MIRAI 2.0 Project Short Course for PhD Students in Sustainability

Syllabus

About MIRAI 2.0

MIRAI 2.0 is a collaboration between 20 Swedish and Japanese universities, aiming to contribute to long-term research collaboration and to promote Sweden and Japan as nations of world-leading large-scale research infrastructure.

MIRAI 2.0 (2020-2023) focuses on early career researchers and addresses scientific issues within Ageing, Materials Science, Sustainability, Artificial Intelligence and Innovation and Entrepreneurship relevant to both countries. Visit MIRAI 2.0 website: https://www.mirai.nu/

Course Title: Challenges and Advances in Environmental Change

Course information

Aim:

The course aims to broaden the knowledge of PhD students regarding major challenges and solutions regarding environmental changes.

Objectives:

Having completed the course, the student should deepen his knowledge regarding major environmental changes on a local, regional, and global scales. The students should develop a critical perspective on research performed at different knowledge areas, most specifically on potential solutions to mitigate the effects of environmental changes.

Participants:

Students enrolled in PhD courses in all 20 universities which are affiliated with MIRAI 2.0 initiative. Students who plan to participate in this course will apply through their university. Up to 20 students may be admitted to the course.

Design Concepts:

Pair module-structured,
Comparison-oriented
Interaction-emphasized
Practice-minded
The course content consists of **online lectures** and **field activities both in Japan and Sweden.**
Each module or lecture may require a paper or other assignment.

Program Coordinator:

Guangwei Huang (Sophia University)

Responsible Universities: Sophia University and Linköping University

Instructors:
Faculty members from both Japan and Swedish universities which are affiliated with MIRAI
Each module comprises lectures by both Japanese and Swedish instructors.
<Sophia University (Japan)>
Guangwei Huang, Xuepeng Qian and Masachika Suzuki
<Linköping University (Sweden)>
Alex Prast, Anna Ljung, David Bastviken, Stefan Anderberg and Björn-Ola Linnér

Certificate of accomplishment
There is no academic credits attached to this course.
Certificate of accomplishment will be given to students who attend all lectures and successfully meet the equirements.

Credit recognition
Academic credits may be granted for the course under the European Credit Transfer System at the discretion of the participant's institution on evaluation of the course work based on credentials to be issued on request.

Course literature - The list of course literature will be provided by the course teachers.

Modules and contents

Module A "Concept and theory"
<Lecture title> Weak, Strong Sustainability and Planetary Boundaries
<Instructor> Guangwei Huang, Sophia University
<Description>
This module presents an overview of sustainability definitions, concepts and related theories, aiming at equipping students with a strong foundational knowledge of sustainability and discussing the balance between environmental, social, and economic systems. It also provides students with a better understanding of how sustainability can be approached from water perspectives.
<Instructor's profile>
Dr. Huang is a Professor at Sophia University, Japan. Passionate about water, his study evolved from fluid dynamics to water quality modeling and to integrated watershed science and management. In recent years, his main research focus is sustainability science from water perspective such as wetland conservation and wise use, flood vulnerability and resilience analysis in relation to watershed planning. Wording differently, he uses water as a nexus to link the three pillars of sustainability.

<Lecture title>
Drivers of transformations: the what, when, who and how of societal change toward sustainability.
<Instructor> Björn-Ola Linnér, Linköping University
<Description>

Incremental change simply does not suffice to reach theParis Agreement, the 2050 Biodiversity Goals nor the 2030 Agenda and Sustainable Development Goals. Within the United Nations, numerous countries around the world as well as the research community, calls are mounting for profound, enduring and systemic societal transformations involving social, cultural, technological, political, economic and ecological changes. Such transformations require careful attention to the processes by which transformative change occurs. This lectures will present state of the art based on an ongoing assessement report by the International Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

<Instructor's profile>

Björn-Ola Linnér is professor in Environmental Change and at the Centre for Climate Science and Policy Research, Linköping University. His research focuses on transnational governance on climate change and sustainable development goals, societal transformations, the geopolitics of sustainability, and methods for policy analysis and dialogue. His latest books are the co-authored *The Political Economy of Climate Change Adaptation (Palgrave MacMillan 2016)* and *Sustainability Transformations: Agents and Drivers of Social Change (Cambridge* University Press 2019). He is a lead author of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' (IPBES) *Transformative change assessment*.

Module B "Pathways and approaches for SDGs implementation from biogas perspective"

<Lecture title> Biomass utilization and regional symbiosis

<Instructor> Xuepeng Qian, Sophia University

<Description>

The development of biomass for energy production is largely encouraged on a large scale in local cities and developing nations, in addition to traditional domestic utilization. As a matter of fact, many biomass projects still operate, while experiencing low efficiency and operation challenges. In this module, we will see case studies of operation performance of specific biogas projects from Japan and China, with a focus on its project sustainability and connection to the regional symbiosis. Group discussion could be conducted to think about how to improve the situation through scenario analysis.

