, email, office	Project title/theme and brief description	Suitable for ES3008/ FYP/ CNYang/ URECA/ Year of study (if appropriate)	Available to start in:
Wang Xianfeng (xianfeng.wang@ntu.edu.sg) and Yuan Shufang (sfyuan@ntu.edu.sg)	**Bioaccumulation and source tracing of pollutants in coastal Singapore** The bioaccumulation of anthropogenic pollutants throughout coastal food web impose health risks on not only coastal organisms but also human who consume the sea products. In this project, we collaborate with the E2S2 (Energy and Environmental Sustainability Solutions for Megacities) in NUS to investigate the bioaccumulation, trophic transfer, and source tracing of a wide range of emergent organic contaminants (EOCs, by NUS) and trace metals in the coastal food webs of strategically selected sites around Singapore. We will first collect abiotic (seawater and sediment) and biotic (planktons, crabs, prawns, sea snails, mussels, and fish) samples from multiple sites influenced by different land uses and identify the key trace metal pollutants in the coastal food web. We will further determine the food web structure based on both existing dietary knowledge and carbon and nitrogen stable isotopes of aquatic organisms, and quantify the trophic transfer of the key trace metals. Together with the EOCs data from NUS collaborators, we will develop a toolbox of dual (chemical and isotopic) markers to differentiate the major sources of contamination and better trace the anthropogenic sources in the coastal ecosystems. In this study, students will gain hands-on experience on natural sample treatments and advanced instrumental analysis. With the data obtained, students will also learn data processing, illustration, and scientific writing with help from responsible Research Fellow (Shufang Yuan). Opportunities to participate in the field trips to Johor and Singapore straits will also be available.	FYP/ CNYang/ URECA	Immediately

	The students will work closely with members from different research groups in both NTU and NUS.		
Simon Redfern simon.redfern@ntu.edu.sg	**Properties and processes of Earth materials: minerals as societal and intellectual resources** My group is interested in the relationships between structure, dynamics and chemical and physics properties of materials from the Earth's core to the biosphere, and how these properties impact upon broader Earth and environmental processes. Problems addressed include those critical to society today (geohazards and global change) as well as those critical to understanding our place in the universe (how did we get here?) and those critical to understanding the physics and chemistry of the planet (how does Earth work?). The theme is the relationship between mineral structure & microstructure and chemical & physical properties. This includes the relationship between microstructure of biominerals and the physical properties of the structures that they form, the geochemistry of rock-forming minerals and their influence on volcanic processes as well as geochemical cycles din the planet. We are also exploring, for example, how mineral behaviour may form the basis of new wasteforms for clean energy production as well as providing resources for future sustainable societies. Our work employs experimental methods in the lab using Infrared and Raman spectroscopy, high-pressure and high-temperature sample envir so onments using large volume presses, diamond anvil cell methods, and controlled gas atmosphere furnaces and the use of national Synchrotron and Neutron radiation facilities. Our experimental studies are augmented with computational modelling of mineral structure and properties at extreme conditions using high-performance computing facilities and quantum mechanical structure prediction to mimic a wide range of conditions from those of deep planetary interiors, to those of biomineral growth in marine organisms. We have a range of projects, from computational to experimental, and welcome enquiries and discussion to design projects that match the interests and	ES3008/ FYP/ CNYang/ URECA	Anytime

