

Department of Frontier Science for Advanced Environment | List of Laboratories

Division	Laboratory	Research Theme [Faculty Members]	Educational Courses	Entrance Examination Groups		
Core Divisions	Urban Environment and Environmental Geography	Geographical analyses on Human-Environmental Relations [Prof. Tomoki Nakaya / Assist. Prof. Ryohei Sekine]	CES	Env/Geo		
	Solar and Terrestrial Systems and Energy Sciences	Process Engineering for Advanced Resources Utilization Resource Processing and Recovery Engineering	Aiming at Advanced Metal Production Process with Maximum Energy Efficiency & Minimum Environmental Load [Prof. Eiki Kasai / Assoc. Prof. Taichi Murakami / Assist. Prof. Daisuke Maruoka]	EmP	Materials	
		Earth System Monitoring and Instrumentation	Investigation of global atmospheric environment with spectroscopic observations [Assoc. Prof. Isao Murata]	CES	Env/Geo	
		Urban and Regional Environmental Systems	Resolving Water-related Issues in the world through Observation and Prediction [Prof. Yu-You Li (School of Engineering) / Assoc. Prof. Daisuke Sano / Assoc. Prof. Daisuke Komori (School of Engineering)]	CES	Env/Geo	
	Sustainable Recycle Process	Environmental Green Process Study	Let's develop green processes with supercritical carbon dioxide and water! [Prof. Richard L. Smith Jr. / Prof. Masaru Watanabe (School of Engineering) / Assist. Prof. Haixin Guo]	AEC	Chem/Bio	
		Material Process for Circulatory Society	Design of Materials Processes toward Sustainable Society [Prof. Sergey Komarov / Assoc. Prof. Noboru Yoshikawa / Assist. Prof. Takuya Yamamoto]	EmP	Materials	
	Environmentally Benign Systems	Recycling Chemistry	We have examined the chemical recycle of wastes for the realization of resources recycling society [Prof. Toshiaki Yoshioka / Assoc. Prof. Tomohito Kameda (School of Engineering) / Assist. Prof. Shogo Kumagai]	AEC	Chem/Bio	
		Environmental Bioengineering	Creating biomolecular sensing devices for the next-generation biomolecular industry [Prof. Hitoshi Shiku (School of Engineering) / Assoc. Prof. Kumi Inoue / Assoc. Prof. Akichika Kumataani (AIMR) / Assoc. Prof. Hiroshi Yabu (AIMR) / Assoc. Prof. Kosuke Ino (School of Engineering)]	AEC	Chem/Bio	
		Environmental Analytical Chemistry	Analytical chemistry toward better understanding of the environment [Prof. Nobuhiko Iki / Assist. Prof. Atsuko Suzuki / Assist. Prof. Ryunosuke Karashimada]	AEC	Chem/Bio	
	Ecomaterial Design and Process Engineering	Environmentally-Benign Molecular Design and Synthesis	Design of environmentally benign molecular systems with high functionality [Assoc. Prof. Masaki Ota]	AEC	Chem/Bio	
Life Cycle Assessment			-	Materials ※		
Environmental Materials Surface Science		Atomic/molecular level surface design for developing eco-friendly energy system [Prof. Toshimasa Wadayama / Assist. Prof. Naoto Todoroki]	EmP	Materials		
Cooperative Divisions	Earth and Environmental Systems Design	Energy Conversion Chemistry	Research on innovative materials for advanced batteries with high performance and low environmental impact [Prof. Itaru Honma / Assist. Prof. Hiroaki Kobayashi/ Assoc. Prof. Kazuyuki Iwase]	IMRAM	AEC	Chem/Bio
