

Tohoku University Reconstruction Action 2011-2021



Tohoku University Reconstruction Action Leading the Restoration of Tohoku and the Regeneration of Japan Vol.9



Institute for Disaster Reconstruction
and Regeneration Research
Tohoku University

2-1-1 Katahira, Aobaku, Sendai 980-8577 JAPAN
Tel. 022-217-5009
URL <http://www.idrrr.tohoku.ac.jp/>

Issue 1 : May 2012
Issue 2 : October 2012
Issue 3 : June 2013
Issue 4 : July 2014
Issue 5 : March 2015
Issue 6 : July 2016
Issue 7 : December 2017
Issue 8 : August 2019
Issue 9 : March 2021

Leading the Restoration of Tohoku and the Regeneration of Japan Vol.9



**Tohoku University
Reconstruction Action
2011-2021**

Leading the Restoration of Tohoku
and the Regeneration of Japan Vol.9

We can't even remember what we thought that day.
Fate seemed unavoidable, but it did not mean we would stop.

Everybody had the need to support somebody.
Even if it was just out of defiance.

Before we knew it, there was a path behind us.

And looking back,
Looking at what we learned.
Looking at what we can leave for the future.

We can't change what happened.
Because there was a lesson.
Because there was a connection.

We do not let that day just be "that day".

**We believe in the wisdom
that comes from 10 years.
And we believe in the future.**

Contents

Message from the President	004
Message from the Director	006
Status after the Great East Japan Earthquake	008
Main projects for recovery and reconstruction	016
The Institute for Disaster Reconstruction and Regeneration Research	022
Tohoku University Priority Projects	
Project 01: International Research Project on Disaster Science	038
Project 02: Project for the Reconstruction of Community Health Care	
• Comprehensive Education Center for Community Medicine	052
• Tohoku Medical Megabank Organization	062
Project 03: Project for Environmental Energy	074
Project 04: ICT Reconstruction Project	084
Project 05: Tohoku Marine Science Project	096
Project 06: Nuclear Decommissioning and Environmental Restoration Project	
• Center for Fundamental Research on Nuclear Decommissioning	106
• Technology for Decontaminating the Environment	112
• Evaluation of Radiation Effects on Animals	120
Project 07: Regional Industries Restoration Support Project	
• Regional Innovation Research Center	128
• Tohoku Agricultural Science Center for Reconstruction	136
Project 08: Industry-Academia Collaboration Development Project for Reconstruction	144
Tohoku University Member's Projects	
Reconstruction Action 100+	158
Contributions to Reconstruction Planning	182
Lessons from 3.11 - Toward the Future	188
Special Message	
"Tohoku University Leads the Way" by Makiko Uchidate	198



Leading reconstruction and supporting communities through co-creation

22nd Tohoku University President

Hideo Ohno

Tohoku University President since 2018 after steps as Assistant Professor at Hokkaido University, Professor at Tohoku University and Director of the Research Institute of Electrical Communication. Specialization in semiconductor physics and spintronics.

Community co-creation is the identity of Tohoku University.

We have to think of a resilient society 10 years, 20 years in the future.

Our achievements of the last 10 years are essential when dealing with current societal changes.

Since the foundation in 1907, Tohoku University has uphold the principles 'Research First', 'Open Door' and 'Practice Orientation' to educate future leaders, excel in research and help communities both at home and overseas. The Great East Japan Earthquake which hit the region on March 11, 2011, had a huge impact on the university.

Looking back at the disaster

Immediately after the disaster, our members initiated more than 100 Reconstruction Action projects to help recovery of the affected communities. In April 2011 Tohoku University established the Institute for Disaster Reconstruction and Regeneration Research

as a university wide organization to oversee critical projects. It was a weird feeling to focus on research in dire times. But looking back, it was an important and necessary step for our university to contribute to disaster recovery and establish means for long term community support through our research. We got much support from the government, regional municipalities, other universities as well as private companies. And the question was: How do we respond to the support and give back to the communities. The establishment of the Institute for Disaster Reconstruction and Regeneration Research and helping communities through our research outcomes was an important decision we made. Three years ago, it was my turn to lead the university and we made it 10 years

after the disaster. Although there is a feeling of 'we have come this far', we also know that there is still a lot of work ahead of us.

As a comprehensive university in the disaster stricken region

When we first saw the magnitude of the disaster, it was obvious that the expertise and knowledge of a single individual or a single discipline would not be enough. We had to gather and collaborate with other researchers, regional companies, the private sector, government and even the international community. Because university members lean towards focusing on one specific research area, there is the tendency to create silos. But to properly respond

to events like the 3.11 disaster, we had to combine our forces across many different sectors. That was the one experience everybody made and this understanding formed our future actions. As a result we were able to continue our research and actions in fields like disaster science, next-generation medicine or nuclear decommissioning, where a more wider, general approach is necessary.

This experience also shaped our response to the current COVID-19 crisis. From the very beginning, we acted quickly and formed emergency action plans, something we learned from the disaster 10 years ago. The newly established Center for Key Interdisciplinary Research 'System Design of Inclusive Society with Infectious Diseases' combines knowledge from life science and medicine as well as a social sciences aspect how humanity has dealt with infectious diseases in the past. The interdisciplinary perspective provides a better view of the whole picture and more ways to come up with solutions.

Another point we have to keep in mind is mental health care. After the 3.11 disaster, we also focused on training and nurturing 'Interfaith Chaplains', who will not only provide mental health care for survivors of the disaster but can also help people in communities requiring mental support. The role of 'Interfaith Chaplains' will be increasingly important, when we think about supporting people lose their loved ones or are in pain. This includes patients currently affected by COVID as well as their families and also medical staff who have to deal with difficult situations on a daily basis.

As an international project, we are currently establishing a 'Disaster Risk Reduction ISO', which will provide international standards for disaster mitigation and risk reduction. The ISO shows objective indicators to society for the disaster readiness, which utilizes the knowledge we accumulated to protect communities all over the world from future events similar to the Great East Japan Earthquake and beyond.

Furthermore, the seven national universities of Tohoku cooperated to establish the Next Generation Synchrotron Radiation Facility in public-private collaboration. The facility will present new opportunities for international research exchange and contributes greatly not only to the communities in the area but also to academic and industry collaborations both in Japan and overseas.

Thinking about ten, twenty years in the future, our actions do not simply stop with

the recovery and restoration of the region, but are just the beginning for further projects aimed at community support to improve the well-being of the people around the world.

Our identity as a university supporting communities

After the Great East Japan Earthquake, we focused even more on 'co-creation' together with the community. 'Contributing to society' was already an important task of our university before the earthquake together with 'education' and 'research'. But 'co-creating' a future together with the community for the community implied a more



interactive engagement. All current projects are future oriented and our reconstruction actions as well as the wider 'Research with Social Impact' has the common idea of supporting and collaborating with communities. That is why we were able to continue our efforts for more than 10 years.

In June 2017, we were selected as one of the first three Designated National Universities by MEXT. During the process, our performance in Disaster Science and Next Generation Medicine received special attention. It is a sign that communities value our contributions and support. After I took over as president, we established the Tohoku University Vision 2030 as well as the Connected University Initiative to further promote co-creative actions with communities. In order to dynamically connect to communities and the world, we need an even more free and flexible approach to collaboration. During the COVID crisis it is our duty to build bridges and overcome disparities in a borderless and

inclusive way.

Our university was founded with the help and support of the community. We are well aware of the debt we owe society for creating our academic community. It is therefore our turn to give back and help communities in these difficult times.

New challenges

10 years is a long time. People and communities change. In recent years, impacts of climate change such as heavy rain disasters and large typhoons are becoming more frequent. The current pandemic is also a disaster heavily affecting communities. And it is an unfortunate fact, that we will not be able to entirely avoid future disasters. But we will be able to create a resilient society by advancing our actions such as carbon neutrality. We have to make sure we are prepared for future, unseen threats and create disaster ready communities. Since there is no clear goal for a 'resilient society', it is our duty to constantly update and upgrade life in communities so everybody can survive future events. This is not only an issue that impacts the everyday life of people, but is connected to the fundamental structure of nations as well as the way international collaborations work. Japan, with the experience of huge disasters, has to play a major role and Tohoku University's knowledge will certainly be a valuable part in future improvements.

Our Reconstruction Actions as well as Research with Social Impact are just some examples of our activities in the last 10 years. They are all in line with the Sendai Framework for Disaster Risk Reduction established in 2015, the Sustainable Development Goals by the UN as well as the Paris Agreement and have similarities to the Green Recovery or Great Reset currently discussed as response to the COVID-19 pandemic. Since our actions have come to address these issues in line with international communities independently, we have even more the confidence and preparedness to support the global society. We will continue our actions to improve everyday life in the communities with our Green Goals Initiative and aim to realize our idea of a resilient and carbon free society that fosters people's well-being.

The lessons and knowledge we gathered after the Great East Japan Earthquake in collaboration with the people will be an essential part of our university. And we welcome everybody to join us in creating a resilient and green future for all.



Reconstruction Actions that changed Tohoku University

Tohoku University Executive Vice President for Outreach Activity and Earthquake Disaster Reconstruction Director of the Institute for Disaster Reconstruction and Regeneration Research

Nobuyoshi Hara

Executive Vice President for Outreach Activity and Earthquake Disaster Reconstruction since 2018 after steps as Professor at Tohoku University and Executive Vice President for Earthquake Disaster Reconstruction. Director of the Institute for Disaster Reconstruction and Regeneration Research as of 2016. Specialization in corrosion protection and surface treatment engineering.

Reconstruction Actions were born from our honest wish to help and support communities. Collaboration with society is part of Tohoku University's identity. Our philosophy to help people in need has not changed and is always a major driving force when thinking about the future.

At the time of the Great East Japan Earthquake I was at the School of Engineering at Aobayama Campus. It was one of the most damaged places at Tohoku University and the building with my laboratory was considered unsafe to enter. As deputy dean, I was involved in our school's recovery and our own reconstruction projects. We had to focus on the things in front of us first, but when we visited disaster stricken areas, it became obvious that regional recovery was necessary and important.

Looking back at university wide actions during that time, the Institute for Disaster Reconstruction and Regeneration Research was established one month after the disaster and President Inoue and Vice President Kitamura swiftly introduced key reconstruction actions. At that time the university president also held the post of director of the institute, which shows the importance of the projects to us. Disaster recovery became a historical mission of our

university. The fundamental idea was 'creative reconstruction', which did not stop by just recovering from the earthquake, but contributing to the life in affected communities and creating an even better everyday life for the people. In April the year after the disaster, President Satomi was inaugurated and I became the executive vice president for earthquake disaster reconstruction and after being the director of the institute as of 2016. Although my contributions started in the School of Engineering, the desire to support reconstruction actions did not change and our goals were very challenging.

Promoting 8 major projects for reconstruction

The Institute for Disaster Reconstruction and Regeneration Research promoted 8 priority projects as its main pillars. The first was the

International Research Project on Disaster Science. One of the lessons we learned from the Great East Japan Earthquake was how ill equipped we were in face of huge, complex disasters. We had to further expand disaster science research and connect the results and outcomes to real, practical solutions for disaster risk reduction and mitigation. The International Research Institute of Disaster Science was established as a unique place where researchers from humanities, engineering, science and medicine could gather and discuss interdisciplinary options to create one-of-a-kind solutions. The results would not only improve disaster readiness in communities both at home and overseas, but also create a new industry in disaster risk reduction. Especially in field of infectious diseases, we have major contributions related to the current COVID-19 crisis. The second was the Project for the Reconstruction

of Community Health Care. The earthquake was a critical blow to the region of Tohoku which was underpopulated with medical staff to begin with. In order to reestablish community health care, we created the Comprehensive Education Center for Community Medicine and the Tohoku Medical Megabank Organization, which provided new technology such as digital medical records, deployed young doctors to disaster-affected hospitals and provided community medical staffs with opportunities to receive cutting edge training at the Clinical Skills Lab. The large-scaled cohort study also contributed to the health care of people in communities and led to the establishment of the integrated biobank. With the support of the communities we were able to greatly advance Next Generation Medicine. Recently, we also started to provide ECMO training for the treatment of COVID patients. The third Project for Environmental Energy as well as the fourth ICT Reconstruction Project were established as a response to the weak electrical infrastructure and ICT environment that had to be restored and improved quickly. Energy production had to be matched with the characteristics and consumption of the region and we promoted new R&D as well as disaster resilient ICT technology and systems. The fifth Tohoku Marine Science Project looked at the marine ecosystem and utilized scientific findings to restore and improve the fishery industry. The sixth was the Nuclear Decommissioning and Environmental Restoration Project. Nuclear decommissioning was a topic originally not included in our activities, but with the establishment of the Center for Fundamental Research on Nuclear Decommissioning in 2016 we created the basis for important scientific research and education of experts who will acquire necessary skills to perform the difficult tasks related to nuclear decommissioning. The seventh Regional Industries Restoration Support Project and the eighth Industry-Academia Collaboration Development Project for Reconstruction both aimed at the recovery of the industry and new ways to educate and train people. We accumulated important knowledge for future business managers and provided necessary training for agricultural recovery. Additionally, we improved our way to handle public-private collaborations for further practical applications of our research results. As a result, disaster stricken corporations had the opportunity to improve their management, develop new products and even establish new industries.