<Instructor's profile>

Dr. Qian specializes in urban and environmental planning. He has been working on urban and environmental issues such as urban development, transportation, resource sustainability, water, energy, and low carbon, through interdisciplinary and systems approaches. His research interests are focused on exploring the visions of urban and regional sustainability and how to plan and promote transformations for sustainable development.

<Lecture title> Biogas and regional symbiosis in Sweden – prospects, achievements and challenges

<Instructor> Stefan Anderberg, Linköping University

<Description>

This course introduces and discusses the development of biogas in Sweden, which in many cities and regions have been the most important regional response to climate mitigation and other environmental challenges in recent decades. The typical Swedish biogas model is built on a kind of urban symbiosis, where urban biowaste is used for production of biomethane, which is used as a fuel for city buses and other vehicles. This model is now partly challenged by electrification of local transports, but biogas use in other sectors has

increased dramatically. Since this growing demand is currently predominantly covered by imports, the great challenge today concerns increasing the domestic production and realize the large still untapped potentials for biogas production. This module will consist of *a lecture and a seminar* built on selected studies from the Biogas Research Centre at Linköping University with a particular focus on biogas as a regional endeavour, biogas policy in Sweden and other countries in Europe, and future development of biogas in Sweden (scenario studies).

<Instructor's profile>

Stefan Anderberg is professor of Industrial Ecology at Linköping University. He has a PhD in Human Geography from Lund University and was previously co-director of Lund University Centre for Sustainability Studies, associate professor at University of Copenhagen and researcher at the International Institute for Applied Systems Analysis in Austria. His research has been connected to many different sustainability issues but often focused on the development of resource flows in different scales, their impacts and related governance issues, and how cities, regions and companies respond to sustainability challenges. His current research focuses on urban metabolism, waste management, transports, water pollution, urban infrastructures, climate-neutrality strategies in cities and biogas development in Sweden and Europe.

Module C: "Multi-sector partnerships in climate change mitigation and adaptation"

This module introduces cases and literature where business and other actors in society work together to cope with climate change mitigation and adaptation.

<Lecture title> Exploring cases of business and other actors in society for climate change mitigation

<Instructor> Masachika Suzuki, Sophia University

<Description>

Special attentions are paid to the roles of the private sector and the financial community in the efforts to mitigate climate change and to bring economic, social, and environmental "co-benefits" through the implementation of mitigation measures.

<Instructor's profile>

Masachika Suzuki Ph.D. is a Professor at Graduate School of Global Environmental Studies at Sophia University. The area of his research interests includes clean energy technology innovation and development, sustainable finance and banking, and sustainable tourism and community development. Apart from the academic career, he has work experience in the field of environmental and energy consultancy. The previous positions include senior analyst positions at Mitsubishi Securities in Tokyo and Innovest Strategic Value Advisors in New York as well as consultant positions at the UN Department of Economic and Social Affairs (DESA) in NY and the United Nations Framework Convention on Climate Change (UNFCCC) in Bonn.

<Lecture title> Exploring multinational companies' and multisector partnerships' role in climate change mitigation

<Instructor> Anna Ljung, Linköping University

<Description>

In this part of the module, multinational companies' and multisector partnerships' role in the mitigation of climate change will be in focus. Connected academic literature in the area of business strategy, as well as some cases of multisector partnerships in climate change mitigation in Sweden, will be discussed.

<Instructor's profile>

Anna Ljung, Ph.D. is senior lecturer at Linköping university, department of Environmental change. Her academic background is from international marketing, and her research interests include multinational companies' role in society generally, and in the climate change mitigation specifically. Theoretically her basis is found in the business network relationship view of multisector partnerships. She currently participates in research projects with focus on social innovations in multinational companies, business behavior in relation to public environmental policy connected to GHG emissions, and the role of AI in assessments of value chain emissions under the umbrella of EU's Green deal regulations: carbon border adjustments.

Module D: Waste management– challenges in relation to the development of a circular economy

<Lecture title> Municipal solid waste management in Sweden

<Instructor> Stefan Anderberg, Linköping University

<Description>

This module will introduce the development of the handling of municipal solid waste in Sweden, and address the challenges of the municipal solid waste management. In the last 50 years, a radical transformation of the waste handling has taken place where landfilling of municipal waste has been totally replaced by waste incineration for heat and electricity, recycling, composting and biogas production. However, there is still a long way to go to reach circularity in many resource flows. Recycling is often relatively undeveloped and dominated by downgrading of resource values and the widespread incineration, which has become part of EU emissions trading system, is challenged by increasing prices on CO_2 emission permits. This brings needs to improved waste sorting, particularly reduce the plastics in the incinerated waste stream, and develop better systems for reuse and recycling. The module will consist a lecture and a seminar that will focus particularly on the challenges of improving waste sorting and recycling of municipal solid waste.