	experience of each applicant.		
Adam Switzer aswitzer@ntu.edu.sg Yuting Yan and Stephen Chua (assisting)	**Sea floor samples from Singapore / CORE-CT** Previously, we obtained high-resolution sediment cores from the Kallang River Basin (KRB) and the Jurong Lake Area, located in south and western Singapore, respectively. These cores contain valuable information about past environments of Singapore going back to the Last Interglacial up to 125,000 years ago. To reconstruct the palaeoenvironments of Singapore, we have CT-scanned the core segments to understand internal structures and artifacts which provides information on past depositional conditions. Yan et al. (2021) has also recently created a MATLAB-based program to view and manipulate CT data for sedimentary cores. There are two primary scientific objectives : 1. To convert the MATLAB code to R and Python to improve accessibility and usage of Core-CT 2. To use Core-CT and CT-imaging software to detect and quantify bioturbation in sediment cores The URECA student will first convert the published MATLAB code to R and Python to improve accessibility and usage of Core-CT by other sedimentologists and coral researchers. This portion forms part 1 of the URECA project and allows student to better understand the principles of CT-scanning, sediment and coral characteristics, and coding and statistical analysis of CT-data. This should take 3 – 4 months. The URECA student will then use Core-CT and other CT-imaging software to detect and quantify bioturbation in sediment cores. This requires analysing CT-scans of newly acquired sediment cores from the Kallang River Basin and the Jurong Lake Area. The student should think about and come up with statistical methods to quantify the reworking of sediments using CT measurements, and how to visually present these findings.	ES3008/ FYP/ CNYang / URECA	Anytime in 2021
Federico Lauro Contact: flauro@ntu.edu.sg	**Understanding viral lysis and lysogeny under hydrostatic pressure in the deep-sea** Viruses are the most abundant biological entities in the ocean and key players of marine biogeochemistry. They are the primary agents of mortality and control	ES3008/ FYP/ CNYang/ URECA	Immediately

	of marine microbial populations and, as a result, drive much of the secondary production in the Ocean. This is particularly important in the abyssal and bathyal zones where the amount of primary production is limited. Viruses differentially influence the abundance of microbial taxa. For example, there is evidence that prophages (viruses that integrate in the genome of a microbial host) are much less common in Archaea than Bacteria and recent reports indicate that Archaea rather than Bacteria are selectively lysed in deep-sea sediments We seek two undergraduate students who will take a key role in trying to understand: 1) How increasing hydrostatic pressure influences the various stages of phage infection (i.e. adsorption, penetration, replication and lysis). 2) How increasing hydrostatic pressure and heavy metal concentration influences the defense mechanism of microbes against phage infection (i.e. mem brane vesicle formation). 3) How increasing hydrostatic pressure and nutrient deprivation promotes the switching to a lysogenic or lytic cycle. 4) What proportion of Bacteria and Archaea are infected by viruses at various water depths The project duration is either for a semester or for a full year and will combine aspects of classic microbiology (e.g. growing bacterial hosts and viruses under high pressure conditions) with molecular biology (e.g. DNA isolation and sequencing) and bioinformatics. The project might also require travel to the lab of our collaborators in Hokkaido (Japan) for either fieldwork or sample processing.		

Eleanor Slade eleanor.slade@ntu.edu.sg	**Public perceptions of insects in SG (co-supervised with Ong Xin Rui)** Insects make up around half of all living species and provide important ecosystem services like pollination, biocontrol, and decomposition and nutrient recycling. Recently, there has been more attention towards insects amongst the general public and the scientific community due to reports of insect declines and its potential cascading effects on biodiversity and the environment. Yet, insects and their importance are still relatively unnoticed and rarely funded or considered as conservation priorities, unlike vertebrate groups like mammals and birds. Furthermore, due to negative perceptions like fear or disgust towards insects (e.g. mosquitoes, cockroaches), they are seldom the talk of biodiversity conservation. Qualitative and quantitative surveys would be conducted in partnership with Singapore Zoo to assess public perceptions of insects and compare these to the "charismatic" mammals people go to visit in the zoo. **How do invertebrate (dung beetles/litter/soil inverts) traits change across land use and micro-climatic gradients** How animals adapt and respond to changes in their environment is a key question in ecology. Insects have quick generation times and so can respond rapidly to environmental change. This may be expressed in traits which can be easily measured, and which may trade-off against each other. For example, recent studies have shown that ants in the canopy are darker than those at ground level, to combat increased light and temperature. Dispersal traits, such as wing morphology may also change in response to the need for increased dispersal in habitats, and may trade-off with reproductive traits. We have collections of invertebrates collected across disturbance gradients from primary forest, logged forest, fragmented forests and oil palm, with associated data on temperatures, forest structure etc. This project will measure traits of individual specimens from sites across this gradient to if both intra- (differences among individuals within a species) and inter- (differences among species) specific traits change across the gradient. The project will require lab and microscope work, but the invertebrates are already collected, so no fieldwork is involved. **Invertebrate communities across a vegetation gradient in Singapore.**	ES3008/ FYP/ CN Yang - society students ES3008/ FYP/ CN Yang ES3008/ FYP/ CN Yang	