Reconstruction Action 100+ born from individual support activities of our members

Immediately after the earthquake many

members started their own support projects and helped communities, even when they were in a difficult situation themselves. Emergency support actions at disaster areas, emergency health care support at the hospital, information communication and transmission of the actual situation regarding the earthquake and the tsunami and radiation monitoring or the deployment of disaster response robots to the Fukushima Daiichi nuclear power plant were just some of the actions which were done individually to provide important support. Looking at the magnitude of the disaster, many members might have had the feeling that they too



Looking back 10 years, 'There was no clear goal. We just kept running.'

had to do something to help communities. This became the basis for what was to be known as 'Reconstruction Action 100'.

The individual projects involved a wide variety of actions, from community support to industry recovery as well as maintenance of social and information infrastructure. Especially Interfaith Chaplains who supported mental health care of disaster victims contributed to unique actions which soon spread across country. We also established official certificates so chaplains can act as caregivers for terminally ill patients. This is something which would probably not have been possible at any other university.

Looking back at that time, the spirit to help others and support communities is the essence and identity of our university.

The disaster as opportunity to re-conceptualize the own identity

The Great East Japan Earthquake was a disaster where a lot was lost. But we also gained much in the 10 years after. Re-conceptualizing our identity as a university collaborating with communities is one aspect.

Tohoku University was founded with considerable support of local communities and the private sector.

As a result, we have the realization, the essence that we have to give back and support communities and society as much as possible. Being helped again by many people after the disaster 10 years ago strengthened the feeling of gratitude and the need to support others even more.

In 2015 we advanced the reconstruction actions to also address global issues of communities world wide and established Research with Social Impact, 30 projects aimed to create a better future for everybody. In the beginning, the Institute for Disaster Reconstruction and Regeneration Research focused mainly on reconstruction and recovery. Our attention was not really long-term oriented and future aspects came too short. Research with Social Impact included not only our experience and knowledge from the disaster but also aspects important for future sustainability and disaster readiness.

The Tohoku University Vision 2030 from 2018 accelerated the approach and the Connected University Initiative focused even further on bridge building and co-creation with society.

The re-conceptualization of our identity as university collaborating with society was very important for the next steps we took. That is because university actions only show their true value when the results are implemented practically and actually help communities. Outcomes have to just float around in closed academic spaces, but should be given back to society. It seems very obvious, but strongly realizing our connection to local and global communities was an important result of the disaster experience. History is still in the making, but we might even state that Tohoku University evolved after the Great East Japan Earthquake.

Toward a better future for all

Thinking about the next 10, 20 years, our actions should not just stay the same. The multiple Reconstruction Actions have given us many opportunities to collaborate with others and strengthen the way we approach unknown issues to create unique solutions for a better future. But we also have to design that future and think about further steps to take so communities can be prosperous and life for the people will improve.

10 years after the disaster, we are now faced with the COVID-19 crisis and more frequent natural disasters. The Sendai Framework for Disaster Risk Reduction 2015-2030, Sustainable Development Goals as well as the Paris Agreement are all global actions we contribute to. And then there are the challenges such as Disaster Readiness ISO as international standard and the realization of carbon free communities. The challenges are endless. And Tohoku University will continue to restore communities and create a new, more improved environment to support people all over the world.

2011. 3.11

Epicenter **Sanriku Coast** (38.1 degrees North, 142.9 degrees East) 24km depth
Magnitude **9.0**

Maximum seismic intensity **7** (Kurihara City, Miyagi)

Tsunami incursion on the Pacific Coast (maximum height 12m, maximum run-up 40m)

Tsunami inundation area **561km²**

330 Fire

19,729 Deaths

2,559 Missing

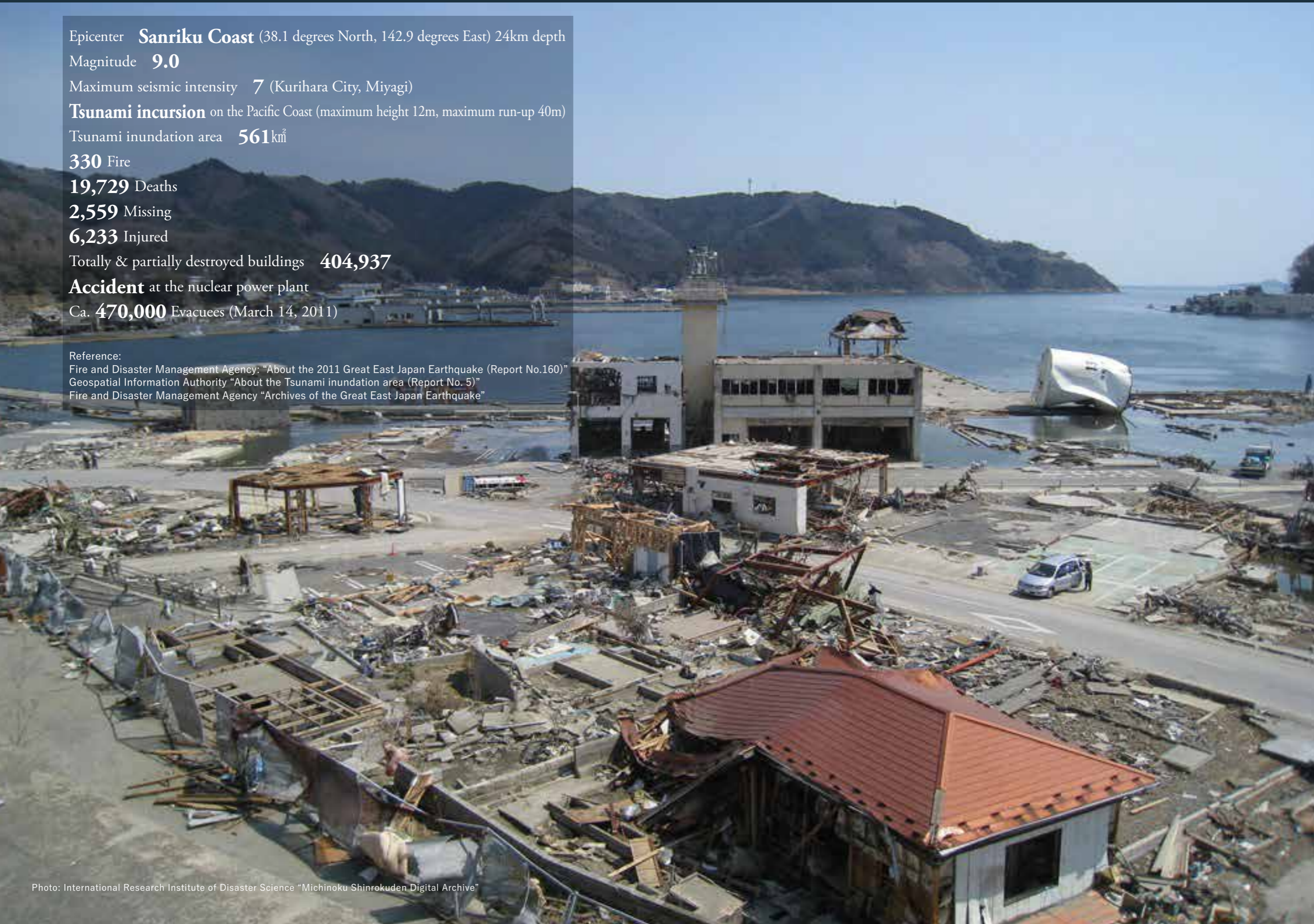
6,233 Injured

Totally & partially destroyed buildings **404,937**

Accident at the nuclear power plant

Ca. **470,000** Evacuees (March 14, 2011)

Reference:
Fire and Disaster Management Agency: "About the 2011 Great East Japan Earthquake (Report No.160)"
Geospatial Information Authority "About the Tsunami inundation area (Report No. 5)"
Fire and Disaster Management Agency "Archives of the Great East Japan Earthquake"

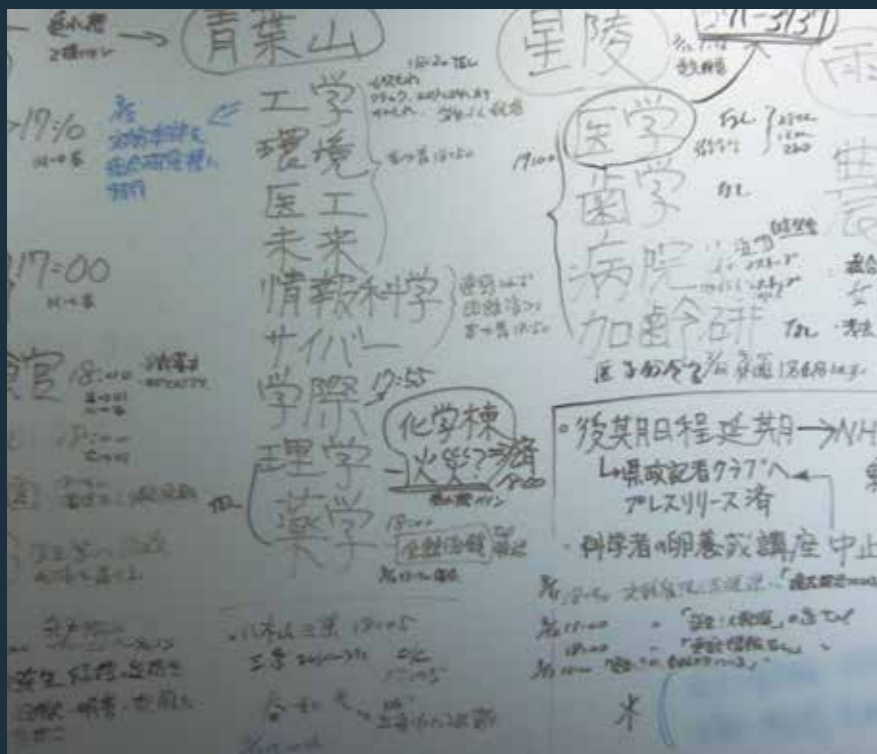


The Great East Japan Earthquake



Damages at Tohoku University

- Loss of lives
 - 3 students dead (by tsunami)
 - 14 students injured
- Building damages
 - Ca. 30 B JPY (27 partial & 3 total reconstructions)
- Research facilities
 - Damages worth ca. 26.9B JPY
- Student housings
 - 640 students affected by partial & total damages
- Others
 - 1 million books scattered & damaged (University Library)
 - Melting of research samples due to long-lasting blackout
 - Dead livestock due to water and gas outage
 - Water damages to materials due to leaks in buildings
 - Increased number of student consultations related to the earthquake, etc.



What happened on 3.11

Earthquake, Tsunami, Nuclear Power Plant Accident

• • • Double & Triple Damages

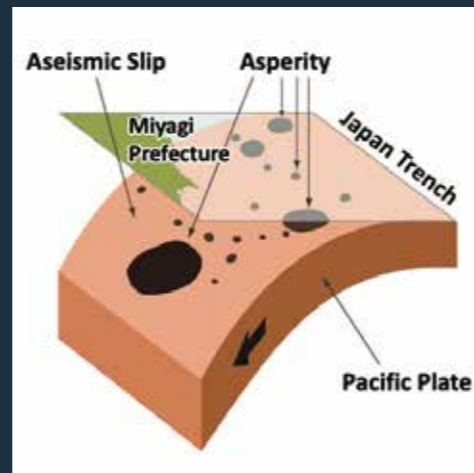
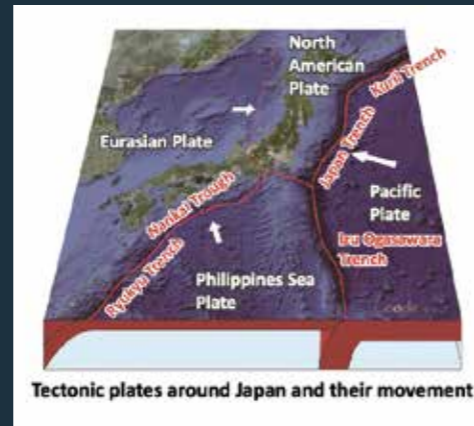
On March 11, 2011, at 14:46, a magnitude 9.0 earthquake with epicentral area off the coast of Iwate to Ibaraki occurred and strong tremors continued for ca. 3 minutes. 30-60 minutes after the earthquake, a tsunami incurred large areas of the Pacific coast line from Aomori to Chiba. Some points recorded a run-up height of over 40m and the coastal region was severely devastated. In Fukushima, a nuclear power plant was damaged due to the earthquake and tsunami, cutting all power supply. As a result, the cooling system failed, leading to a meltdown of the nuclear reactor.