		Hybrid Nano-particle	Liquid-phase synthesis of high-performance hybrid nanoparticles based on green chemistry and their application to develop functional materials [Prof. Atsushi Muramatsu / Assoc. Prof. Masashi Mizukami / Lecturer Sachiko Maki / Assist. Prof. Motohiro Kasuya / Assist. Prof. Mizuho Yabushita]	IMRAM	AEC	Chem/Bio
	Society of Northeast Asia	Social Anthropology	We provide students with knowledge and skills required for specialists in Social Anthropology and Northeast Asian Studies [Prof. Masahisa Segawa / Assoc. Prof. Toshihiro Ueno]	CNEAS	CES	Human/Social
		Cultural Ecology Conservation	We explore the sustainable future of human-nature relations through the anthropological fieldwork reflecting the cultural diversities in human history [Prof. Hiroki Takakura / Assoc. Prof. Sébastien P. Boret / Assoc. Prof. Alyne Elizabeth Delaney]	CNEAS, IRIDeS	CES	Human/Social
		Japanese History	Studies of the history of Edo period from analyzing original historical documents that remaining in the local communities of Japan [Assoc. Prof. Daisuke Sato]	IRIDeS	CES	Human/Social
	Culture of Northeast Asia	Environmental Sciences and Policies	Deriving policy implications from environment-energy policy, international politics, and science and technology studies [Prof. Yusen Asuka / Assoc. Prof. Atsushi Ishii]	CNEAS	CES	Human/Social
		Regional Study on Inner Asia	We are studying the historical changes of the social environment of pastoral and agrarian societies of Inner Asia [Prof. Hiroki Oka]	CNEAS	CES	Human/Social
		Ethnic Culture and Environment	What will become of the Russian language spoken by Russians outside of Russia? [Assoc. Prof. Kenji Yanagida]	CNEAS	CES	Human/Social ※
	Physical Chemistry for Environmental Materials	Chemistry for Environmental Inorganic Materials	Development of advanced optical functional and environmentally sensitive materials by soft chemistry process [Prof. Shu Yin / Assist. Prof. Yusuke Asakura]	IMRAM	AEC	Chem/Bio
		Hybrid Carbon Nanomaterials	Synthesis of hybrid nanocarbons using controlled nanospace as a reaction field and their application to advanced fields [Prof. Takashi Kyotani / Assoc. Prof. Hiroto Nishihara / Assoc. Prof. Akira Watanabe / Assist. Prof. Yasuto Hoshikawa]	IMRAM	AEC	Chem/Bio ※
Environmental System and Materials	Analytical Sciences for Environmental Evaluation	Seeking for seeds development of analysis methods of materials and elements [Prof. Kazuaki Wagatsuma / Assoc. Prof. Susumu Imashuku / Assist. Prof. Hideyuki Matsuta / Assist. Prof. Shunsuke Kashiwakura]	IMR	EmP	Materials ※	
	Hydrogen Functional System Materials	Hydride Research for Innovative Energy Applications [Prof. Shin-ichi Orimo / Assoc. Prof. Shigeyuki Takagi / Assist. Prof. Toyoto Sato / Assist. Prof. Sangryun Kim]	AIMR, IMR	EmP	Materials	
Collaborative Divisions	Process Engineering for Environmentally Adapted Materials	Development of new steelmaking technology contributing to the energy and resources sustainable society [Prof. Kazutoshi Ichikawa / Prof. Kohji Moriguchi / Prof. Masaru Matsumura]	Nippon Steel Corporation	EmP	Materials ※	
	Global Environment	Detection of changes in global atmospheric environment [Prof. Toshinobu Machida / Prof. Hideaki Nakajima]	National Institute for Environmental Studies	CES	Env/Geo	