	Dung beetles and litter invertebrates are important bioindicator taxa and ecosystem engineers. Invertebrate distributions and community structures across Singapore are still relatively unknown for a lot of groups. Working with colleagues in NParks we are sampling the invertebrates communities in the parks and nature reserves around the central catchment area to determine how the fauna changes with vegetation and disturbance and create species lists. This project may involve fieldwork setting traps in the field, and then lab work sorting, pinning and identifying the samples, and molecular work to generate barcodes. *****If you are interested in invertebrates in tropical forests, oil palm, or urban environments and have ideas for potential projects then do come and have a chat*****		
Janice Lee Contact: janicelee@ntu.edu.sg	**Title: Do voluntary sustainability standards for agricultural production contribute towards climate mitigation and adaptation? [Unavailable, if you have any related research interests, please send me an email]** There are plenty of voluntary sustainability standards that push for sustainable production of agricultural commodities. Apart from these standards being good for the environment, there could be co-benefits related to climate mitigation and adaptation for farmers and their landholdings. This project would embark on a comprehensive review of voluntary sustainability standards and identify the criteria and indicators that contribute towards climate mitigation and adaptation.	ES3008/ FYP/ CNYang/ URECA	Anytime from May 2024
Janice Lee Contact: janicelee@ntu.edu.sg	**Title: What are the types of Independent Smallholder Sustainable Palm Initiatives out there? [Unavailable, if you have any related research interests, please send me an email]** Sustainable palm initiatives include preparing smallholders for obtaining voluntary sustainability certificates such as the RSPO, which help farmers obtain premiums for their produce. Unfortunately, many independent smallholders (i.e., smallholders with no prior knowledge and help for planting palm oil) lag behind in sustainable palm production. There have been many sustainability palm initiatives set up for independent smallholders, but there is no oversight or review	ES3008/ FYP/ CNYang/ URECA	Anytime from May 2024

	of what these initiatives entail. This project would embark on a comprehensive review of independent smallholder sustainable palm initiatives across the world and understand what are the factors that contribute to their adoption and success, as well as what are the lessons learned over time.		
David Lallemant Contact: David Lallemant: dlallemant@ntu.edu.sg	**Title: (Re)-develop crowd-sourced post-disaster damage assessment platform** Rapid assessment of damages after a disaster is a difficult but critical task in order to support disaster response, recovery and reconstruction efforts. The use of remote sensing (e.g. satellite imagery) to support such task has been increasingly used to support such efforts, in order to quantify the amount and spatial distribution of damage. The analysis of raw remote sensing data of damage remains a huge and very complex task. Several efforts have focused on leveraging the crowd to rapidly analyse optical imagery which can cover thousands of square kilometers. Such crowd-mapping & crowd-analysis initiatives are often time-consuming and tedious for individual volunteer mappers, and several studies suggest sub-par quality of assessment. This project builds on previous work conducted at Stanford University in which a new tasking protocols and post-processing methods were tested. Specifically, rather than having volunteers assess damage to individual buildings seen in an image, the volunteers are tasks with comparing damage from two images. The work will involve modifying a pre-existing web-based crowd-sourcing tool on the Pybossa platform, and re-run experiments. The experiment will use data from the 2010 earthquake in Haiti. This work may lead to further work exploring crowd-sourcing, or the use of AI for rapid disaster damage assessment. Coding and data analysis experience are desirable. Effort ~ year-long project	CNYang/ ES3008/ FYP	January
David Lallemant, Maricar Rabonza	**Title: Measuring probabilistic lives saved from risk reduction interventions** Measuring the effectiveness of disaster risk reduction intervention is famously difficult, since disasters are relatively infrequent and highly variable. Risk	CNYang/ ES3008/ FYP	January