According to the Tohoku University Research Center for Prediction of Earthquakes and Volcanic Eruptions, a fault close to the Japan Trench shifted over 50m, leading to a 10m shift of an area off the coast of Miyagi, resulting in the catastrophic earthquake.

Destruction due to the earthquake and tsunami resulted in 19,729 deaths, 2,559 missing persons, and 404,937 totally or partially destroyed buildings (see "About the 2011 Great East Japan Earthquake (Report No. 160)" Fire and Disaster Management Agency). Furthermore, due to addition of the nuclear power plant accident, the number of evacuees rose to 470,000 people 3 days after the disaster.

Because of the scattering of radioactive materials from the nuclear power plant, the health of residents in East Japan was a major concern, also leading to sales restrictions of agricultural products, damaging the primary sector of the economy.

The calm and principled behavior of disaster victims within this unprecedented crisis was praised by the international community. However, the weaknesses of the social fundament regarding disaster risk reduction and security became obvious, exceeding all assumptions concerning disaster scale, damaging core functionalities of major cities.



The Japanese archipelago is located in the area where the four plates, the North American plate and the Eurasian plate (continental plates), the Pacific plate, and the Philippine Sea plate (oceanic plates) meet. There are many earthquakes occurring in various places such as the inland area due to the accumulated strain. Furthermore, the boundary between the subducting oceanic plates and the continental plates is divided into two types: the fixed part (asperity) and the part slowly sliding without stopping. The stress due to the tectonic motion becomes asperity leading to earthquakes when reaching the limit.

Tohoku University's Situation

Even under devastating conditions and although some facilities and laboratories were damaged, Tohoku University speedily recovered, and started various activities to contribute to the recovery and reconstruction of the region.

In March immediately after the earthquake, the Research Center for Disaster Prevention started investigations and research activities, and in April the "Institute for Disaster Reconstruction and Regeneration Research" was established, interdisciplinary research and investigations regarding various issues and problems. Simultaneously, individual departments started projects to support regeneration and restoration activities, as well as volunteer activities of students.

In 2001 Prof. Koji Minoura actually published an article titled "Tsunami Disasters will be Repeated", analyzing the Sanriku earthquake and resulting tsunami in 868, and predicting the high probability of a tsunami (Tohoku University Journal "Manabi no Mori" Summer Edition 2001). The catastrophe 2011 unfortunately made it evident, that such research results were not properly shared with the entire community.

The question became: What can the knowledge of a university do with respect to regeneration and reconstruction after an earthquake, and what preventive and mitigating measures could be introduced. What can Tohoku University do, as the only comprehensive university in the world, experiencing this kind of disaster? Let's support the renewal of Japan through creation of new values and contribute to society by solving issues related to disaster regeneration. ... All efforts of Tohoku University regarding reconstruction activities have this common goal.



The Research Center for Disaster Risk Reduction organized debriefings in April, June, and September 2011 as well as March 2012, marking "One Month", "Three Months", "Six Months", and "One Year" after the Catastrophe, communicating reports of investigations and research results. At the "One Year" debriefing, the International Research Institute of Disaster Science was established, and international research in Disaster Science was announced in a joint declaration.



Student volunteers of the "Tohoku University Regional Reconstruction Project "HARU"" are preserving cultural treasures.



Immediately after the earthquake, the Tohoku University Hospital accepted patients in collaboration with disaster affected towns and villages. Details are described in "Lives Saved by the Ishinomaki Red Cross Hospital, the Kesenuma Hospital and the Tohoku University Hospital" (Aspect)



Promoting research for the community



Major contributions for the recovery of the university's education and research foundation at the time of the disaster.

Close collaboration with university members and the government to establish the Institute for Disaster Reconstruction and Regeneration Research as well as the International Research Institute of Disaster Science one year after the earthquake.

On March 11, I was in Tokyo for official business when I felt the tremors. At first, there was no phone connection and it was difficult to even begin appropriate disaster response actions.

It was noon two days after the event, when I finally got back to Sendai. To get a grasp of the situation, I visited all campuses. In many cases the ceilings of research buildings fell down, pillars and walls had huge cracks and it was obvious that full restorations were required. There was also a lot of damaged research equipment. Looking at the impact of the disaster we knew that we had to act quickly to recover as soon as possible. During the meetings, faculty and staff members from all departments participated to get our campus back to normal. As a result it was also possible to receive support from the government and we secured emergency funding to proceed with recovery and reconstruction actions.

20th Tohoku University President

Akihisa Inoue

Tohoku University President (2006-2012) after steps as Professor and Director at the Institute for Materials Research, Advisor to the president of Tohoku University and Vice President at Tohoku University. Specialization in Materials Science and Non-Equilibrium Materials.



Discussions with the Minister of Education, Culture, Sports, Science and Technology. Similarities of government and university strategies made early emergency funding possible.

Tohoku University had the duty as a comprehensive university in the center of the disaster area to support regional communities with interdisciplinary research and we established the Institute for Disaster Reconstruction and Regeneration Research in April 2011 as well as the International Research Institute of Disaster Science one year later. These organizations and research activities are real treasures of the university and it is important that we continue our collaboration with the community to promote disaster science.

Tohoku University has to maintain and increase further research capabilities to be present when it is our turn to support communities. Students should challenge new academic ideas and reach out to different kinds of areas. Continuous research and community collaboration will always be an important way for the university to grow.



Supporting communities via university actions

Vice President (2006-2012)

Yukihiisa Kitamura

Vice President at Tohoku University (2006-2012) after steps at MEXT, University of Tokyo, Hitotsubashi University and Tohoku University.

The Great East Japan Earthquake brought devastating damages to the region of Tohoku. The impact on Tohoku University was severe and we were desperately gathering necessary information for the first recovery steps.

In April 2011 we could establish the Institute for Disaster Reconstruction and Regeneration Research as a university wide organization. We wanted to make a statement that we will reinforce our education and research to support communities and not just aim for a simple recovery after the disaster, why we included words like 'research' and 'regeneration'.

It has been 10 years since. In terms of disaster reconstruction, I believe Tohoku University was successful in showing its uniqueness and supporting communities. Based on the concept as 'Connected University' it is still important to further demonstrate the university's presence to the local and global communities. The current COVID crisis changed fundamental structures of society and it is no longer possible to simply act 'as before'. Education and research changed and the university has to find new ways to create and communicate important outcomes to the community. It is also important that students are aware of how they can change the world in these uncertain times. With the reconstruction, the hardware was established and improved, but how things will be operated and how the region will develop further depends on the next generation of thinkers and leaders. I am convinced, Tohoku University's students have the necessary potential and will find a way to further improve our living.



Coordinating recovery actions immediately after the earthquake. Meetings were organized in the morning and late afternoon.

21st Tohoku University President

Susumu Satomi

21st Tohoku University President (2012-2018) after steps as Professor at Tohoku University and Director of the Tohoku University Hospital. Specialization in transplant surgery.



Swift response of the Tohoku University Hospital immediately after the earthquake and important support to regional medical care.

As important projects for recovery and reconstruction across many fields as Tohoku University President.

At the time of the Great East Japan Earthquake I was on the 10th floor of the clinical laboratories building as Director of the University Hospital. The tremors were a horrifying experience. The disaster was more than anything I imagined, but at the University Hospital we had regular training expecting a huge earthquake, so we were able to establish a countermeasures headquarter on the fourth floor of the hospital just 20 minutes after the event and started gathering important information. Luckily none of the patients lost their lives and I still can vividly recall the relief I felt. But soon after, we got the news of the devastating situation in the coastal areas. We knew our colleagues were doing their best in regional hospitals, so we decided to forget about our individual specialization and preferences. We would simply do our best as doctors to help patients in need. It was of utmost importance to not exhaust the capabilities of hospitals at the front line. And we focused on supporting them as much as possible, without intervening unnecessarily.

After the Great East Japan Earthquake Tohoku University's position and role within our communities became very clear. When I

succeeded President Inoue in 2012, everybody focused on recovery and restoration and we all had the one goal: The restoration of Tohoku and the regeneration of Japan. With the reconstruction, we also established organizations like the Tohoku Medical Megabank Organization and the International Research Institute of Disaster Science and it is very encouraging to see research results of Tohoku University in the media in recent years. All these actions of Tohoku University are a treasure others do not possess. Of course, results do not come instantaneously. Using this unique treasure, we can become a university that supports and collaborates not only with regional but global communities. The current COVID-19 pandemic comes with major changes to society and the way we see things. It is important to create value and structures that lead to peace and prosperity of everybody by not only using new technology but comprehensive wisdom and knowledge that come from academic activities. I am sure, Tohoku University will be that place where people get necessary skills and training to become these kinds of future leaders.

Toward a leading university with 10 years worth of treasures

Main projects for recovery and reconstruction

An outline of Tohoku University's actions to lead the restoration of Tohoku and the regeneration of Japan.

2011.

03.11

The Great East Japan Earthquake at 14:46

Est. Headquarters for Disaster Countermeasures

03.12

Accepting patients at the Tohoku University Hospital from the disaster stricken areas

03.13

Emergency damage assessment of Tohoku University's facilities

03.14

The Tohoku University Hospital dispatched medical staff to the disaster stricken area, including the Ishinomaki Red Cross Hospital, the Kesenuma Hospital, and the Ishinomaki area together with supplies and medical equipment

Termination of all lectures and conferment ceremonies, as well as press release regarding entry examinations, freshmen admission, and admission ceremonies



2011.03.11

03.15

Web page for emergency contacts

03.24

"Tohoku University Regional Restoration Project 'HARU'" established by volunteers of Tohoku University

04.01

Establishing the Research Center for Disaster Recovery

Initiation of the Investigative Research Project for Regional Industry Regeneration

04.05

Web page for disaster support by Tohoku University student volunteers

04.13

Emergency debriefing 1 month after the Great East Japan Earthquake



2011.03.14

04.25

Tohoku University activity announcement & partial resumption of lectures

04.26

Lifeline restoration within the university's perimeters

04.27

Establishment of the Institute for Disaster Reconstruction and Regeneration Research

05.01

Establishment of the Center for Community Health Care at the School of Medicine

05.06

Entrance ceremony at each faculty and graduate school

05.09

Reopening classes



2011.03.24



2011.06.24

06.07

Office for Tohoku University Volunteers Disaster Support

06.10

Emergency debriefing 3 months after the Great East Japan Earthquake

06.24

Dispatch of the rescue robot "Quince" to the Fukushima nuclear power plant

07.01

Organization of 7 priority projects by institutes

Tohoku University Restoration PR Campaign "Striding Forward - Tohoku University" (~March 31, 2012)



2011.07.01

07.16

Tohoku University President Akihisa Inoue and U.S. Ambassador John V. Roos exchange thoughts on the development of regenerative activities

08.01

Evaluation of Radiation Effects on Animals

08.02

Tohoku University President Akihisa Inoue and German Ambassador Volker Stanzel exchange thoughts

09.13

Emergency debriefing 6 months after the Great East Japan Earthquake

09.21

Special session with Akira Ikegami "Starting over from Japan's 'second ruins' - Issues which cannot be postponed"

10.01

Establishment of the Research Organization of Electrical Communication



2011.09.21

10.22

Disaster risk reduction symposium "What kind of Earthquake was the Great East Japan Earthquake 2011?"

10.23

Collaboration Agreement of Kobe University and Disaster Science Laboratories of Tohoku University

10.24

UN Day @ Tohoku University "Recovery and Regeneration from the Great East Japan Earthquake - Messages from Tohoku to the World"

10.27

International Symposium "Regeneration and Recovery after the Catastrophe"

11.10

Joint research agreement with Sendai City and Tsukuba University regarding alga biomass



2011.10.23

11.17

Green energy research development symposium toward the regeneration of Tohoku

11.22

Collaboration agreement with IBM Japan (Risk assessment of mega earthquakes & tsunamis)

12.11

Los Angeles Mayor Antonio R. Villaraigosa visits Tohoku University and exchanges thoughts with President Inoue on the "TOMODACHI Fund" as well as collaborative activities regarding disaster recovery.

