

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	Environmental Geography	Understanding Diverse Human-Environment Relationships from Geographical Perspectives [ Prof. Tomoki Nakaya / Assist. Prof. Ryohei Sekine ]	CES	Env/Geo	
	Solar and Terrestrial Systems and Energy Sciences	Process Engineering for Advanced Resources Utilization	Aiming at Advanced Metal Production Process with Maximum Energy Efficiency & Minimum Environmental Load [ Prof. Taichi Murakami / Assist. Prof. Daisuke Maruoka ]	EmP	Materials	
		Earth System Monitoring and Instrumentation	Variations of ozone and related trace species in the atmosphere [ Assoc. Prof. Isao Murata ]	CES	Env/Geo	
		Urban and Regional Environmental Systems	Researches on Water Resources and Environments [ Prof. Yu-You Li * / Prof. Daisuke Sano * / Prof. Daisuke Komori * / Assoc. Prof. Kengo Kubota ]	CES	Env/Geo	
	Environmentally Benign Systems	Recycling Chemistry	Aimed on the realization of a resources-material recycling society [ Prof. Toshiaki Yoshioka / Assist. Prof. Shogo Kumagai ]	AEC	Chem/Bio	
		Environmental Analytical Chemistry	Development of Chemical Motifs for Environmental and Biomedical Analysis [ Prof. Nobuhiko Iki / Assist. Prof. Ryunosuke Karashimada / Assist. Prof. Ryota Sawamura ]	AEC	Chem/Bio	
		Environmental Bioengineering	Development of Environmental/Biomedical Sensors and Visualization Systems for Material Functions with Micro/Nano Electrodes [ Prof. Hitoshi Shiku (School of Engineering) / Assoc. Prof. Kosuke Ino (School of Engineering) ]	AEC	Chem/Bio※	
	Sustainable Recycle Process	Environmental Green Process Study	Advancement of model-based process development for sustainable circular society [ Prof. Yasuhiro Fukushima / Prof. Masaru Watanabe * / Assoc. Prof. Hajime Ohno / Lecturer Alexander Guzman Urbina / Assist. Prof. Jialing Ni ]	AEC	Chem/Bio	
		Mechanics and Design of Composite Materials	Design, development and evaluation of multi-functional composite materials [ Prof. Fumio Narita / Assist. Prof. Hiroki Kurita / Assist. Prof. Zhenjin Wang ]	EmP	Materials	
	Ecomaterial Design and Process Engineering	Environmentally-Benign Molecular Design and Synthesis	Innovative experimental and theoretical technologies on chemical engineering for creating sustainable society [ Assoc. Prof. Masaki Ota ]	AEC	Chem/Bio※	
Environmental Materials Surface Science		Atomic-level design of novel catalyst materials for eco-friendly society [Prof. Toshimasa Wadayama / Assoc. 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 / Lecturer Kazuyuki Iwase / Assist. Prof. Moriyuki Kanno ]	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 / Assist. Prof. Ryota Osuga ]	IMRAM	Chem/Bio※	
		Polymer Hybrid Nanomaterials	Reveals the core of hierarchical structural dynamics of hybrid nanomaterials using synchrotron X-ray analysis [ Prof. Maiko Nishibori / Lecturer Sachiko Maki / Assist. Prof. Kakeru Ninomiya ]	SRIS	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 [ Assoc. Prof. Toshihiro Ueno / Assoc. Prof. Yongchao Cheng ]	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