Those who wish to apply for the laboratories with the sign ※, please contact the Academic Affairs Section in advance.

[Educational Courses] CES : Cultural Environmental Studies EmP : Eco-materials and Processing AEC : Applied Environmental Chemistry
 [Entrance Examination Groups] Env/Geo : Environment and Geography Group Chem/Bio : Chemistry and Bioengineering Group Materials : Materials Group Energy : Environment & Energy Group
 Human/Social : Human and Social Science Group
 [Institution] FRRI : Fracture and Reliability Research Institute CNEAS : Center for Northeast Asian Studies IRIDeS : International Research Institute of Disaster Science
 IMRAM : Institute of Multidisciplinary Research for Advanced Materials IMR : Institute for Materials Research IFS : Institute of Fluid Science AIMR : Advanced Institute for Materials Research

Department of Environmental Studies for Advanced Society

Department of Environmental Studies for Advanced Society | List of Laboratories

Division	Laboratory	Research Theme [Faculty Members]	Educational Courses	Entrance Examination Groups		
Core Divisions	Resources Strategies	Geo-environmental Measurement and Analysis	Accurate measurement, analysis and record of the earth environments status and development / improvement of the best [Assist. Prof. Nobuo Hirano]	-	-	
		Nanocomposite Science and Interfacial Materials Design	Development of functional composites to create next generation life styles [Assoc. Prof. Yoshinori Sato]	-	Energy	
		Design of Environment-Friendly Materials	Design of materials harmonizing with life and environment [Prof. Hideaki Matsubara / Assoc. Prof. Masanobu Kamitakahara]	-	Energy ※	
		Geoenvironmental Remediation	Development of Environmental Load Reduced Remediation Technology [Prof. Chihiro Inoue / Assist. Prof. Mei-Fang Chien]	-	Energy	
		Geomaterial and Energy	Inspire the energy and resources of the Earth. Standing on between pure science and advanced engineering. Only one and highly active Lab. [Prof. Noriyoshi Tsuchiya / Assoc. Prof. Atsushi Okamoto / Assist. Prof. Masaoki Uno / Research Assoc. Hiroyuki Yamagishi] Development of subsurface measurement technologies for energy utilization on environmental issue [Prof. Hirokazu Moriya (School of Engineering)]	-	Energy	
		Earth Exploitation Environmental Studies	We are developing the high performance next generation and eco-friendly machine construction system to create a recycling society [Prof. Hiroshi Takahashi / Assoc. Prof. Kiyotoshi Sakaguchi / Assist. Prof. Tomoaki Satomi]	-	Energy	
	Energy Resources	Distributed Energy System	Efficient energy conversion system to realize low carbon society [Prof. Tatsuya Kawada / Prof. Toshiyuki Hashida (School of Engineering) / Assoc. Prof. Keiji Yashiro Assoc. Prof. Go Yamamoto (School of Engineering) / Assoc. Prof. Kazunaga Sato (School of Engineering)]	-	Energy	
		Resources and Energy Security	Security and risk management for resources and energy development as well as data-driven earth and environmental science [Prof. Takeshi Komai / Assoc. Prof. Noriaki Watanabe / Assist. Prof. Kengo Nakamura]	-	Energy	
		Designing of Nano-Ecomaterials	Development of the materials and energy benign to the environment [Prof. Hideyuki Takahashi / Assist. Prof. Shun Yokoyama]	-	Energy	
		International Energy Resources	Carbon dioxide reduction through more efficient resource utilization [Assoc. Prof. Guido Grause / Assoc. Prof. Gregory P. Trencher]	-	※	
Environmental Policies	Environmental Technology and Innovation		-	Human/Social ※		
	Socio-Environmental Dynamic Analysis		-	※		
	Environmental and Energy Economics	Integrated analysis of material flows and economic activities contributing sustainable resource management [Prof. Kazuyo Matsubae / Assist. Prof. Kaoru Kakinuma]	-	Human/Social		
Cooperative Divisions	Advanced Policies for Environment	Crustal Complex Systems Design		-	Energy ※	
		Information Sciences for Environment	Environmental Study and Disaster Mitigation by Applied Electromagnetic Wave Technology [Prof. Motoyuki Sato / Assist. Prof. Kazutaka Kikuta]	CNEAS	-	Energy
	Powder Processing for Functional Materials	Earth-friendly Environmental Powder Technology [Prof. Junya Kano / Assist. Prof. Shingo Ishihara]	IMRAM	-	Energy	
	Extraction of Crustal Energy	Application of extreme environments in the earth's crust and unconventional energy resources for sustainable human life [Prof. Takatoshi Ito / Assist. Prof. Anna Suzuki / Assist. Prof. Yusuke Mukuhira]	IFS	-	Energy	
	Metallurgy and Recycling System for Metal Resources Circulation	For Achievement of Sustainable Society [Prof. Etsuro Shibata / Assoc. Prof. Atsushi Iizuka]	IMRAM	-	Energy	
	Energy and Environmental Materials Creation	Development of new energy materials and environmentally-conscious materials for opening up our future [Prof. Takahisa Omata / Assist. Prof. Satoshi Tsukuda / Assist. Prof. Issei Suzuki]	IMRAM	-	Energy	
	High-Temperature Physical Chemistry of Materials	Bring innovation to materials processing [Prof. Hiroyuki Fukuyama / Assoc. Prof. Makoto Ohtsuka / Assist. Prof. Masayoshi Adachi]	IMRAM	-	Energy	
	Endowed Divisions	Control of Environmental Materials DOWA Holdings Co., Ltd.	Control of Environmental Materials	Creation and production of environmentally friendly electronic devices with highly efficient energy storage and practical applications [Assoc. Prof. Norihiro Shimoi]	-	Energy ※
			Geosphere Environment	Waste management and protection and remediation of environmental pollution for resource recycling [Prof. Toshikazu Shiratori (DOWA Holdings Co., Ltd.) / Prof. Takashi Nakamura]	-	Energy ※
		Study of Functional Materials	We are developing the efficient optical device of an ultraviolet range, and the application to the environmental clean-up [Prof. Ryuichi Toba (DOWA Holdings Co., Ltd) / Assist. Prof. Takahiro Ohashi]	-	Energy ※	
Collaborative Division	Environmental Risk Assessment	Safe and secure utilization of geosphere [Prof. Hiroshi Asanuma / Prof. Ming Zhang / Assoc. Prof. Yasuhide Sakamoto] National Institute of Advanced Industrial Science and Technology		Energy ※		