12.21

Establishment of the "Tohoku University 'Striving Forward' Scholarship"



2011.10.24

2012

01.01

Establishment of the Comprehensive Education Center for Community Medicine

01.19

Collaboration agreement between the National Institute of Information and Communication Technology and Tohoku University

02.01

Establishment of the Tohoku Medical Megabank Organization

03.11

Disaster Experience Memories Toshinroku "Listening and Writing the Disaster Experience - The 3.11. Experience from the Eyes of 90 Tohoku University's Members"

Debriefing 1 year after the Great East Japan Earthquake by Tohoku University

Spirit of Tohoku University 2011.3.11 One-year memorial symposium of the Great East Japan Earthquake "Disaster Recovery and Social Businesses"



2012.01.19

Main projects for recovery and reconstruction

2012 2013 2014 2015

04.01
Establishment of the International Research Institute of Disaster Science

Installment of the Resilient ICT Research Center within the Research Organization of Electrical Communication

05.23
Opening ceremony of the International Research Institute of Disaster Science and joint declaration with national and international collaborating organizations

06.01
Relocation of the Tohoku University Clinical Skills Laboratory

06.19
Reorganization of the 7 priority projects by the institutes into 8 projects with the amendment of "Project for the Decontamination of Radioactive Materials"

10.16
Comprehensive collaboration agreement with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

12.01
Establishment of the Technological Research Center for Early Living Environment Recovery

12.10
Opening the Tohoku Medical Megabank Organization Community Support Center in Ishinomaki

12.13
Opening the Tohoku Medical Megabank Organization Community Support Center in Kesenuma

02.11
NHK regeneration support "Toward Tomorrow" at Tohoku University"

02.14
Opening the Tohoku Medical Megabank Organization Community Support Center in Iwanuma

02.22
Michael Sandel Special Classroom @ Tohoku University "Let's Talk about Restoration"

02.25
Establishment of the Disaster Management Promotion Office

03.09
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "Toward 'Leading the Reconstruction of Japan'"

03.27
Cooperation agreement with the Tohoku University Consumers' co-operative regarding mutual support in cases of disasters

04.25
Cooperation Agreement of the 7 national universities in the Tohoku region in cases of disasters

05.01
Cooperation agreement of Tohoku University and Iwate Medical University regarding collaboration with respect to the Tohoku Medical Megabank Organization

05.16
Opening the Tohoku Medical Megabank Organization Community Support Center in Tagajo

07.01
Adoption of a project by the School of Engineering to the Qatar fund

10.01
Publication of "Tohoku University Records of the Great East Japan Earthquake"

03.09
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "Toward 'Leading Reconstruction of Tohoku and Rebirth of Japan'"

03.28
Collaborative cooperation agreement of Tohoku University with the Japan Atomic Energy Agency

04.01
Establishment of the Tohoku Agricultural Science Center for Reconstruction

04.25
Disaster Mitigation Pocket – the "YUI" Project

06.03
Ceremony of the U.S. Prudential Foundation's announcement for financial support of Regional Innovation Producer School graduates

07.29
Completion ceremony for the Tohoku Medical Megabank Organization facilities

07.30
Opening ceremony of the Tohoku Qatar Science Campus Hall

Reconstruction of the Graduate School of Agricultural Science Field Science Center (Onagawa Field Center)

08.20
Tohoku University's "Fundamental Research and Core HR Education Program for Decommission of Nuclear Reactors, Maintenance of Structural Building Integrity, and Disposal of Nuclear Waste" was selected by the Fundamental Research and HR Education Project for Safe Decommission and Related Measures

09.02
Opening ceremony of the Material Solutions Center

10.01
Installment of the Safety Confirmation System

11.10
Completion ceremony for the International Research Institute of Disaster Science facilities

03.14
The 3rd UN World Conference on Disaster Risk Reduction (~March 18)

03.15
Reconstruction Symposium "Messages from Tohoku University ~ Connecting the Lesson from the Disaster to the Future"

04.01
Establishment of the Global Center for Disaster Statistics

10.14
Publication of "After the Third World Conference on Disaster Risk Reduction ~ Ongoing Projects of Tohoku University"

11.05
Establishment of a Tohoku University Venture "Tohoku Magnet Institute"



2012.03.11



2012.05.23



2013.02.11



2013.02.22



2013.03.09



2013.04.25



2013.05.01



2014.03.09



2014.07.30



2014.11.10



2015.03.14



2015.03.15



2015.10.14



2015.11.05

Main projects for recovery and reconstruction



2016

03.01
Establishment of a disaster prevention and business continuity plan

03.08
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "Toward the future - 5 Years after the Great East Japan Earthquake"

04.01
Reviewing regulations to increase functionality of the institute

Inauguration of Executive Vice President for Earthquake Disaster Reconstruction Nobuyoshi Hara as director

Establishment of the Research Center for Remediation Engineering of Living Environment Contaminated with Radioisotopes



2016.03.08

2017

04.16
Start emergency investigation of the Kumamoto Earthquake

06.02
Establishment of a Steering Committee

12.01
Establishment of the Center for Fundamental Research on Nuclear Decommissioning

2018

03.09
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "The Power of the Next Generation ~ Creating the Future"

06.30
Selection as Designated National University Corporation Establishment of leading research activities at the Core Research Cluster with Disaster Science as one of its four pillars

07.05
Investigation and recovery support after the storm in northern Kyushu

09.08
Investigation and recovery support after the earthquake in Mexico

09.11
Partially reorganizing projects of the Reconstruction Action 100+ including the Center for Fundamental Research on Nuclear Decommissioning and the Tohoku Agricultural Science Center for Reconstruction as part of Tohoku University Priority Projects

11.25
First "World Bosai Forum / International Disaster Risk Reduction Conference in Sendai" (~ November 28)



2017.06.30



2017.11.25

2019

02.02
Disaster Reconstruction and Regeneration Symposium "Leading Disaster Recovery through Creation and Reforms"

02.06
Investigation and recovery support after the earthquake in Taiwan

06.18
Investigation and recovery support after the earthquake in northern Osaka

06.28
Investigation and recovery support after the storm in western Japan



2018.02.02

2020

09.06
Investigation and recovery support after the Iburi earthquake in eastern Hokkaido

09.28
Investigation and recovery support after the Sulawesi earthquake in Indonesia

11.27
Announcing the "Tohoku University Vision 2030" in order to clarify the university's mission until 2030 for disaster recovery and a sustainable future.



2018.11.27

2020

01.03
Investigation and recovery support after the earthquake in Kumamoto

02.13
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "In Collaboration with Society - The Importance of Disaster Risk Reduction"

06.18
Investigation and recovery support after the earthquake in Yamagata

10.12
Investigation and recovery support in eastern Japan after the 2019 Typhoon No 19.

11.09
Second "World Bosai Forum / International Disaster Risk Reduction Conference in Sendai" (~ November 12)



2019.02.13

2020

02.10
Administrative Vice-Minister Teturo Suemune from the Reconstruction Agency visits Tohoku University

03.10
Symposium of the Institute for Disaster Reconstruction and Regeneration Research "Lessons from the Disaster - Toward Future Personalized Medicine" postponed.

07.01
Starting "Lessons from 3.11 - Toward the Future"

07.03
Investigation and recovery support after the 2020 storm.

07.22
First Online Symposium "Living with Disasters"



2020.03.10

2020

09.17
Second Online Symposium "Living with Being Alive"

10.15
General Director Kaide Hideyuki from the Reconstruction Agency visits Tohoku University

11.18
Executive Vice President for Outreach Activity and Earthquake Disaster Reconstruction Nobuyoshi Hara speaks at the "Miyagi Reconstruction Collaboration Forum"

12.09
Minister of Education, Culture, Sports, Science and Technology Koichi Hagiuda visits Tohoku University



2020.07.01

Tohoku University's Institute for Disaster Reconstruction and Regeneration Research

As a comprehensive university in the center of the disaster stricken area, Tohoku University has the mission and responsibility to contribute to the recovery and reconstruction of the region.

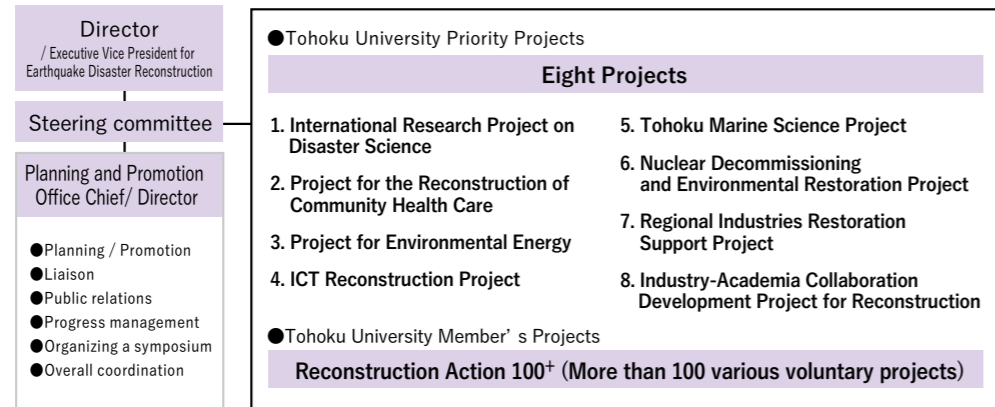
"We wish to be the driving force for the recovery and regeneration of not only the surrounding Tohoku region but Japan itself."

In order to realize this goal, Tohoku University installed the Institute for Disaster Reconstruction and Regeneration Research, collaborated with the government, local communities and residents, as well as various institutions and corporations, and advanced support through eight university-wide projects with high priority and numerous individual concepts summarized as Reconstruction Action 100+.

The movement was established by our common desire to establish "Creative Reconstruction" to support the disaster stricken communities. Whilst contributing to the recovery of the everyday life of the people, we continue our efforts to advance cutting edge education and research leading to a new Tohoku and a better Japan. We are determined to consolidate diverse knowledge of our members and engage in recovery actions after the Great East Japan Earthquake.

Establishment	April, 2011	Purpose	To play a leading role in the recovery and rebirth as a university located in the center of the disaster-affected area
Missions			
Mission1 Contributing to Post-disaster reconstruction and regional regeneration			
Mission2 Creating a multidisciplinary center of excellence for postdisaster reconstruction			
Mission3 Establishing a cross-disciplinary research organization to conduct problem-solving projects			

Organization Chart



- ※ Appointing the EVP for Earthquake Disaster Reconstruction as Director of the institute (formerly led by the President) as of April 2016
- ※ Reorganization of the Project for Decontamination of Radioactive Materials to the Nuclear Decommissioning and Environmental Restoration Project

Issues of the "Tohoku University Reconstruction Action"

In order to communicate Tohoku University's actions to the general public, issues of the "Tohoku University Reconstruction Action" are published on a regular basis.

- Issue 1: May 2012
- Issue 2: October 2012
- Issue 3: June 2013
- Issue 4: July 2014
- Issue 5: March 2015
- Issue 6: July 2016
- Issue 7: December 2017
- Issue 8: March 2019
- Issue 9: March 2021



◀ Please also visit our homepage

<http://www.idrrr.tohoku.ac.jp/>



The 3rd UN World Conference on Disaster Risk Reduction

The UN World Conference on Disaster Risk Reduction

The UN World Conference on Disaster Risk Reduction is an international conference organized by the United Nations to establish policies related to global disaster risk reduction. The first world conference was held 1994 in Yokohama and the second in 2005 in Kobe. During the second world conference the "Hyogo Framework for Action 2005-2015" was established.

The third world conference was held in Sendai, which was affected by the Great East Japan Earthquake, from March 14-18, 2015, to establish a new international disaster risk reduction framework after 2015. On the last day, the "Sendai Framework for Disaster Risk Reduction 2015-2030" was selected, aiming to reduce casualties and economic damages after disasters by employing global disaster risk reduction measures.



Conference Report

Tohoku University's Actions

The Great East Japan Earthquake Forum	Symposia & Seminars	Exhibitions	Posters	Study Tours
Events 10	Events by national institutions 282	Events by national institutions 138	Events by national institutions 63	Events by national institutions 29
Events by Tohoku University 4	Events by Tohoku University 35	Events by Tohoku University 15	Events by Tohoku University 8	Events by Tohoku University 4

- ※ Events by national institutions are counted from the web page of Sendai City, including public forums. Events of international institutions with settlement in Japan are also included.