Contact: David Lallemant: dlallemant@ntu.edu.sg Maricar Rabonza: MARICARL001@e.ntu.edu.sg	analysis offers a methodology to calculate probabilistic benefits of disaster risk reduction interventions even when no disasters occur. While some of this has been conducted before in the context of cost-benefit analysis of interventions, this is very rarely used to calculate probabilistics fatality reduction. This project will involve working on a case study to calculate probabilistic lives saved from a particular disaster risk reduction policy or activity. The work has direct societal implications, in that it will constitute one of the first attempt to celebrate successful risk reduction interventions through quantitative analysis. The research will involve a literature review and document analysis, data collection, cleaning and analysis. The student will have the opportunity to work closely with a PhD student with expertise in risk analysis. Effort: semester-long or year-long project (scope can be adapted)		
David Lallemant, Lim Tian Ning Contact: David Lallemant: dlallemant@ntu.edu.sg	**Title: Investigating new technologies and methods for natural hazards exposure data collection** Understanding risk requires an understanding of the infrastructure, housing and other assets that could be impacted by various hazards such as earthquakes, typhoons and floods. The inventory of these assets is called the "exposure" to risk. Typically exposure is collected from field surveys of buildings, or extrapolated from census or other databases. This project will investigate the use of novel tools such as street-view imagery or drones to collect this information. Work would involve research on current cutting-edge practices for exposure data collection for various hazards, and the testing of new methods. Project may involve the collection of new street-view & drone data, or the analysis of existing data collected previously. No prerequisites required. Effort: semester-long or year-long project (scope can be adapted)	CNYang/ ES3008/ FYP	January

Janelle Thompson janelle.thompson@ntu.edu.sg	**Astrobiology & Extremophilic Biology** **1. Culture-based analysis of diverse extremophiles.** This project will be based in our lab in ASE B1. In this project you will enrich, culture, identify and (possibly) genome sequence novel isolates from Singapore's Microbial Biodiversity, which represents a rich and relatively untapped source of natural capital for biotechnology. Methods to be used include anaerobic cultivation using alternative electron acceptors and selection under high temperature, extreme pH, or high pCO2. **2. Thermophilic viral diversity and function** This project will be based in our lab in ASE B1 and SCELSE labs. Project entails metagenomic characterization of viral assemblages associated with biofilms along thermal gradients. How does the viral assemblage change? Is there evidence of interaction between viral and microbial populations? Do thermotolerant viruses host enzymatic potential of biotechnological interest? Prior laboratory experience -or- bioinformatics experience, a plus. **3. Also happy to discuss other related project ideas (e.g. fields of astrobiology or extremophiles)**	FYP/ CNYang/ URECA	Sem 1, 2 or Summer 2024. Minimum commitment 1 year.
Janelle Thompson janelle.thompson@ntu.edu.sg	**Environmental Health** **1. eDNA-based biosurveillance of pathogen reservoirs and hosts** This project will be based in the laboratories at SCELSE. In our SCELSE lab we routinely use eDNA and eRNA based approaches to study microbial diversity and have led the campus wastewater surveillance network SARS-CoV-2 through the pandemic. We are currently validating methods to track eDNA from potential pathogen vectors and reservoirs (e.g. insects, fish, birds, mammals) to assess overall genetic biodiversity using metabarcoding approaches. In this project we will carry out a series of observations of the biological community in Nanyang Lake, here on NTU's campus using eDNA based-assessment and visual observation for validation. Through time-series sampling we'll examine the	FYP/ CNYang/ URECA	Sem 1, 2 or Summer 2024. Minimum commitment 1 year.