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International Education & Exchange	[Research Assoc. Akiko Matsuda]
Outreach and Research Development	[Research Assoc. Tomoko Monobe]
Environmental Research Promotion Center	[Assist. Prof. Yuko Saito / Assist. Prof. Masahiro Oba / Research Assoc. Masae Mitsuhashi]



TOHOKU UNIVERSITY
Graduate School of Environmental Studies



Department of Frontier Science for Advanced Environment

Message from the Dean

For many years already now our society has been a loud voice advocating for the environment. There are many pressing environmental issues like global climate change, population explosion, famine, resource limitations, and a dependence on fossil fuels for energy. It is thus easy to become pessimistic about the resolution of these issues. To be sure, these are serious problems and it is important to acknowledge them and sound the alarm for the future of humanity and the Earth itself. But we cannot leave things there. Environmental issues lead to poverty and social unrest, and we do not want to see a future in which these issues cause people's hearts to harden against one another. Unfortunately, we still don't have a clear prescription against such a future. This is where we stand now.

Problems related to population, food, resources, and energy threaten the sustainability of the Earth. These problems are interrelated, but there is no single answer that will solve them all. Furthermore, the social issues that relate to the environment are compounded by the richness and diversity of human life in terms of individual opinions and values, which are often in a state of tension with each other. There is no simple answer here either.

I believe that Environmental Studies is an area that exists to create new knowledge related to the Earth and society based on the rigorous observation of present conditions. It is an academic field responsible for tackling the larger question of what a sustainable society should look like while searching for solutions to specific, individual problems as they arise.

Tohoku University established the Graduate School of Environmental Studies in 2003. Its mission is to foster graduates and develop areas of study that will shed light on the fundamental essence of the environmental and sustainability issues we now face. To understand the core of these issues, it is necessary to move beyond the conventional disciplinary boundaries of natural science, social science, and the humanities.

Tohoku University is supported by a long and excellent tradition of pioneers who have performed some of the world's top research in a variety of fields. To continue that pioneering tradition, we must continue to develop new science and technology while also thinking more broadly about how that technology interacts with the mechanisms of social change and demand.

In 2011, we here in Sendai and the broader region of Tohoku experienced a large earthquake and disaster that devastated the area. In this calamity, we lost many important things. Yet we have since pushed ahead slowly and with determination. The connection between nature and the people of this area remains strong, and it creates the foundation for a society based on sufficiency*. We cherish Tohoku, and the wider world.