Great East Japan Earthquake Forum (Presentation by President Satomi)



Exhibition (Tohoku University Reconstruction Actions)



Study Tours (International Research Institute of Disaster Science)

Contributing to the WORLD BOSAI FORUM

The World Bosai Forum

The World Bosai Forum is an international forum aimed at the reconstruction of disaster stricken areas of Tohoku and tasked to promote the Sendai Framework for Disaster Risk Reduction approved by the third UN World Conference on Disaster Risk Reduction. It collaborates with the Disaster Risk Reduction Conference at Davos and connects participants from government institutions, industry, academia and the private sector. Where the Disaster Risk Reduction Conference at Davos is centered around disaster risk reduction experts from Europe and America, the World Bosai Forum focuses on the participation of the general public as well. So far, two events were organized in Sendai in 2017 and 2019 and we presented practical solutions to disaster risk reduction based on the knowledge and experience of the Great East Japan Earthquake.

• First World Bosai Forum (WBF2017)

Date: November 25 -28, 2017
Place: Sendai International Center and Exhibition Hall, Tohoku University Hagi Hall

Director Fumihiko Imamura from the International Research Institute of Disaster Science was the committee chairperson and President Susumu Satomi the president of the event. The forum attracted 947 participants from 42 countries and regions with diverse background such as industry, academia, government and general public. 49 sessions, 93 poster presentations, 27 mini presentations as well as a study tour and excursion were organized during the event. Current developments and issues related to disaster risk reduction as well as the Sendai Framework for Disaster Risk Reduction 2015-2030 and BOSAI (disaster mitigation) in general were discussed. The event also aimed to create a new opportunity for further international collaboration.



Logo



Opening remarks by President Susumu Satomi



Sessions

• Second World Bosai Forum (WBF2019)

Date: November 9 - 12, 2019
Place: Sendai International Center and Exhibition Hall, Tohoku University Hagi Hall

The steering committee was established by members of the International Research Institute of Disaster Science and Professor Yuichi Ono acted as Founder and CEO of the World Bosai Forum Foundation. The event attracted 871 participants from the United Nations, government, international institutions, research organizations, local municipalities and industry from 38 countries and regions. During the forum 50 presentations, 3 keynote lectures, 47 poster sessions, 33 flash talks and 14 exhibition booths were organized, discussing developments related to the Sendai Framework for Disaster Risk Reduction 2015-2030, the Global Target E and practical solutions related to general disaster risk reduction. President Hideo Ohno, Executive Vice President Nobuyoshi Hara and Director Fumihiko Imamura from the International Research Institute of Disaster Science gave opening remarks and keynote presentations, communicating the role of Tohoku University and the International Research Institute of Disaster Science during the restoration of the area after the Great East Japan Earthquake.



Poster



Session by the Institute for Disaster Reconstruction and Regeneration Research



Reconstruction Symposium Three University Presidents Discussion

Disaster Reconstruction and Regeneration Symposium

The institute organizes annual symposia to report on the progress of projects and promotes the collaboration and cooperation with local and global communities. In order to overcome various difficulties in the disaster stricken area as well as to utilize the characteristics and resources of the region, Tohoku University promotes "Creative Reconstruction" toward the development of a new Tohoku via necessary research of important technology and education of future leaders.

Leading the recovery of Japan in 2013

Two years after the Great East Japan Earthquake on March 9, 2013, the Symposium "Toward 'Leading the Reconstruction of Japan'" was held at the Sendai Garden Palace. President Susumu Satomi, who acted as director of the institute gave opening remarks and representatives from individual projects reported on their activities. Furthermore, lively

discussions with project partners and collaborators were possible, who expressed their continuous support and expectations in the projects. About 200 participants from local communities, industry and academia gathered, showing the high interest in Tohoku University's reconstruction actions.

Program

- 13:00 **Opening Remarks**
President Susumu Satomi
- 13:10 **Opening Remarks by Special Guests**
MEXT Research Promotion Director Daisuke Yoshida
Deputy Director of the Miyagi Reconstruction Office at the Reconstruction Agency Koza Inada
Miyagi Governor Yoshihiro Murai
- 13:25 **Reports from 8 Priority Projects**
 - 1. International Research on Disaster Science**
Director of the International Research Institute of Disaster Science
Arata Hirakawa
 - 2. Reconstruction of Community Health Care**
Director of the Comprehensive Education Center for Community Medicine Hideo Harigae
Director of the Tohoku Medical Megabank Organization
Masayuki Yamamoto
 - 3. Environmental Energy**
Dean of the Graduate School of Environmental Studies
Kazuyuki Tohji
 - 4. ICT Reconstruction**
Director of the Research Institute of Electrical Communication
Masataka Nakazawa
- 14:50 **Break**
- 15:05 **5. Tohoku Marine Science**
Professor at the Graduate School of Agricultural Science
Akihiro Kijima
- 6. Decontamination of Radioactive Materials**
Senior Assistant Professor at the Graduate School of Engineering
Hiroaki Takahashi (as acting representative)
Assistant Professor at the Institute of Development, Ageing and Cancer
Masatoshi Suzuki (as acting representative)
- 7. Regional Industries Restoration Support**
Director of the Regional Innovation Research Center
Masahiko Fujimoto
- 8. Industry-Academia Collaboration Development for Reconstruction**
Executive Vice President for Industry Collaboration
Hiroshi Kazui
- 16:30 **Reports from Reconstruction Actions 100+**
Regeneration Support for Food, Agriculture, and Communities
Professor at the Graduate School of Agricultural Science
Yutaka Nakai
International Studio for Reconstruction Concepts
Professor at the Graduate School of Engineering Yasuaki Onodera
- 16:55 **Expectations for the Future**
General Manager, Digital Editing Department, Kahoku Shimpō Publishing Co. Hideaki Hachiro
Director of the Ishinomaki City Hospital Hideo Ise
- 17:20 **Closing Remarks**
Executive Vice President for Earthquake Disaster Reconstruction
Nobuyoshi Hara



Opening Remarks by President Susumu Satomi



Exhibition



Presentations

“Toward the restoration of Tohoku and the regeneration of Japan” in 2014

The Symposium “Toward the restoration of Tohoku and the regeneration of Japan” was held on March 9, 2014, in Sendai Westin with ca. 200 participants from local communities, industry and academia. After the opening remarks by President Susumu Satomi, MEXT Director for Research Promotion Shinjiro Komatsu, Kobe University President Hideki Fukuda and Miyagi Deputy Governor Shuichi Miura commented as special guests on the event. During the symposium, representatives from individual projects gave their

summary reports and screenwriter Makiko Uchidate gave a speech titled “Tohoku’s Spirit, Technique and Body: How to be Japan’s Yokozuna” and elaborated on the role expected of Tohoku University in the future as well as the importance of “technique”. Sendai City Mayor Emiko Okuyama also gave a presentation on the 3rd UN World Conference on Disaster Risk Reduction as well as the role of Sendai in these activities. Simultaneously, the Exhibition of Reconstruction Actions was also organized.

Program

- 10:30 **Opening Remarks**
President Susumu Satomi
- 10:35 **Opening Remarks by Special Guests**
MEXT Research Promotion Director Shinjiro Komatsu
Kobe University President Hideki Fukuda
Miyagi Deputy Governor Shuichi Miura
- 10:50 **Keynote Presentation:**
Tohoku’s Spirit, Technique and Body -How to be Japan’s Yokozuna-
Screenwriter Makiko Uchidate
- 11:35 **Reports from 8 Priority Projects (1)**
1. International Research Project on Disaster Science
Director of the International Research Institute of Disaster Science
Arata Hirakawa
2. Project for Environmental Energy
Dean of the Graduate School of Environmental Studies
Kazuyuki Tohji
- 12:20 **Break**
- 13:30 **Reports from Reconstruction Actions 100+**
Education of “Interfaith Chaplains” and Social Implementation
Professor at the Graduate School of Arts and Letters
Iwayumi Suzuki
- 13:50 **Reports from 8 Priority Projects (2)**
3. Project for the Reconstruction of Community Health Care
Director of the Comprehensive Education Center for Community Medicine
Hideo Harigae
Director of the Tohoku Medical Megabank Organization
Masayuki Yamamoto
4. ICT Reconstruction project
Deputy Director at the Research Institute of Electrical Communication Naomichi Numata
5. Tohoku Marine Science Project
Professor at the Graduate School of Agricultural Science
Akihiro Kijima
- 15:35 **Keynote Presentations:**
Toward the 3rd UN World Conference on Disaster Risk Reduction
Sendai City Mayor Emiko Okuyama
- 15:55 **Reports from 8 Priority Projects (3)**
6. Project for the Decontamination of Radioactive Materials
Director of the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes
Keizo Ishii
Professor at the Institute of Development, Ageing and Cancer
Manabu Fukumoto
7. Regional Industries Restoration Support Project
Director of the Regional Innovation Research Center
Masahiko Fujimoto
8. Industry-Academia Collaboration Development Project for Reconstruction
Professor at the Institute for Materials Research
Akihiro Makino
- 17:25 **Closing Remarks**
Executive Vice President for Earthquake Disaster Reconstruction
Nobuyoshi Hara



Exhibition



Presentations



Screenwriter Makiko Uchidate

“Messages from Tohoku University -Connecting the Lesson from the Disaster to the Future” in 2015

As a public forum of the 3rd UN World Conference on Disaster Risk Reduction the symposium “Messages from Tohoku University ~ Connecting the Lesson from the Disaster to the Future” was organized on March 15, 2015 at the Tokyo Electron Hall Miyagi with 1500 participants. During the event, Secretary-General Ban Ki-moon of the United Nations gave a keynote presentation, pointing out Tohoku University’s contributions through the reconstruction projects and future developments. Afterwards,

project leaders of the 8 Priority Projects were involved in a podium discussion with Prof. Andrew Gordon from Harvard University, discussing the three topics “Mega Disasters and Disaster Risk Reduction”, “Industry and Life” as well as “People and Medical Care”. In the afternoon, President Satomi spoke on behalf of Tohoku University and Director Imamura, Prof. Hino of the International Research Institute of Disaster Science and Prof. Ishii of the University Hospital presented their messages.

Program

Forenoon Session: Reconstruction of Tohoku and the Regeneration of Japan

- 10:00 **Keynote Lectures**
Secretary-General Ban Ki-moon
- 10:30 **Opening Remarks**
Executive Vice President for Earthquake Disaster Reconstruction
Nobuyoshi Hara
- 10:35 **Panel Discussion 1: “Mega Disasters and Disaster Risk Reduction”**
Coordinator
International Research Project on Disaster Science Director of the International Research Institute of Disaster Science(Special Advisor to the President, Reconstruction Actions) Fumihiko Imamura
Panelists
ICT Reconstruction Project Director of the Research Organization of Electrical Communication Masataka Nakazawa
Deputy Director of the International Research Institute of Disaster Science Makoto Okumura
Professor at the Leading Graduate Schools (Global Safety) Norihito Umino
Professor at Harvard University (Disaster Archives) Andrew Gordon
Vice-President IBM Japan(Chairperson for Disaster Risk Reduction at Keidanren) Takayuki Hashimoto
- 11:20 **Panel Discussion 2: Industry and Life**
Coordinator
Professor at the Graduate School of Agricultural Science (Special Advisor to the President, Reconstruction Actions) Yutaka Nakai
Panelists
Project for Environmental Energy Professor at the Graduate School of Environmental Studies Kazuyuki Tohji
Tohoku Marine Science Project Professor at the Graduate School of Agricultural Science Akihiro Kijima
Regional Industries Restoration Support Project Director of the Regional Innovation Research Center Masahiko Fujimoto
Industry-Academia Collaboration Development Project for Reconstruction Professor at the Institute of Multidisciplinary Research for Advanced Materials Takashi Nakamura
- 12:05 **Panel Discussion 3: “People and Medical Care”**
Coordinator
Professor at the Graduate School of Medicine (Special Advisor to the President, Reconstruction Actions) Kazuhiko Igarashi
Panelists
Project for the Reconstruction of Community Health Care Director of the Comprehensive Education Center for Community Medicine Hideo Harigae
Project for the Reconstruction of Community Health Care Director of the Tohoku Medical Megabank Organization Masayuki Yamamoto
Project for the Decontamination of Radioactive Materials Director of the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes Keizo Ishii
Project for the Decontamination of Radioactive Materials Professor at the Institute of Development, Ageing and Cancer Manabu Fukumoto