		Environmental Sciences and Policies	Deriving policy implications from environment-energy policy, international politics, and science and technology studies [ Prof. Jusen Asuka ]	CNEAS	CES	Human/Social※
		Environmental Governance & Transformation	Examining global environmental governance and its transformation from traditional social science, interdisciplinary, and transdisciplinary perspectives [ Assoc. Prof. Atsushi Ishii ]	CNEAS	CES	Human/Social
	Culture of Northeast Asia	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 / Lecturer Takuya Hasegawa / Assist. Prof. Ayahisa Okawa ]	IMRAM	AEC	Chem/Bio
		Hybrid Nanosystem	Development of Hybrid Materials based on Multidisciplinary Precise Synthesis Across Organic, Inorganic, and Bio towards Sustainable Society [ Prof. Kiyoshi Kanie / Lecturer Masaki Matsubara / Assoc. Prof. Megumi Suyama ]	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. Hirotomo Nishihara ]	AIMR, IMRAM	AEC	Chem/Bio※
	Environmental System and Materials	Analytical Sciences for Environmental Evaluation	Seeking for seeds development of analysis methods of materials and elements [ Assoc. Prof. Susumu Imashuku / Assist. Prof. Hideyuki Matsuta ]	IMR	EmP	Materials※
		Hydrogen Functional System Materials	Hydride Research for Innovative Energy Applications [ Prof. Shin-ichi Orimo / Assoc. Prof. Shigeyuki Takagi / Assist. Prof. Kazuaki Kisu ]	AIMR, IMR	EmP	Materials
Endowed Division		Innovative Analytical Pyrolysis Frontier Laboratories Ltd.	Development of analytical methods and instruments for polymer characterization by Pyrolysis-GC/MS [ Prof. Toshiaki Yoshioka / Assoc. Prof. Atsushi Watanabe (Frontier Laboratories Ltd.) / Assist. Prof. Shogo Kumagai ]	AEC	Chem/Bio※	
Collaborative Divisions		Process Engineering for Environmentally Adapted Materials	Development of new steelmaking technology contributing to the energy and resources sustainable society [ Prof. Kohji Moriguchi / Prof. Masaru Matsumura / Prof. Tomohiko Omura / Prof. Shinya Nariki ]	Nippon Steel Corporation	EmP	Materials※
		Global Environment	Observation of Global Atmospheric Environment and Carbon Cycle Changes [ 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] Human/Social : Human and Social Science Group Env/Geo : Environment and Geography Group Chem/Bio : Chemistry and Bioengineering Group Materials : Materials Group Energy : Environmental & Energy Group  
[Institution] AIMR : Advanced Institute for Materials Research CNEAS : Center for Northeast Asian Studies FRRI : Fracture and Reliability Research Institute IFS : Institute of Fluid Science IMR : Institute for Materials Research  
IMRAM : Institute of Multidisciplinary Research for Advanced Materials IRIDeS : International Research Institute of Disaster Science SRIS : International Center for Synchrotron Radiation Innovation Smart