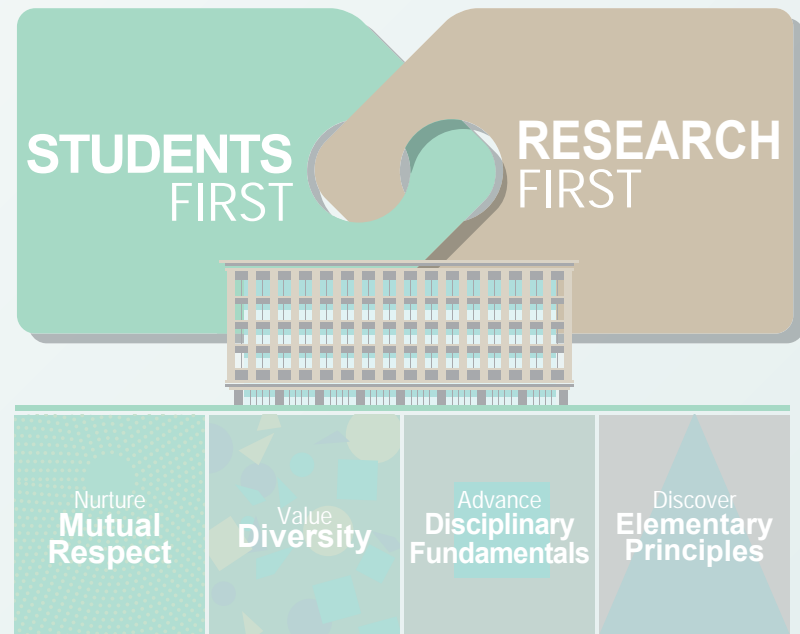
Environmental science is still a young discipline. I look forward to watching it grow. I want to challenge the unknown. I am convinced that the accumulation of transformational knowledge will propel human society to new levels. I hope that many people will join us in our pursuit.



*A society moving from endless growth, consumption and "more is better" towards a society where "enough is best" and people become more content with less energy and resources.

For Students

At Tohoku University, we have long advocated our core principle of "Research First". This guides the fulfillment of our mission as a research university to discover fundamental principles and to contribute to the betterment of humanity and society. The Graduate School of Environmental Studies also has worked hard to educate students through world-leading research to foster scientific thinking and deeper understanding of human society and nature. Through that education, "Students First" joins "Research First" as an inseparable pair.



Nurture Mutual Respect

Respect others. We shall strive to understand other people's position. Relationships within and between generations and international communities depend on nurturing respect.

Value Diversity

Many past civilizations which have failed to preserve diversity have placed extreme burdens on the environment and subsequently collapsed. The sustainability and future prosperity of ecological systems requires diversity. Efforts to maintain diversity therefore expand possibilities for the future.

Advance Disciplinary Fundamentals

Fundamental knowledge and techniques are the foundation of advanced science and technology. Only where there is a firm disciplinary base can the fruits of new discoveries emerge. We must study disciplinary fundamentals constantly and thoroughly.

Discover Elementary Principles

The fundamental role of the university is to pursue not immediate reward but the discovery of universal principles. This task must form the focus of our efforts.