President Susumu Satomi and Secretary-General Ban Ki-moon



Opening Remarks by Executive Vice President Nobuyoshi Hara



Exhibition at Kawauchi Hagi Hall



Panel Discussion



Participants



Study Tours

Program	
Afternoon Session: Lessons from the Disaster for the Future	
14:00	Opening Movie Tohoku University's Actions After the Great Earthquake
14:05	Opening Remarks for the Afternoon Session President Susumu Satomi
14:15	Toward the Future: Our Messages "Lessons from the Great East Japan Earthquake and the New Role of Tsunami Science" Director of the International Research Institute of Disaster Science Fumihiko Imamura "Can Mega Earthquakes be Predicted? - Lessons from the Great East Japan Earthquake 2011" Professor at the International Research Institute of Disaster Science Ryota Hino
15:35	Break
15:50	"Building the Stage for Future Regional Health Care and Training Next Generation Experts" General Manager of Regional Medical Education Support at the University Hospital (Former Director of Medical and Social Affairs at the Japan Red Cross Ishinomaki Hospital) Tadashi Ishii
16:30	Talk Session "Toward the Future" Facilitator Marty Kuehnert Guests Nihonjin Project



Presentation by Director Imamura



Talk Session

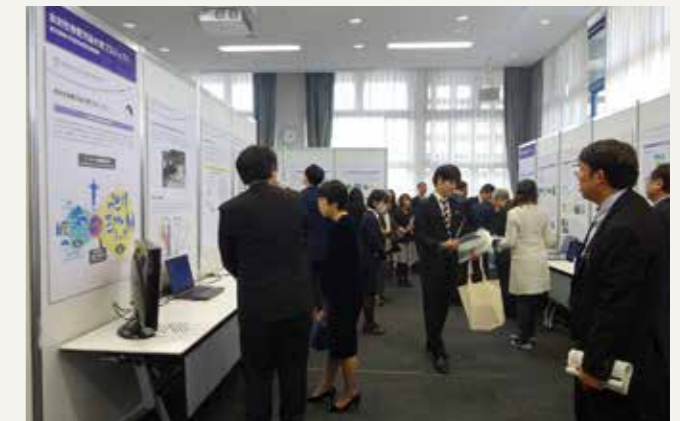
"Together Toward the Future - Five Years after the Great East Japan Earthquake" in 2016

On March 8, 2016, the symposium "Together Toward the Future - Five Years after the Great East Japan Earthquake" was held at Tohoku University's Centennial Hall (Kawauchi Hagi Hall). After MEXT's Director for Research Promotion Yayoi Komatsu gave opening remarks, Executive Vice President Hara presented a summary of Tohoku University's Reconstruction Actions.

Additionally, Director of the Tohoku Medical Megabank Organization Masayuki Yamamoto and Research Professor Akihiro

Makino from the Institute for Materials Research also presented their newest findings. At last, the 3D documentary produced by NHK Media Technology with the advice from Director Imamura "The 3.11 Tsunami - Memories for the Future" was shown. The campus tour organized for participants of the symposium presented individual activities and facilities of reconstruction projects. Furthermore, a special exhibition presented results from the 8 Priority projects and Reconstruction Actions 100+.

Program	
13:30	Opening Remarks President Susumu Satomi
13:35	Opening Remarks by Special Guests MEXT Research Promotion Director Yayoi Komatsu
13:40	The Future of Reconstruction Actions Executive Vice President for Earthquake Disaster Reconstruction Nobuyoshi Hara
14:20	Break
14:45	Keynote Presentations "How to Begin Next Generation Medicine at Tohoku University - Thinking about the Unknown" Director of the Tohoku Medical Megabank Organization Masayuki Yamamoto "Development of Ultra Low-Energy Magnetic Materials at Tohoku University - Achievements and Future Prospects" Research Professor at the Institute for Materials Research Akihiro Makino
16:05	Break
16:25	3D Documentary "The 3.11 Tsunami - Memories for the Future"
16:55	Closing Remarks Executive Vice President (Industry Collaboration) Hideo Shindo



Special Exhibition



Presentation by Executive Vice President Nobuyoshi Hara



"The 3.11 Tsunami - Memories for the Future"

“The Power of the Next Generation - Creating the Future” in 2017

On March 9, 2017, the symposium “The Power of the Next Generation - Creating the Future” was held at the Multi-media Hall (Tohoku University, Kawauchi campus) with ca. 300 participants. Six years after the Great East Japan Earthquake, it was necessary to involve the next generation of young academics and leaders in the reconstruction process and communicate important ideas as well as future actions. After opening remarks by President Satomi, MEXT Research Promotion

Specialist Taishi Nishiki addressed the current situation. Executive Vice President Hara also presented Tohoku University's developments regarding Reconstruction Actions and President Yozo Tachibana of Rakuten Baseball, Inc. spoke about revitalizing the region of Tohoku with the help of young people through various activities such as baseball. Last but not least, young researchers discussed their research activities, experiences and future ideas.

Program

- 13:00 **Opening Remarks**
President Susumu Satomi
- 13:05 **Opening Remarks by Special Guests**
MEXT Research Promotion Director
Yasunao Seki
(Appointed speaker: Specialist Taishi Nishiki)
- 13:10 **The Future of Reconstruction Actions**
EVP for Earthquake Disaster Reconstruction
Director of the Institute for Disaster Reconstruction and
Regeneration Research Nobuyoshi Hara
- 13:50 **Keynote Speakers**
“**Toward the most beloved team in Japan**
-Revitalizing Tohoku with the power of the next generation-”
President of Rakuten Baseball, Inc. Yozo Tachibana
- 15:10 **Panel Discussion**
“**The Reconstruction of Tohoku and the Role of the Next Generation**
for the Renewal of Japan”
Panelists (Young Researchers from Reconstruction Actions)
 - International Research Project on Disaster Science
Graduate School of Engineering 1st year Ph.D. Student
Fumiya Makinoshima
 - Project for the Reconstruction of Community Health Care
Tohoku University Hospital Assistant Professor
Eikan Mishima
 - Tohoku Marine Science Project
Graduate School of Agricultural Science Assistant Professor
Ayu Katayama
 - Tohoku Agricultural Science Center for Reconstruction
Graduate School of Agricultural Science 2nd year Master student
Shohei Takizawa
 - Project on Fundamental Research and Core HR Education
Program for Decommission of Nuclear Reactors,
Maintenance of Structural Building Integrity,
and Disposal of Nuclear Waste Graduate School of Engineering
2nd year Master student Yushi Kato
- Coordinator**
International Research Institute of Disaster Science Director
Institute for Disaster Reconstruction and Regeneration
Research Deputy Director Fumihiko Imamura
- 16:25 **Closing Remarks**
International Research Institute of Disaster Science Director
Institute for Disaster Reconstruction
and Regeneration Research Deputy Director
Fumihiko Imamura



President Yozo Tachibana of Rakuten Baseball, Inc.



Participants



Panel Discussion

“Leading Disaster Recovery through Creation and Reforms” in 2018

On February 2, 2018, the symposium “Leading Disaster Recovery through Creation and Reforms” was organized at the Yuraku-cho Asahi Hall in Tokyo with more than 500 participants.

Parliamentary Secretary Hideki Nizuma and Deputy Minister for Reconstruction Toru Doi gave the opening remarks and Tohoku University President Susumu Satomi presented future plans of the university. Furthermore, EVP Nobuyoshi Hara presented the progress of the recovery activities by the Institute and provided an outlook for futures tasks and objectives.

During the main discussions, Director Imamura of the International Research Institute of Disaster Science detailed the activities of the International Research Project on Disaster Science and the formation

of Disaster Science as part of Tohoku University's Core Research Cluster, Director Watanabe from the Center for Fundamental Research on Nuclear Decommissioning explained the scientific progress regarding the Nuclear Decommissioning and Environmental Restoration Project, and Director Yamamoto of the Tohoku Medical Megabank Organization outlined the achievements of the composite biobank toward the establishment of Next Generation Medicine. The talks highlighted not only the current progress but also the detailed contributions to the local communities as well as future aspects for further developments.

After the symposium, musician miki, who is actively involved in the reconstruction of Miyagi's coastal area, gave a small concert.

Program

- 13:00 **Opening Remarks**
Special Advisor to the President Yutaka Nakai
- 13:05 **Opening Remarks by Special Guests**
Administrative Officer to the Minister for Education, Culture,
Sports, Science and Technology
Administrative Officer to the Minister for Reconstruction
Hideki Niizuma
Deputy Minister for Reconstruction
Toru Doi
- 13:10 **After Recovering from the Great East Japan Earthquake**
Excellence and Innovation in Synergy toward a Leading University
President Susumu Satomi
- 13:30 **Reconstruction Actions**
What Comes Next
EVP for Earthquake Disaster Reconstruction
Director of the Institute for Disaster Reconstruction
and Regeneration Research
Nobuyoshi Hara
- 13:50 **The Core Research Cluster for Disaster Science**
International Research Project on Disaster Science
International Research Institute of Disaster Science Director
Institute for Disaster Reconstruction
and Regeneration Research Deputy Director
Fumihiko Imamura
- 14:30 **Realizing Safe and Secure Communities**
Contributing to the Nuclear Decommissioning
of the Fukushima Daiichi Nuclear Power Plant
Nuclear Decommissioning and Environmental Restoration Project
Director of the Center for Fundamental Research on Nuclear
Decommissioning Yutaka Watanabe
- 15:00 **Break**
- 15:20 **Leading Next Generation Medicine with a Unique Integrated Biobank**
Project for the Reconstruction of Community Health Care
Director of the Tohoku Medical Megabank Organization
Masayuki Yamamoto
- 16:00 **Mini Concert “Songs to Tohoku - Let's Walk Together”**
Singer Song Writer miki
- 16:55 **Closing Remarks**
Special Advisor to the President Yutaka Nakai



Participants



Presentations



Concert by miki

“In Collaboration with Society -The Importance of Disaster Risk Reduction” in 2019

On February 13, 2019, the symposium “In Collaboration with Society - The Importance of Disaster Risk Reduction” was organized in Sendai with more than 150 participants from the government, industry and the general public.

Tomonori Nishii from MEXT’s Scientific Research Institutes Division addressed the relevance of the event for future nation wide projects. During the symposium EVP Hara summarized the activities and achievement of the institute in his talk “Reconstruction Actions for a better future”, Prof. Toda from the International Research Institute of Disaster Science detailed his findings regarding earthquakes from active faults, Director Matsuzawa from the Research Center for

Prediction of Earthquakes and Volcanic Eruptions communicated the dangers from earthquakes occurring in oceanic trenches. Director Imamura from the International Research Institute of Disaster Science presented findings regarding tsunami damages and Prof. Kuriyama explained necessary actions to approach public health after large scaled disasters. Each presenter was able to express the importance of Disaster Science and possible measures to reduce risks of natural disasters.

The participants were able to engage in lively discussions with the presenters after the main talks, establishing a place for important communication to spread the word regarding disaster risk mitigation.

Program

- 13:00 **Opening Remarks**
President Hideo Ohno
- 13:05 **Opening Remarks by Special Guests**
Manager at MEXT Department for Research Promotion
Tomonori Nishii
- 13:10 **The Future of Tohoku University’s Reconstruction Actions**
Executive Vice President for Outreach Activity and Earthquake
Disaster Reconstruction
Director of the Institute for Disaster Reconstruction
and Regeneration Research
Nobuyoshi Hara
- 13:30 **Preparing for Active Fault Earthquakes: The Nagamachi
-Rifu Fault as an Example**
Professor at the International Research Institute
of Disaster Science Shinji Toda
- 14:10 **Preparing for Trench Earthquakes:
Lessons from the Great East Japan Earthquake**
Director of the Research Center for Prediction of Earthquakes
and Volcanic Eruptions Toru Matsuzawa
- 14:50 **Break**
- 15:05 **Recent Developments in Disaster Risk Reduction
-From the Great East Japan Earthquake 3.11
to the Sulawesi Earthquake and Tsunami in Indonesia 2018**
International Research Institute of Disaster Science Director
Institute for Disaster Reconstruction and Regeneration Research
Deputy Director Fumihiko Imamura
- 15:45 **The Public Health Care Approach to Large-scaled Disaster Response**
Professor at the International Research Institute of Disaster Science
Sinichi Kuriyama
- 16:25 **Closing Remarks**
Special Advisor to the President
(Earthquake Disaster Reconstruction)
Hideo Harigae



Participants



Opening Remarks by President Ohno



Presentations

※ The 2020 symposium “After Reconstruction -Toward Personalized Medicine for Future Health Care” was originally planned for March 10, 2020, at Kawauchi Hagi Hall, but had to be postponed due to the COVID-19 pandemic.

Contributing to disaster risk reduction and the creating disaster readiness ISO as international standard



Prof. Imamura investigating the disaster in the Kesenuma region.