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	Measurement, observation and equipment development for understanding of various geosphere information [ Assist. Prof. Nobuo Hirano ]	-	-	
		Nanocomposite Science and Interfacial Materials Design	Development of High-Functional Non-Metal Light Element Materials for a Next-Generation Sustainable Life Style [ Assoc. Prof. Yoshinori Sato ]	-	Energy ※	
		Design of Environment-Friendly Materials	Design of materials harmonizing with environment and life [ Prof. Masanobu Kamitakahara / Assist. Prof. Masaki Umetsu]	-	Energy	
		Geoenvironmental Remediation	The Development of Environmental Friendly Biotechnologies for Pollution Remediation and Resource Recovery [ Prof. Chihiro Inoue / Assoc Prof. Mei-Fang Chien ]	-	Energy ※	
		Geomaterial and Energy	Geo-environmental systems driven by fluid-rock reactions [ Prof. Atsushi Okamoto / Assoc. Prof. Masaoki Uno / Assist. Prof. Otgonbayar Dandar / Assist. Prof. Astin Nurdiana ]	-	Energy	
			Development of subsurface measurement technologies for energy utilization on environmental issue [ Prof. Hirokazu Moriya (School of Engineering) ]			
			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 / Assist. Prof. Xiaodong Liu Assist. Prof. Delima Canny Valentine Simarmata]	-	Energy ※
		Resource Circulation and Environmental Applications	Efficiently cycling resources and CO <sub>2</sub> for a cleaner environment [ Prof. Atsushi Iizuka ]		Energy	
	Energy Resources	Distributed Energy System	Toward the development of sustainable energy system [ Prof. Tatsuya Kawada / Assoc. Prof. Keiji Yashiro / Assoc. Prof. Kazunaga Sato* / Assist. Prof. Riyan A. Budiman / Assist. Prof. Mina Yamaguchi ]	-	Energy ※	
		Resources and Energy Security	The Deepening of Geo-Environmental Science and Sustainable Resource and Energy Development [ Prof. Noriaki Watanabe / Assist. Prof. Jiajie Wang / Assist. Prof. Alviani Vani Novita ]	-	Energy	
		Designing of Nano-Ecomaterials	Development of functional nano-ecomaterials for energy and environment in the environmentally benign systems [ Prof. Hideyuki Takahashi / Assoc. Prof. Shun Yokoyama / Assist. Prof. Koji Yokoyama ]	-	Energy	
		International Energy Resources	Interdisciplinary study on energy and resources including natural and social sciences for sufficient and sustainable society [ Prof. Noriyoshi Tsuchiya / Assoc. Prof. Hiromi Kubota / Assist. Prof. Kazumasa Sueyoshi / Assist. Prof. Diana Mindaleva Research Assoc. Hiroyuki Yamagishi ]	-	Energy ※	
	Environmental Policies	Environmental Urban Energy	To realize carbon neutrality, we conduct research on socio-techno-economic transition and facilitate urban decarbonization process [ Assoc. Prof. Takuro Kobashi ]	-	Human/Social	
		Environmental and Energy Economics	Integrated analysis of material flows and economic activities contributing sustainable resource management [ Prof. Kazuyo Matsubae / Assist. Prof. Zhengyang Zhang ]	-	Human/Social	
		Industrial Ecology	Understanding the environmental impacts of global supply chain and consumption [ Assoc. Prof. Keiichiro Kanemoto ]	-	Human/Social	
Cooperative Divisions	Advanced Policies for Environment	Powder Processing for Functional Materials	Earth-friendly Environmental Powder Technology [ Prof. Junya Kano / Assist. Prof. Shingo Ishihara / Assist. Prof. Kizuku Kushimoto ]	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. Yusuke Mukuhira ]	IFS	-	Energy ※
		Metallurgy and Recycling System for Metal Resources Circulation	For Achievement of Sustainable Society [ Prof. Etsuro Shibata / Assist. Prof. Ken Adachi ]	IMRAM	-	Energy
		Energy and Environmental Materials Creation	Development of new energy materials and environmentally-conscious materials for opening up our future [ Prof. Takahisa Omata / Lecturer Issei Suzuki / Assist. Prof. Tomoyuki Yamasaki ]	IMRAM	-	Energy
		High-Temperature Physical Chemistry of Materials	Bring innovation to materials processing [ Prof. Hiroyuki Fukuyama / Assoc. Prof. Makoto Ohtsuka / Lecturer Masayoshi Adachi ]	IMRAM	-	Energy
Endowed Divisions	Control of Environmental Materials DOWA Holdings Co.,Ltd.	Environmental Policy and Impact Assessment	Assessment of the social and environmental impacts of resource use for better management of anthropogenic stocks and flows [ Prof. Kazuyo Matsubae / Prof. Tomoki Nakaya / Prof. Minoru Tobita / Assoc. Prof. Masahito Yoshimura ]		-	Energy ※
		Environmental Process Science	Development of material synthesis and recycling processes necessary for resource circulation [ Prof. Hideyuki Takahashi / Prof. Tomohito Kameda / Prof. Balachandran Jayadevan / Assoc. Prof. Mei-Fang Chien / Assoc. Prof. Masahito Yoshimura ]		-	Energy ※
		Environmental Policy Implementation Studies	Development and social implementation of sustainable technologies for resource circulation and treatment of waste [ Prof. Toshiaki Yoshioka / Prof. Toshikazu Shiratori (DOWA Holdings Co.,Ltd.) / Assoc. Prof. Yuko Saito ]		-	Energy ※
	Course for Environmental harmony design of hard materials		Development of designing(simulation) study for maximum properties and environmental harmony in cemented carbide and other hard materials [ Prof. Hideaki Matsubra / Assist. Prof. Sota Terasaka ]			Energy ※
Collaborative Division		Environmental Risk Assessment	Studies for utilization of safe and secure geothermal energy [ Prof. Hiroshi Asanuma / Prof. Yasuhide Sakamoto ]	National Institute of Advanced Industrial Science and Technology	-	Energy ※