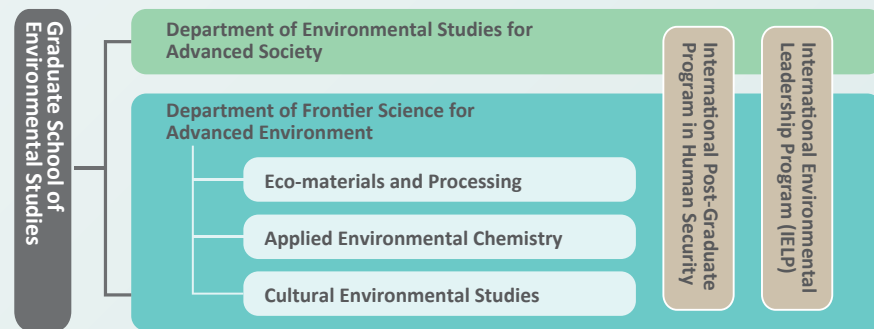
Philosophy

- ▶ To construct an environmental science including environmental management that integrates the humanities and science;
- ▶ To train people to acquire high and comprehensive competence and become able to serve active roles in international society;
- ▶ To implement education and research to pursue sustainability of human life space;
- ▶ To implement education and research to analyze environmental issues from diverse perspectives, taking regional and ethnic factors into consideration;
- ▶ To implement education and research for the construction of an energy system that is in harmony with the environment;
- ▶ To implement education and research for the creation of an efficient recovery and utilization system of materials and biotechnology that can coexist with nature;
- ▶ To implement education and research for the creation of new recyclable resources and reproductive technologies that support a recycle-based society; and
- ▶ To implement education and research for the planning of an environmental creation scheme in order to build symbiotic social structures.

Education

About GSES

The Graduate School of Environmental Studies offers 2 schools: the Department of Environmental Studies for Advanced Society and the Department of Frontier Sciences for Advanced Environment, the Department of Frontier Sciences for Advanced Environment consists of three educational courses.



The Graduate School of Environmental Studies is intended to create a social system that can become bases of a cultural and recycle-based society which supports sustainable development by integrating the "knowledge" of Tohoku University as a comprehensive university. The purpose of our education is to train people to acquire high-level knowledge and skills and to become individuals who can tackle myriad challenges on a global scale.

Department of Environmental Studies for Advanced Society

This department aims at an education to nurture human resources with an ability to create solutions to the environmental problems that threatens human society. The department welcomes students who have a strong interest in the environmental aspects of civilization and thinking, who have a good understanding of the realities of social sciences and policy, who would like to obtain a solid basic knowledge on various technologies, and who can meet the challenge of integrating these towards creating innovative solutions. Moreover, we are looking for students who would like to cultivate an ability to provide a direction for society from a global perspective.

Department of Frontier Science for Advanced Environment

This department aims at an education to nurture human resources with an ability to manage advanced environmental technologies from an international bird's-eye perspective of the environmental problems that threaten human society. The department welcomes students who would like to study and acquire environmental expertise in fields such as geo-system and energy science, environmental chemistry and ecoengineering, and eco-material design and process engineering. Students should have a strong motivation to explore outside of their own field from the broad perspective of environmental sciences, and study together with international students from other Asian countries. We expect students to wish to lead in their advanced research on the environment by integrating their deep specialisms with an international perspective and broad background knowledge.

▶ Eco-materials and Processing

This course teaches and researches the fields of resources, materials and energy which are critical to sustainable human society. Specifically, treatment of raw materials used for safeguarding the global environment, material processing, recycle technology, low-energy and developing new materials capable of reducing the environmental burden. Together with acquiring the detailed knowledge of the special characteristics of these technologies, you can deepen your basic knowledge of humanities and social science.

▶ Applied Environmental Chemistry

This course aims at reducing the environmental load in industries that are supplied materials and resources taken from the environment, and also energy-intensive industries such as those manufacturing chemical products and other materials. Students acquire an advanced knowledge to pioneer new environmental-friendly processes. In addition, you can deepen your basic knowledge of environment assessment and economic valuation.

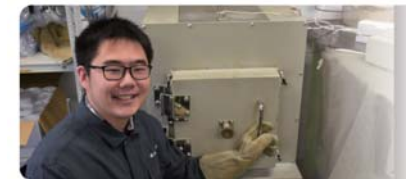
▶ Cultural Environmental Studies

In addition to the technical objectives mentioned in the above two courses, it is also necessary for a sustainable human society to solve cultural challenges related to the social system. Together with acquiring knowledge of sciences, you can study research fields that directly connect society, such as social history, social anthropology, environmental law, environmental policy, environmental economics, and technology management.