As leading comprehensive university of the disaster stricken region, we played a major role in disaster recovery and reconstruction. With the many activities and achievements in the field of disaster science, we have to think how to apply the results to practical disaster risk reduction.

One major result of our 10 year project was that everybody understood the importance to focus on ‘saving lives’ at times of disasters such as the 3.11 Great East Japan Earthquake. Otherwise it would have been impossible to obtain a definitive answer to discussions such as how high to build the seawall or what kind of evacuation system to employ. We also could convince people outside the disaster stricken area who did not experience the catastrophe how important disaster risk reduction actually is. There are increasing numbers of young people interested in disaster risk reduction and I think we could contribute greatly to the education of the next generation. One of the most difficult aspects when dealing with reconstruction planning was how to obtain a consensus. There are multiple ways to approach policies and actions, but everybody had to agree on the matter. That includes bureaucrats, experts, supporters from Japan and overseas as well as local members of the community. The plan for reconstruction had to be devised within a year, and since many people evacuated to shelters, just gathering

and discussing issues was sometimes difficult. As a leading research university in the disaster stricken area, it was also a major achievement to communicate new activities not necessarily related to disaster science such as education of interfaith chaplains and the neuroscience behind the power to survive. The World Bosai Forum organized every two years also plays a major role in looking forward. We have the opportunity to inform the community about recent actions and get everybody on the same page.

Unprecedented weather extremes and major natural disasters are happening more often due to the current global climate change. How to approach unknown types of disasters. That is another question we have to think about and we are preparing for. Furthermore, we are currently preparing a ‘Disaster Readiness ISO’ as international standard for disaster risk reduction. It will communicate important information how to mitigate future disasters. I am convinced we can contribute to communities both at home and abroad by presenting our experience and revitalizing the regional industry through new standards.

Vice President
International Research Institute of
Disaster Science Director

Fumihiko Imamura

Director of the International Research Institute of Disaster Science since 2014 after steps as Professor at the Graduate School of Engineering and the International Research Institute of Disaster Science. Advisor to the President since 2020. Specialization in Tsunami Science.

Utilizing the experience of the Great East Japan Earthquake for the future



Collaborative Agreement between Tohoku University and TEPCO.

Special Advisor to the President
(Earthquake Disaster Reconstruction)
Director of the Center for Fundamental
Research on Nuclear Decommissioning

Yutaka Watanabe

Professor at Tohoku University Graduate School of Engineering since 2008 after steps as Lecturer and Assistant Professor at the Graduate School of Engineering. Since 2016 Director of the Center for Fundamental Research on Nuclear Decommissioning. Specialization in corrosion protection and plant life management.

10 years after the severe accident at the Fukushima Daiichi Nuclear Power Station, the most challenging phase of nuclear decommissioning has just begun. Both R&D and education is an increasingly important duty of the university.

The Center for Fundamental Research on Nuclear Decommissioning has three roles. The support of the safe decommissioning of the Fukushima Daiichi Nuclear Power Plants via fundamental research, the application of the obtained knowledge to the decommissioning of normal nuclear power plants and the education of next-generation experts through our academic activities.

The decommissioning of accident-damaged nuclear power plants like Fukushima involves several steps. The fuel debris and other radioactive materials have to be collected and maintained so the environment is safe without any special actions. The high risk state after the accident has to be reduced in stages to a situation where safe management will be possible. Currently, new releases of radioactive materials from the system have been suppressed and the conditions within the buildings and the reactors are becoming clearer. We have managed to organize the surrounding environment for the next phase. The main process of nuclear decommissioning comes now.

In April 2020, Tohoku University's Institute for Disaster Reconstruction and Regeneration

Research and TEPCO signed a collaborative agreement to establish a new division for basic research to support the nuclear decommissioning at the Fukushima Daiichi Nuclear Power Plants within the Center for Fundamental Research on Nuclear Decommissioning. The center will support the needs of TEPCO's specialists on-site, break them down into research tasks and provide solutions and new ideas. The academic process will also involve the education of students and future specialists. Then, the research for practical use will begin with those that have high significance and potential for practical use. In order to achieve the safe decommissioning of the nuclear power plants, we need to involve knowledge and development ideas across many technical fields. There are many new, important academic frontiers to be explored.

The nuclear decommissioning of the Fukushima Daiichi Nuclear Power Plants is an unprecedented, technically very difficult project. But it is also most important for the recovery of the Fukushima region and the trust of global communities in the Japanese future. It is our duty to gather our knowledge and work on solving the problems and we ask for at the help from experts in all scientific fields.



Tohoku University Hospital is a base for the air ambulance supporting the entire prefecture of Miyagi within 30 minutes. Many patients were brought to the hospital after the 3.11 event.

We continue to train regional medical personnel and communicate our experience of health care at times of disasters to our students. Turning our experience into an asset to maintain medical care even in the event of unforeseen circumstances.

Immediately after the earthquake the Tohoku University Hospital set up and emergency response headquarter. It was our duty as hospital to maintain medical care to fulfill the role expected by our patients. At that time, I was a member of the emergency response headquarter and was involved in the early decision making process of the hospital such as how to accept injured patients. There was some initial confusion, but all departments collaborated very quickly and we were able to resume treatment early on. It was a relief that most of our patients were unharmed by the earthquake.

One year after the disaster, the School of Medicine established the Comprehensive Education Center for Community Medicine to restore and support regional medical care. The center aims to train medical personnel of the disaster stricken communities and provide new technology and techniques from the University Hospital such as training with medical simulations. We are able to enhance the skills of medical personnel in local communities, improving the regional health care system. The

center also provides opportunities for people involved in medical care to talk about their experience in local communities to students and other staff members.

The disaster stricken communities were suffering from a declining population to begin with and the lack of doctors and nurses was a big issue. The 3.11 disaster was another blow to regional medical care and a severe crisis which almost led to the breakdown of community health care. In recent years, typhoons and disasters caused by heavy rain as well as the COVID-19 pandemic have a severe impact on the region. The current situation has many hidden risks and it is our duty to remember the experience and communicate the lessons learned to the next generation, so people are prepared in the future.

Tohoku University has created a solid foundation for disaster readiness and the capability to swiftly respond to unexpected events will be a real strength. We will continue to communicate our experience and archive important lessons of medical care to be ready for the next emergency situation.

First, we need to ensure the risks are managed. Then, make it safe without special management.

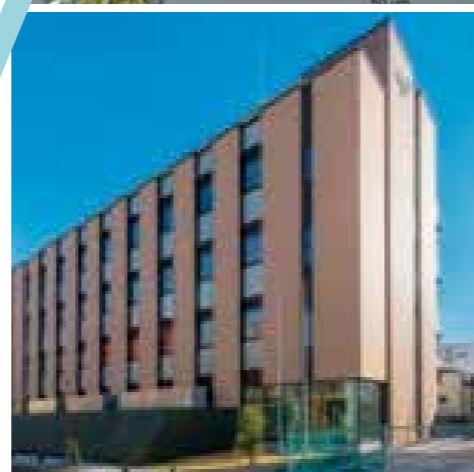
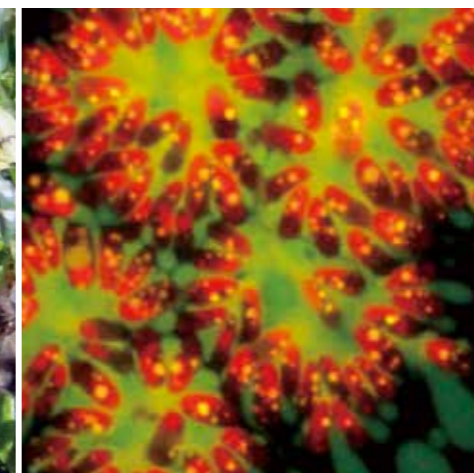
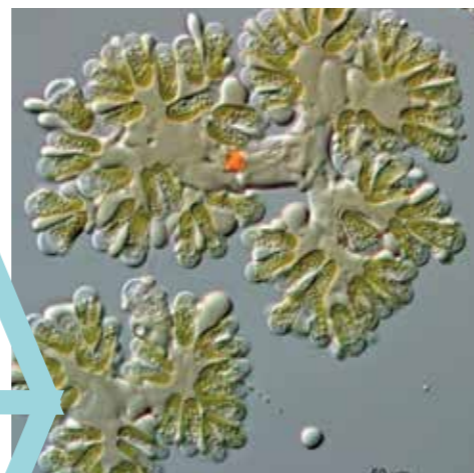


Special Advisor to the President
(Earthquake Disaster Reconstruction)
Director of the Comprehensive Education
Center for Community Medicine

Hideo Harigae

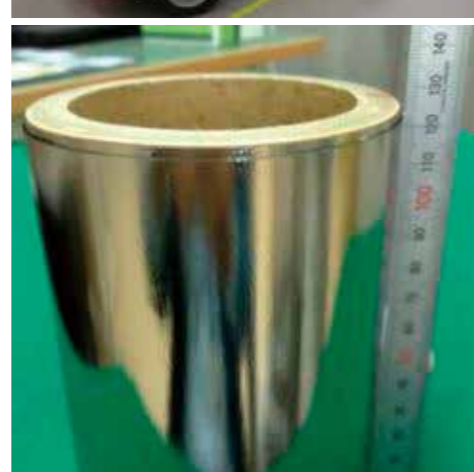
Professor at Tohoku University School of Medicine since 2007 after steps as Lecturer at the University Hospital. Deputy Director of the University Hospital and Director of the Comprehensive Education Center for Community Medicine since 2012. Specialization in Hematology and Immunology.

Tohoku University Reconstruction Action 2011-2021



Tohoku University Priority Projects

- 038 Project 01. International Research Project on Disaster Science
- 052 Project 02. Project for the Reconstruction of Community Health Care
- 074 Project 03. Project for Environmental Energy
- 084 Project 04. ICT Reconstruction Project
- 096 Project 05. Tohoku Marine Science Project
- 106 Project 06. Nuclear Decommissioning and Environmental Restoration Project
- 128 Project 07. Regional Industries Restoration Support Project
- 144 Project 08. Industry-Academia Collaboration Development Project for Reconstruction



Project 01

International Research Project on Disaster Science

Tohoku University was involved in Disaster Risk Reduction Research prior to the Great East Japan Earthquake of March 11, 2011. Although an earthquake off the coast of Miyagi was predicted and some measures were already implemented, the actual magnitude of the 3.11 earthquake and great tsunamis were far beyond anything expected, amplified by an accident at Fukushima Daiichi Nuclear Power Plant. The Great East Japan Earthquake and Tsunami revealed weaknesses and limits of traditional science and technology systems. Based on disaster lessons, the International Research Institute of Disaster Science (IRIDeS) was established in April 2012, as interdisciplinary research organization working for renewal of disaster and emergency response policies in order to prepare for the next new mega disaster.

Natural disaster research promoted by IRIDeS considers the disaster cycle: Mitigation, Preparedness, Response, and Recovery. IRIDeS pursues disaster science that explores events within each stage of the above cycle and integrates lessons and findings across the cycle. The mission of IRIDeS is to: apply knowledge derived from research on the 2011 Great East Japan Earthquake and tsunami disaster and its recovery and research findings on disasters worldwide to society; construct studies to build social systems in which humans and society can respond wisely to changing disasters, overcoming hardships and applying lessons learned; and systemize these studies as practical disaster research and build their academic value.

IRIDeS promotes interdisciplinary research across fields to advance disaster science, collaborating with other research institutions, companies and disaster-affected areas. Our achievements to date include deeper understandings of the impact and mechanism of the mega earthquake and tsunami, development of disaster medical care, formation of disaster digital archives, provision of disaster risk reduction education and contributions to global disaster risk reduction policies.



Project Leader
International Research Institute of Disaster Science
Director Fumihiko Imamura

The International Research Institute of Disaster Science was established one year after the Great East Japan Earthquake. In order to find solutions for the problems, Tohoku University researchers in the areas of science, medicine and humanities gathered to create a world-leading organization in disaster science. Since then, we have promoted collaborative research based on the disaster cycle and have not only supported recovery but also contributed to other disaster responses. We have also supported the Third UN World Conference on Disaster Risk Reduction and the World Bosai Forum. Now, ten years after the earthquake, disaster memories and lessons started to fade. We also work with various stakeholders to pass on disaster experiences.