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[Institution] IFS : Institute of Fluid Science IMRAM : Institute of Multidisciplinary Research for Advanced Materials

Outreach Sections

Environmental Research Promotion Center	[ Prof. Makoto Osada / Assoc. Prof. Masahiro Oba / Assist. Prof. Masae Mitsuhashi / Research Assoc. Koko Yokoi ]
Institute for Resource initiatives	[ Prof. Jeongsoo Yu ]
Outreach & Communications Office	[ Research Assoc. Tomoko Monobe ]



TOHOKU UNIVERSITY  
Graduate School of  
Environmental Studies







When someone makes an invention and tries to put it into practice in a society, the trial often fails with a single-direction approach. Specifically, a resource or energy-related issue is a problem with complicated boundary conditions that are globally connected. Finding the best answer requires wide and deep knowledge on the issues.

The faculty members of the Graduate School of Environmental Studies (GSES) are the top leaders of various academic fields in not only engineering and natural sciences but also social sciences and the humanities. They have been leading their own fields and, at the same time, have communicated with each other to find a common horizon for Environmental Studies. Now, based on those achievements, we will take a step further toward a practical use of Environmental Studies, where we will be able to indicate a way to solve environmental issues by connecting the knowledge of those in diverse fields.

## TO THE MAKERS OF 2050

Now, many countries and regions in the world have committed to achieve carbon neutral operation by 2050. However, the path to reach this goal is still in a fog. Finding the route will be tasked to the present teenagers and those in their twenties. My desire is that the young people who are, or will be, studying in GSES will acquire skills in the specialized fields and play important parts in the community, society, and in the world. Furthermore, I hope they obtain the ability to grasp the issues from a bird's-eye view to select a better future for themselves and for others.

GSES started with a single department of Environmental Studies, which was reorganized into the two departments of Environmental Studies for Advanced Society and Frontier Sciences for Advanced Environment in 2015, and has provided unique educational curriculums.

Many international programs, as well as training programs, have been offered to achieve our educational goal. I hope the students will actively utilize these chances to deepen their studies.

In these two years, we have suffered from the COVID-19 pandemic, and our university activities have been restricted. However, what we should do for the future remains unchanged. Let us step forward together.

Professor **Tatsuya Kawada**

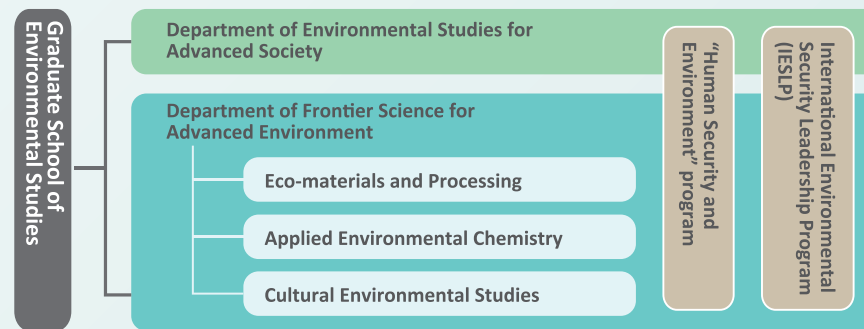
Dean, Graduate School of Environmental Studies,  
Tohoku University



Message from the Dean

### 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 Security Leadership Program (IESLP)

The International Environmental Security Leadership Program (IESLP) is a graduate educational program established within the Graduate School of Environmental Studies with the support of the Japanese Government Scholarship for International Students. This program, launched in response to the growing number of cases of infectious diseases, aims to develop leaders who can solve environmental security issues such as social environment, living environment, and infectious diseases, with ASEAN countries as the focus countries.