	hypothesis that the biological community in Nanyang Lake is influenced by seasonal forcings such as the monsoons and migratory birds and we'll evaluate the overall biodiversity of targeted groups to other estimates from man-made and natural systems. **2. Also happy to discuss other related project ideas (e.g. fields of microbial water quality, marine/mariculture disease, environmental health assessment)**		
Benoit Taisne Contact: btaisne@ntu.edu.sg	**Range of approaches to study volcanic system** In the team we always welcome students interested in studying volcanoes. The projects could include the use of remote sensing, space based or ground based, to identify and characterise the scale of an ongoing eruption. But could also be laboratory work, where we design small scale experiment to test the impact of different factors on volcanic unrest and plumbing system evolution. We also develop tools to analyse monitoring data in real-time to improve our level of confidence in forecasting the likely outcome of an unrest.	ES3008/ FYP/ CNYang/ URECA/ Year of study	Anytime
Natasha Bhatia Contact nbhatia@ntu.edu.sg	**1. Importance of Coral Reefs for Recreation in Singapore** I have a set of data from a survey that was conducted around the time of the pandemic, asking the local coastal habitat users their perceptions of coral reef ecosystems. I would like someone to conduct the same survey again, and then conduct a temporal analysis to see how viewpoints may have changed **2. A temporal analysis of "relational" ecosystem service value** Relational value is the value associated with how society relates to nature, and how natural spaces provide opportunities for us to relate better to one another. Singapore's rate of urbanisation means we've lost some of our natural areas over time, and therefore potentially some opportunities to relate to nature and one another. I'd like to conduct a study that targets the older generation and the younger generation in Singapore, to look at how relational value may have changed with urbanisation. Requires socio-economic field work.	FYP FYP Or ES3008/CNYang/ URECA if you're	January/ August January/ August

	3. Artistic inspiration as an ecosystem service in Singapore Historically, Singapore has been home to poets, artists, film makers, writers and photographers; and more recently, instagrammers, bloggers and mixed media makers, many drawing direct inspiration from the natural habitats that can be found in Singapore. By quantifying artistic inspiration as an ecosystem service, we will have the opportunity to present conservation managers and policy makers with something that can be used in a practical sense to represent the intrinsic value of nature in management frameworks, potentially helping to add to the reasons to conserve. Will likely be presented as a national scale GIS data layer. Mostly desk based research, but potentially also some field work **4. The changing cultural value of coastal Singapore** Cultural services are the nonmaterial benefits society gains from nature. In the rapidly urbanising coastal areas around Singapore, it's likely that these services have changed dramatically over time. By knowing how these changes might have impacted the current generation, we may be able to mitigate future undesirable impacts. **Got an idea in this wheelhouse you don't see here? Happy to talk more!	willing to hit the ground running FYP or CNYang/URECA/ ES3008 if you want to focus on one specific area	January/ August
Shawn Lum shawn.lum@ntu.edu.sg Collaborators: Dr Ngo Kang Min, Norman Lim (NIE), A/P Lee Yee Hui (NTU-EEE)	**Forest Fragmentation, Effects of Defaunation, and Forest Regeneration** are the principal themes that have interested me over the past 30 years, and has been informed by the work I have done with Dr Ngo Kang Min and others over the years in a long-term study at the Bukit Timah Nature Reserve. I am happy to discuss potential projects that involve plant ecology, conservation biology and plant evolution as well, but some projects that are on-going include: 1. **Large seeded trees - how dispersal limited are they?** Habitat loss has resulted in the loss of 50% or more of Singapore's mammals and birds, with larger species disproportionately impacted. Many are important seed dispersers and it has often been asserted that the loss of these large seed predators should adversely impact regeneration of the large seeded trees that were dispersed by now-extinct larger vertebrates. Using the families Myristicaceae and Burseraceae as case studies, we will use field	FYP/ES3008/ URECA/CNYang (projects will be scaled according to the programme /course)	May/August