International Environmental Leadership Program (IELP)

The International Environmental Leadership Program (henceforth referred to as "IELP") at Tohoku University Graduate School of Environmental Studies provides a trans-disciplinary education, combining the humanities and sciences with instructors from the Regional Environment and Socio-Cultural Studies, Geosystems and Energy Sciences, Environmental Chemistry and Ecoengineering, Ecomaterial Design and Process Engineering and International Program for Environmental Sustainability Science courses. It is through this context that the program educates both Japanese and foreign exchange students side by side, making use of maximized synergy among participants from multiple countries and placing high emphasis on specialized research in environmental fields. IELP fosters a comprehensive way of thinking that is crucial for international environmental leaders, the program seeks to equip students with a sense of internationalism, practical know-how, management capability, and the individual leadership and group-minded orientations inherent in strategic planning.
URL: <http://www.kankyo.tohoku.ac.jp/ielp/index.html>

Voice



Zhe Ma

D1
Process Engineering for
Advanced Resources Utilization (Kasai Lab.)
Enrolled in 2017
China

I have been interested in environmental and engineering study since I was a bachelor student, as environment problems caused by industrial development come seriously which can be felt in my daily life in China. Meanwhile, it takes a world-leading level that environment science in Japan as is known to all. And fortunately, I have got a chance to study in Graduate School of Environmental Studies at Tohoku University.

As a member of Kasai Laboratory, in which the research concentrates on environment problems in iron making process, my research focuses on PM2.5 formed during iron ore sintering process, while PM2.5 has been known as a serious atmospheric environmental problem caused by human activities. I am trying to clarify the mechanism that how the PM2.5 is formed in the sintering packed bed and what are the factors of its emission characteristics, in order to give advices to control PM2.5 occurred in sinter plants.

With the two-year training of master's course in GSES, I can feel the improvement of capability on research as well as the way of thinking, which becomes the basic of my doctoral study and takes me one step closer to my dream of being an engineer who can really solve some problems.

I am also enjoying in Japan-daily-life like ramen and Japanimation as here are many friends to share these interests with. I believe it is a good choice for students who want to devote in environmental science and interested in Japan.



Chelsea Adelina Langa

D1
Resources and Energy Security (Komai Lab.)
Enrolled in 2016
Mozambique

In regards to Environmental Studies, the program Tohoku University offered was very interesting to me because of the cutting-edge research methods applied for natural resources and energy management. By joining the Graduate School of Environmental Studies I found the opportunity to do research regarding to current environmental problems and solutions, in general, as well as the methods available in the landfill site selection, maintenance and treatment of waste, which is my which field of study.

I started as a master student in Komai-Watanabe Lab, now I have upgraded to the Ph.D. course. In my previous research I have studied about siting of new landfilling facilities, analyzing the various factors this process requires and making maps in the GIS environment which is a field that is getting more attention in waste management. Since I need to use spatial analysis tools such as GIS for my research, here I find all support I need in terms of technology and data analysis. The level of research is high and demands that we stay up to date in terms of new techniques applied in the waste management. My lab-mates are also very helpful and we share a great work environment. For my Ph.D. studies my research will continue to be the implementation of spatial analyst tools in the waste management system. Aside from lab life, we attend many different courses that were lectured in a very international environment because the students are from the various countries and many different research topics, while still being able to absorb Japanese culture.

Meanwhile, in the IELP course we learn about environmental issues from different perspectives, both the natural and social sciences. There are many presentations and that strengthens our capacity to deliver talks for different background audiences. It also puts us in contact with studies different than our own yet relevant for strengthening our abilities and future work.

International Post-Graduate Program in Human Security

Tohoku University started "the International Joint Educational Program in Human Security" from April 2005, by linking the Cultural Studies and the Graduate School of Agricultural Science, the Graduate School of Medicine, the Graduate School of International Cultural Studies and the Graduate School of Environmental Studies. Our institute, the Graduate School of Environmental Studies, takes part in this program in the environmental perspectives. The human race has been affecting the nature and has promoted the social and economic, and cultural system the problems would be hardly solved. "Human Security and Environment" program educates and researches especially on shortage and contamination of water resource, air pollution, climate change, ecological destruction of forest, desertification, soil deterioration, energy resources and so on with incorporating global and historical perspectives.