In addition to classes in the regular graduate education curriculum, students will receive a number of advanced education courses necessary for developing international environmental security leaders, enabling them to acquire a broad range of background knowledge, including advanced, practical skills with an international perspective. All classes are conducted in English, with some cultural and lifestyle discussions conducted in both English and Japanese, and IESLP faculty members conduct advanced courses and seminars that are deeply relevant to international environmental leaders. Students enroll in courses and majors.

URL: <http://www.kankyo.tohoku.ac.jp/ielp/index.html>

### Voice



#### Eko Pramudyo

Resource and Energy Security Science (Watanabe Lab.)  
Enrolled in 2018  
Indonesia

I decided to accomplish my master's and doctoral studies in GSES Tohoku University because it facilitates wide-range of research interests, including resources and energy topics, in an attempt to create better future environment and society. Moreover, GSES offers interesting programs, such as IESLP (formerly IELP) in which I belong to, which provide learning-opportunities on interdisciplinary collaboration in solving environmental problems. Here, I focused on experimental works to clarify the possibility of creating enhanced-geothermal system (EGS) reservoirs in granitic rock through fracturing using CO<sub>2</sub> injection. The well-equipped experimental systems and experienced-research instructors greatly benefit my study. I believe that GSES is a great place to study for those who wish to become future-environmental leaders.



#### Podolinnia Valentina Alekseevna

Recycling Chemistry (Yoshioka Lab.)  
Enrolled in 2020  
Russia

I have always been passionate and actively engaged in environmental protection activities, both through social involvement and research and development. GSES offers a rare chance to connect with experts and participate in significant research projects that shape the future.

Presently, I am involved in research focused on using clay and metal oxide-based materials to create an economically feasible large-scale stem cell culture system. This research aims to make a positive impact on the world by advancing SDGs 2, 3 and 12, through contributions to fields such as regenerative medicine and cultured meat. After graduation, I aim to contribute to sustainable development by working in the food or biomedical industry.

Being a part of the GSES program at Tohoku University provides a unique opportunity to be a catalyst for global change. I encourage you to follow your passions and join the environmental science community at Tohoku University!

#### "Human Security and Environment" program

The "Human Security and Environment" program in the Graduate School of Environmental Studies was created in FY2020 as the successor to the International Joint Educational Program in Human Security (HS Program), which had been jointly operated by four graduate schools of Tohoku University since 2005—the Graduate School of Medicine, the Graduate School of Agricultural Science, the Graduate School of Environmental Studies, and the Graduate School of International Cultural Studies.

The interdisciplinary education for which the HS Program strove is now increasingly important, so its curriculum framework has been passed on to the International Joint Graduate Program in Resilience and Safety Studies (GP-RSS). The "Human Security and Environment" program provides students with the opportunity to take courses in several different fields through GP-RSS, which is operated by five graduate schools (the Graduate School of Medicine, the Graduate School of Agricultural Science, the Graduate School of Engineering, the Graduate School of International Cultural Studies, and the Graduate School of Environmental Studies) and one research institute (the International Research Institute of Disaster Science).

In addition to receiving professional guidance from their own laboratories and academic advisors, students enrolled in this program can also take courses offered by other graduate schools through GP-RSS. There are also special programs in which external experts are invited to give lectures and hold discussions to help deepen students' understanding of issues related to the environment, health, food and agriculture, and society.