	observations, camera trap data and long-term tree demographic data to examine impacts of defaunation on dispersal and regeneration of primary forest trees. 2. **Tree mortality and community composition in primary and secondary forests**. Long-term studies in Singapore (at Bukit Timah Nature Reserve) and elsewhere have demonstrated shifts in tree species composition in tropical rainforests over the past 30 years. This project aims to look closely at tree mortality to look for patterns in mortality that are difficult to discern when demography data that is more typically collected at five-year intervals. Work will be conducted primarily at Bukit Timah, with the establishment of monitoring sites in selected spots in the Central Catchment Nature Reserve.. 3. **Assessing reforestation success in Singapore forests** Students will be involved in a long-term monitoring project that focuses on reforestation plots in Singapore. By measuring the trees, and using past data of tree measurements of the planted trees, we can learn about long-term reforestation success in these study sites. We can also learn about natural forest regeneration by studying the understorey plant community. The sites also experience frequent large-mammal visits, and students can also study the effect of large herbivores on forest dynamics and regeneration.		
Observational Seismology Contact: Wei Shengji shjwei@ntu.edu.sg	**Earthquake source physics and seismological research in SE Asia** Understanding the fundamental physics of earthquakes is critical for seismic hazard preparation and mitigation, in particular in SE Asia. The project aims at using advanced modelling and data processing approaches (e.g. machine learning) and state-of-the-art earthquake observations to gain insights to the physical processes of earthquakes. The student will process the seismic and other relevant datasets for earthquakes and make proper interpretations to the results, under the content of rock physics and plate tectonics.	ES3008/FYP/ URECA/CNYang	Anytime
Aquatic Biochronology Lab (ABL)	**Marine fishes/fisheries in Singapore and SE Asia** Students interested in marine fishes (particularly otoliths), illegal fishing in SE	ES3008/ FYP/ CNYang/ URECA	Anytime

Contact: Joyce Ong joyce.ong@ntu.edu.sg	Asia, impacts of climate change on fishes, or socio-ecological links between humans and fishes are welcome. Some examples of projects are finding out information on illegal, unreported and unregulated fishing in SE Asia, investigating the ages of marine and freshwater fishes collected in Singapore using otoliths, being part of a team to create an otolith atlas (see here for Taiwan example) for freshwater and marine fishes in Singapore. Projects relating to aquaculture are also welcome, some past examples are daily growth of aquaculture fishes and use of black soldier fly larvae for fish feed. Other ideas are welcome, good writing, communication and organizational skills are required, prior experience with R and statistics would be helpful.		
Steve Yim steve.yim@ntu.edu.sg	**Big data research on the environmental sustainability in the operations of school campuses** This study aims to analyze a range of environmental sustainability data collected in the two campuses of an international school. The big data set includes energy usage, food waste, water usage, etc. The objectives of this study is: 1) To assess the characteristics of each type of environmental sustainability data in each campus 2) To evaluate the effectiveness of on-going measures/interventions on the overall environmental sustainability performance in the campuses 3) To offer recommendations/interventions to further improve the environmental sustainability performance in the two campuses In this study, a number of knowledge/skills will be learned: 1) Data analysis skills using statistical and machine learning approaches 2) Big data research on environment 3) The knowledge of environmental sustainability in actual operations of school campuses	ES3008/ FYP/ CNYang/ URECA	Anytime

	This study seeks for 2 to 3 students to form a group to work on this collaborative project. The students have to be: 1) Keen to environmental sustainability 2) Open to learn new skills and software 3) Flexible and responsible to work in a team 4) With experience in data analysis or taking relevant courses		
Aron Meltzner meltzner@ntu.edu.sg	**Three-dimensional and digital elevation model analysis of coral microatolls in Singapore, toward improved Holocene sea-level reconstructions** Little is known about past relative sea level (RSL) in Singapore. Our research group uses coral microatolls as natural 'tools' to extend tide-gauge records back in time and to reconstruct RSL in Singapore over the past ~8000 years. We have identified and photo-documented microatolls at sites in the Southern Islands of Singapore. These microatolls will be used to reconstruct RSL, but detailed, quantitative analyses of the RSL changes recorded by each microatoll are crucial steps in the interpretive process. The URECA student will use structure-from-motion techniques to generate 3-dimensional (3D) and digital elevation models (DEMs) of selected fossil coral microatolls. The student will then analyse and interpret the 3D models and DEMs, quantifying RSL at various times in the past, and estimating rates of RSL change. These results will stand alone but will also contribute to our broader efforts to reconstruct high-accuracy, high-precision RSL histories for Singapore. The URECA student will have opportunities to join our group during field work in the Southern Islands, and to collaborate with other group members in parallel efforts to reconstruct RSL in Singapore.	Suitable for all levels — multiple students sought for this project. Each project details and associated expectations will be tailored to student's level and interests.	Anytime