URL: <http://www2.kankyo.tohoku.ac.jp/human-security/>

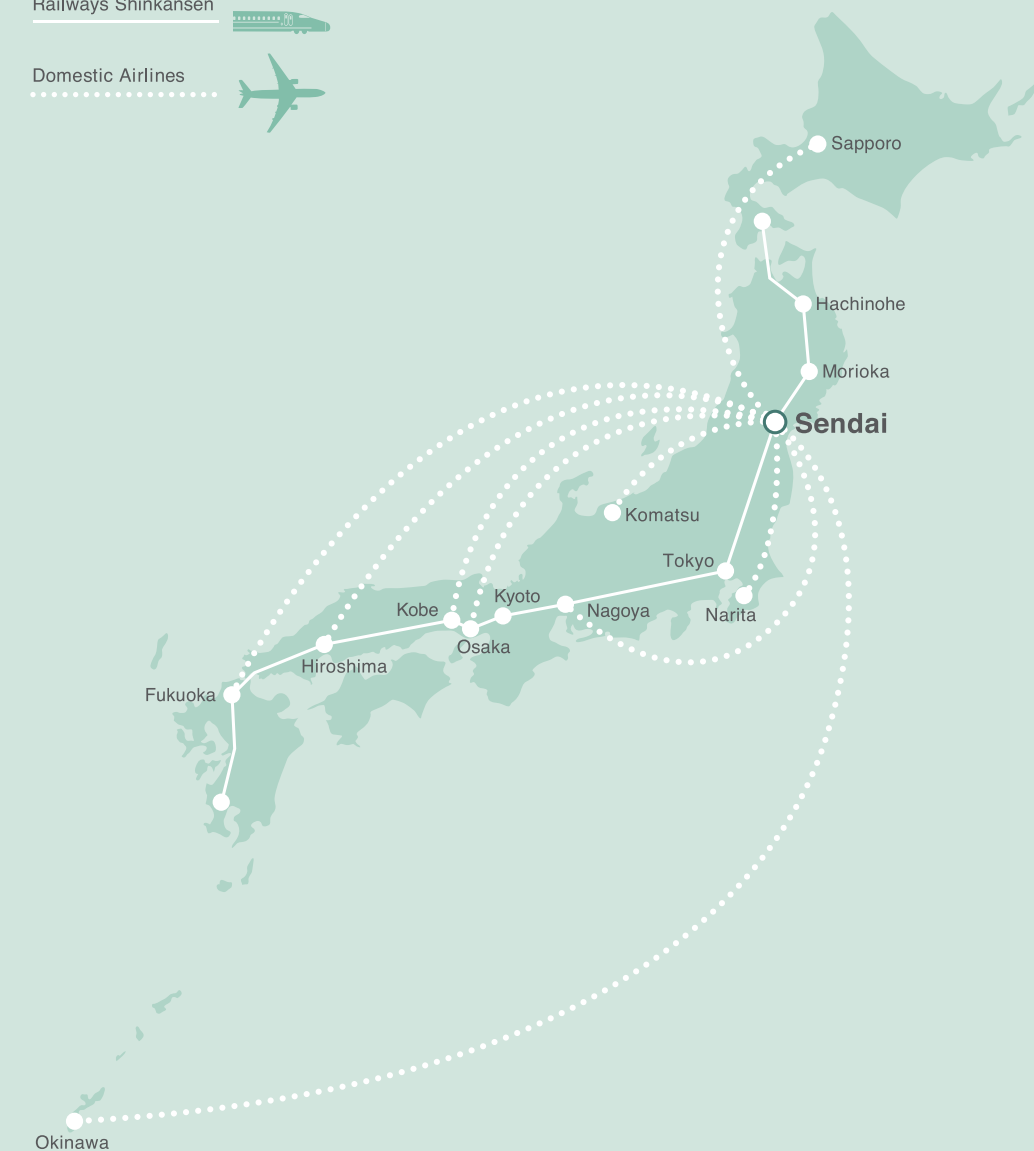
Location

North- East of Japan

Size of the City (as of 1st October 2018)
Area:786.30 km²
Population:1,088,669
Population Density:1,385 inhab./km²

Railways Shinkansen

Domestic Airlines



Graduate School of Environmental Studies, Tohoku University

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