<http://www.human-security.tohoku.ac.jp/>

#### Location

North- East of Japan

Size of the City (as of 1st October 2022)  
Area:786.35 km<sup>2</sup>  
Population:1,099,239  
Population Density:1,398 inhab./km<sup>2</sup>

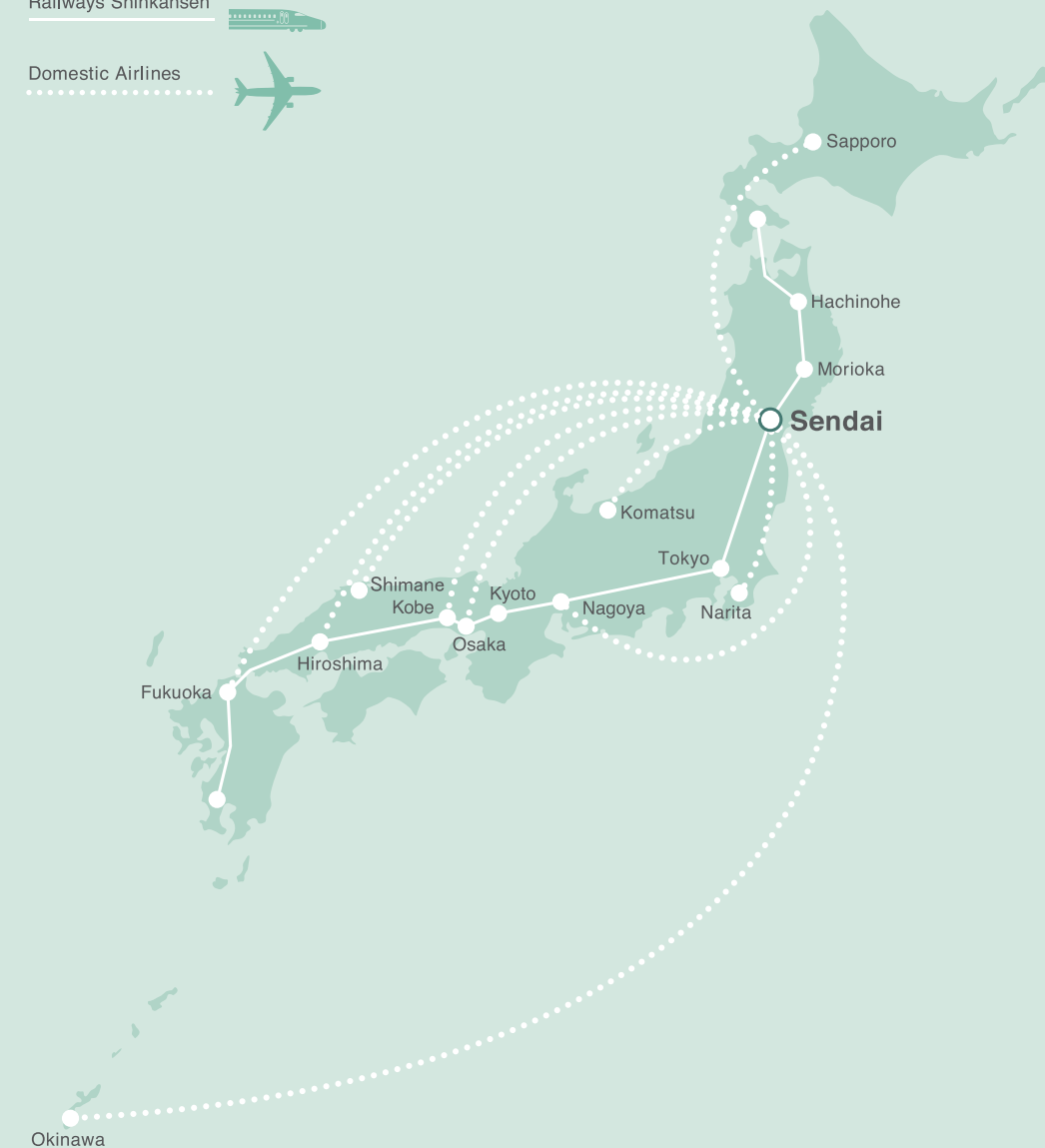
Railways Shinkansen



Domestic Airlines



Voice



#### Graduate School of Environmental Studies, Tohoku University

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