Kyle Morgan kmorgan@ntu.edu.sg	**Coral reef science in Southeast Asia** Coral reefs in Southeast Asia support high biodiversity. Human activities have radically altered living coral populations and their environments from those that originally formed reefs. There is an absence of scientific data from the region, which makes it challenging to predict how stressed reef systems will continue to grow and respond to climate change. We use multiscale ecological and geological datasets to understand how coral reef degradation has affected coastal resilience across Southeast Asia. We welcome students interested in different aspects of coral reef science, including: coral reef paleoecology, coral reef ecology, carbonate production by coral reef organisms, ocean environmental conditions and water quality, carbonate sediments, methods for quantifying 3D structure of corals and reefs, remote sensing of marine habitats.	FYP/ CNYang/ URECA	Anytime
Perrine Hamel (perrine.hamel@ntu.edu.sg)	**Play-Based Environmental Education** Background: Physical play-based experiences have been increasing in popularity – see scavenger hunt/mystery activities like Hidden.SG or various pop-up events. This project aims to investigate the current supply and demand for such activities in Singapore, and to explore how these experiences might be used for environmental education. No experience in game design required but a keen interest is appreciated. Tasks - Review papers and grey literature on play-based environmental education - Participate in existing play-based experiences in Singapore - Contribute to conceptualization (and execution, if time permits) of a play-based environmental education program for NTU and/or Singapore	FYP/ CNYang/ URECA	Immediately

Perrine Hamel (perrine.hamel@ntu.edu.sg)	**Hydrology of the Pakerisan River watershed** The Pakerisan River Valley in Bali, Indonesia, was declared a Cultural Heritage Site by UNESCO in 2012, acknowledging its importance from a spiritual, agricultural, and water resource standpoint. Given the pressures brought by land conversion and climate change, it is critical to better understand current hydrology and expected changes in the near future. With this aim, this project aims to develop and validate a hydrological model of the Pakerisan River watershed. The model will then be used to evaluate the impact of scenarios of land use and climate change.	FYP/CNYang/URECA	
Le Chencheng ccle@ntu.edu.sg Collaborator: Prof Zhou Yan (NTU-you CEE)	**Sustainability Assessment of Mycoprotein Cultivation from Food Waste** Food waste is a significant problem today, with an estimated one-third of all food produced for human consumption going to waste yearly. This waste represents a significant economic loss and has negative environmental impacts, contributing to greenhouse gas emissions and pollution. To achieve sustainable food systems, efforts to reduce and repurpose food waste are necessary. One promising solution is the cultivation of mycoprotein using food waste as a substrate. In this sustainability assessment, the student will ● Evaluate the feasibility of using food waste as a substrate for mycoprotein cultivation for the techno-economic analysis. Consider the costs associated with collecting and transporting food waste and the capital and operating costs of the mycoprotein production process. Consider the potential revenue generated from the sale of mycoprotein products. ● Evaluate the environmental impacts of using food waste for mycoprotein cultivation. Consider the greenhouse gas emissions, water	FYP/ CNYang/ URECA (Projects can be scaled according to the programme)	Immediately

	use, and land use associated with the production and transportation of food waste and the mycoprotein cultivation process. Assess the potential benefits of mycoprotein cultivation, including its lower environmental footprint than conventional meat production. This study seeks for 1 to 2 students, who should be keen on sustainability, willing to learn new skills, able to work well independently and in a team, and have prior experience in data analysis or relevant coursework. The students will participate and work closely with researchers from other institutions of NTU and from industries.		