<Instructor's profile>

See Module B.

<Lecture title> Development of waste management in Japan

<Instructor> Xuepeng Qian, Sophia University

<Description>

The development of waste management will be introduced, as well as the progress of Sound Material-Cycle Society based on material flow analysis. Japan relies heavily on incineration due to the limited landfill capacity. Although innovative schemes have been established, the recycling rate hasn't been improved much in recent years. In 2022, a new law went into effect, requiring municipal governments to collect all household plastic waste as well as plastics packages. This brings changes to the current waste sorting and collection system. Behavior studies of waste sorting at source will be covered as a focus to show the citizens' perspective of waste management and policy. Moreover, with the progress of waste management system in Asian countries, the polices of waste sorting at source and their implementation have become an urgent topic. Some comparative studies will be also introduced in the lecture.

<Instructor's profile>

See Module B.

Module E: The water-society nexus

This module introduces cases and literature on challenges regarding water management across landscapes with consideration to ecosystem function and revises and societal needs. The toping includes interactions between water and other tightly linked environmental issues or activities e.g. carbon and nutrient cycling, pollution and agriculture and forestry. A major aim is to generate opportunities to learn about and compare perspectives and challenges on this topic among Asia and Europe.

<Lecture title> Moving from sectoral control to integrated watershed management
<Instructor> Guangwei Huang, Sophia University
<Description>
Integrated watershed science and management is the process of studying and managing human activities and natural resources in a cross-sector manner on a watershed basis. Using theories and case studies, this module aims at providing students with a better understanding of what is integrated watershed science and management, why needed, what has been achieved, and what should be pursued further.
<Instructor's profile>
See Module A.

<Lecture title> Landscape water management in Sweden and associated challenges in a changing climate
<Instructor> David Bastviken, Linköping University
<Description>
This part will discuss human interventions in the hydrological cycle and consequences for water availability, productivity in forestry and agriculture, ecosystem services, and feedbacks on e.g. landscape greenhouse gas emissions, The possible futures in the light of climate change and the need of adaption will also be discussed.
<Instructor's profile>
David Bastviken is a Professor at Linköping university, Department of Environmental Change. Bastviken started his research career in limnology and microbial ecology and have over time developed into biogeochemistry. His work extends from lakes, streams wetlands, into upland environments and societal water and waste systems, now encompassing element cycling and pollution issues across landscapes. Interactions between ecosystem and societal processes where water is involved and greenhouse gas emissions have been one focus of his research. He also studies drinking water systems and associated exposure to a wide range of chemical compounds, as well as natural formation of organohalogen compounds. Bastviken has also been active in trying to develop methods to overcome methodological bottlenecks in our understanding of greenhouse gas emissions from landscapes. Bastviken is a part of a research group on the above topics and some in this group may also take part in the teaching.

Course schedule

Lectures (online) are 90 minutes except field studies
Module A: "Concept and theory"

Date: to be announced

Guangwei Huang, Sophia University	to be announced
Björn-Ola Linnér, Linköping University	to be announced

Module B: "Pathways and approaches for SDGs implementation from biogas perspective"

Date: September 13 (Tue) and September 20 (Tue)

Lecture part: Sept. 13 (Tue.) 10:00-11:30 (CEST)/17:00-18:30 (JST)

Seminar part: Sept. 20 (Tue.) 10:00-11:30 (CEST)/17:00-18:30 (JST)

Xuepeng Qian, Sophia University

Stefan Anderberg, Linköping University

Module C: "Multi-sector partnerships in climate change mitigation and adaptation"

Date: December 6 (Tuesday)

Masachika Suzuki, Sophia University 10:00-11:30 (CEST)/17:00-18:30 (JST)

Anna Ljung, Linköping University 11:40-13:10 (CEST)/18:40-20:10 (JST)

Module D: Waste management– challenges in relation to the development of a circular economy

Date: September 20 (Tuesday) and September 27 (Tuesday)

Lecture part: September 20 (Tuesday) 11:40-13:10 (CEST)/18:40-20:10 (JST)

Seminar part: September 27 (Tuesday) 10:00-11:30 (CEST)/17:00-18:30 (JST)

Xuepeng Qian, Sophia University

Stefan Anderberg, Linköping University

Module E: The water-society nexus

Date: September 23 (Friday)

Guangwei Huang 10:00-11:30 (CEST)/17:00-18:30 (JST)

David Bastviken 11:40-13:10 (CEST)/18:40-20:10 (JST)

Field Studies

In Sweden: October 3 (Mon) thru 7 (Fri)

In Japan: (TBA)