Project Activities

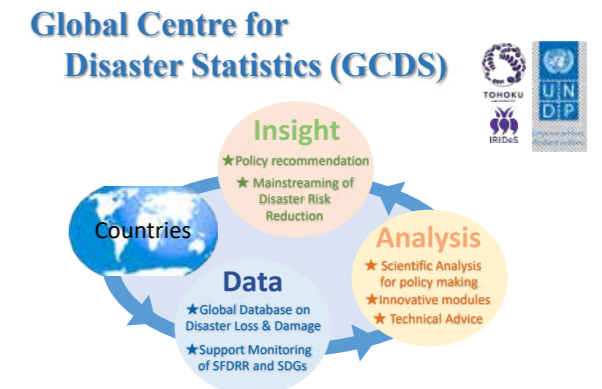
International Research Project on Disaster Science

- 2011 9 Started the archive project of the Great East Japan Earthquake, "Michinoku Shinrokuden".
- 2012 3 Story-tellers' symposium "Kataritsugi" (passing on) (annual event thereafter)
- 3 Debrief meeting 1 year after the Great East Japan Earthquake
- 4 Establishment of the International Research Institute of Disaster Science (IRIDeS, Prof. Hirakawa as its first Director)
- 6- Started IRIDeS Friday Forum (Regular event).
- 7 World Ministerial Conference on Disaster Reduction in Tohoku
- 9 8th Association of Pacific Rim Universities (APRU) Natural disaster Research Symposium
- 2013 1 The Great East Japan Earthquake Archive Symposium (annual event thereafter)
- 2- Comprehensive partnership agreements with eleven municipalities e.g. Tagajo
- 3 2nd Annual Symposium on the Great East Japan Earthquake
- 3 Community activity project "Power to Live with Disasters"
- 3 Publication of "Disaster Risk Reduction Pocket Notebook for Families"
- 6 Publication of research outcomes "Analyzing the Great East Japan Earthquake"
- 2014 3 3rd Annual Symposium on the Great East Japan Earthquake
- 4 Started New IRIDeS administration (Prof. Imamura as its second Director).
- 9 Opening of IRIDeS building at the Aobayama New Campus
- 2015 3 The Third UN World Conference on Disaster Risk Reduction
- 4 Establishment of the Global Centre for Disaster Statistics
- 11 World's first success in measuring the speed of tectonic plate movement of the pacific plate in the Japan Trench after the Great East Japan Earthquake
- 2016 3 5th Annual Symposium of the Great East Japan Earthquake
- 4- Collaboration and support of emergency investigations and recovery after the Kumamoto earthquakes
- 2017 3 6th Annual Symposium of the Great East Japan Earthquake
- 11 1st "World Bosai Forum / International Disaster Risk Reduction Conference 2017 in Sendai"
- 2018 3 7th Annual Symposium of the Great East Japan Earthquake
- 2018 Field Survey and debrief meetings on the Hualien Earthquake in Taiwan, the Northern Osaka Prefecture Earthquake, Western Japan Heavy Rain Disaster, the Hokkaido Iburi Earthquake and the Sulawesi Earthquake and Tsunami, Indonesia
- 2019 3 8th Annual Symposium of the Great East Japan Earthquake
- Field Survey and debrief meetings on the Kumamoto Earthquake, the Yamagata Earthquake, the damages by Typhoon Hagibis
- 11 2nd "World Bosai Forum / International Disaster Risk Reduction Conference 2019 in Sendai"
- AIWEST-DR2019 in Sendai
- 2020 4- Started new research projects to help communities in times of the COVID-19 crisis, applying the lessons from the Great East Japan Earthquake.
- 5- IRIDeS Friday Forum became online (Regular event).
- 8 Field Survey and debrief meetings on the heavy rain disaster in July (online)
- 11 Final report on Typhoon Hagibis in cooperation with the Tohoku Academic Joint Research Team (online)
- 2021 3 Publication of "51 Approaches to Disaster Science: Lessons from the 2011 Great East Japan Earthquake"
- 10th Annual Symposium on the Great East Japan Earthquake



Activities of the Global Centre for Disaster Statistics

As contribution to the Sendai Framework for Disaster Risk Reduction adopted at the 3rd UN World Conference on Disaster Risk Reduction, Tohoku University in collaboration with the United Nations Development Programme (UNDP) established the Global Centre for Disaster Statistics (GCDS) in April 2015. The centre assembles disaster loss and damage data from all over the world and analyze it to help generate disaster risk reduction policy. The activities of the centre are recognized by the United Nations Office for Disaster Risk Reduction (UNDRR) as a Sendai Framework Voluntary Commitment (SFVC).



Contributions to the 3rd UN World Conference on Disaster Risk Reduction and the World Bosai Forum

Tohoku University and the International Research Institute of Disaster Science played a key role in the organization of the 3rd UN World Conference on Disaster Risk Reduction held in March 2015. We fully supported the invitation of the conference to Sendai and participated in many of the public forums which were organized simultaneously to the main conference. Furthermore, we provided inputs to the negotiation process to develop the Sendai Framework for Disaster Risk Reduction 2015-2030 which contains seven global targets as well as four priority areas for action. During the conference, we had the opportunity as the only large-scale university experiencing the Great East Japan Earthquake and Tsunami to share our findings and lessons with the international community which are reflected in the concept of Build Back Better in the Sendai Framework. Additionally, the university president announced the concept of the World Bosai Forum as well as the establishment of the Global Centre for Disaster Statistics during the conference.

The World Bosai Forum is an international conference with participation of the general public in association with the International Disaster Risk Conference in Davos, Switzerland. Based on the results of the 3rd UN World Conference on Disaster Risk Reduction, we created a venue to share practical solutions for disaster risk reduction in public-private collaboration with the international community in order to advance the implementation of the Sendai Framework for Disaster Risk Reduction. We also archive and communicate the experiences and findings related to disaster risk reduction after the Great East Japan Earthquake and Tsunami. The International Research Institute of Disaster Science fully supported the World Bosai Forum and played a major role in the organization.

The First World Bosai Forum attracted 947 participants from 42 countries and regions, with a total number of more than 10,000, including general public. The Second World Bosai Forum in 2019 attracted 871 participants from 38 countries and regions, and likewise with more than 8,000 general public in total. IRIDeS Director, Prof. Imamura served as a local organizing chairperson, and Prof. Ono, Founder of the World Bosai Forum Foundation conducted overall coordination.



3rd UN World Conference on Disaster Risk Reduction



Opening of the First World Bosai Forum



Closing of the First World Bosai Forum



The Second World Bosai Forum Reduction



The Second World Bosai Forum Reduction

Field Survey

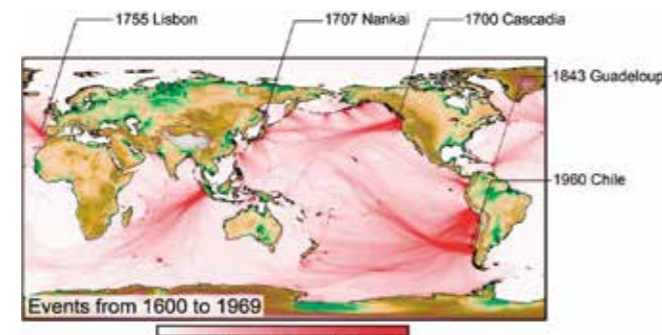
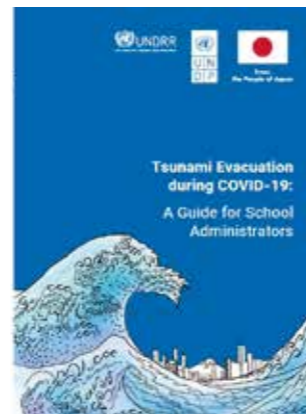
After a disaster, it is necessary to investigate what happened (is happening) on site and take detailed records for further actions. At the International Research Institute of Disaster Science, we conducted field surveys and provided the results to the communities, progressing the interdisciplinary aspect of disaster science. So far we have carried out the field surveys to record damage caused by the heavy rain in Akita and Iwate (2013), the typhoon Haiyan in the Philippines (2013), the heavy rain in Yamagata (2014), the Nagano Earthquake (2014), the Nepal Earthquake (2015), the heavy rain of Kanto and Tohoku (2015), the Kumamoto Earthquake (2016), the Fukushima Earthquake and Tsunami (2016), the heavy rain in Northern Kyushu (2017), the Hualien Earthquake in Taiwan (2017), the Osaka Earthquake (2018), the 2018 heavy rain in western Japan (2018), the Hokkaido Eastern Iburu Earthquake (2018), the Sulawesi Earthquake and Tsunami (2018), the Yamagata Earthquake (2019), and the East Japan Typhoon in 2019. Each time we analyzed damage and provided our findings to the communities by publishing reports as well as making important information available on our homepage. We also presented the results of more detailed analyses in academic publications to share necessary information and contribute to the development of disaster science.



On site investigation after the East Japan Typhoon (2019)

Global Activities Commemorating the "World Tsunami Awareness Day"

The UN General Assembly designated November 5 as World Tsunami Awareness Day in December 2015. The International Research Institute of Disaster Science started global awareness activities in 2016 commemorating the first "World Tsunami Awareness Day", collaborating with people from Hawaii, Indonesia, Thailand and Philippines. To analyze and visualize the impact of earthquakes and tsunamis of the past 400 years, we continue to communicate important findings to the media. In 2020 we cooperated with the United Nations Office for Disaster Risk Reduction as well as the United Nations Development Programme and established tsunami evacuation guidelines in times of the COVID-19 pandemic.



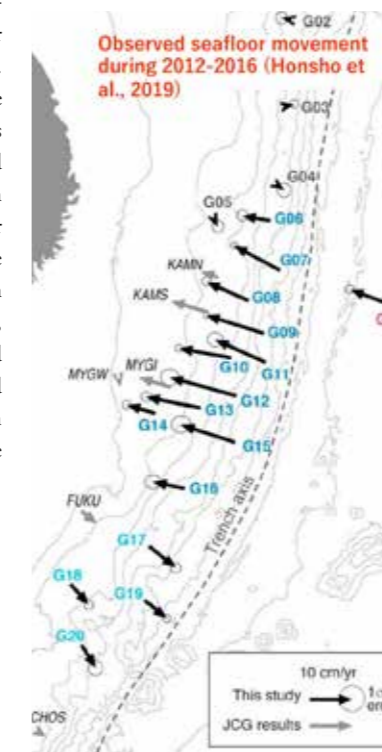
Publishing actions and findings of the Great East Japan Earthquake

Researchers of Tohoku University entered disaster-affected areas immediately after the earthquake to explore the earthquake and tsunami mechanisms, assess the damages, provide medical cares and support local affected communities as much as possible. Based on those experiences and findings, IRIDeS has published two books: "Analyzing the Great East Japan Earthquake" (two volumes, Akashi Publishing) in June 2013, and "51 Approaches to Disaster Science: Lessons from the 2011 Great East Japan Earthquake" (Tohoku University Press), in March 2021,

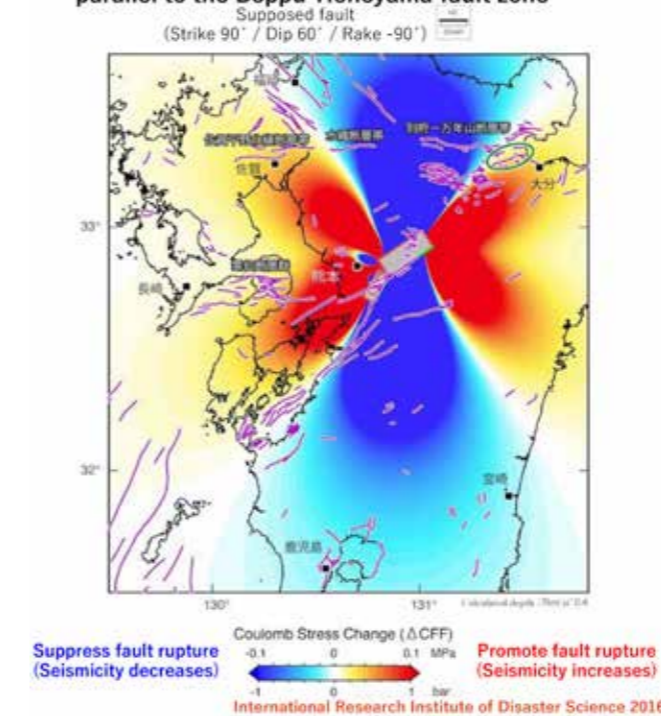


Seafloor Observations and Geological Surveys Revealing the Mechanism of Subduction and Inland Earthquakes

In the event of the 2011 Tohoku Earthquake, we observed the seafloor movement associated with the mega earthquake for the first time in the world. Continuous observations in the following years showed complex long-term movements after the earthquake as well. We shared these valuable observation results with other national and international research institutes, searching for ways to assess possible mega disasters in advance. Furthermore, we also modeled inland earthquakes based on field surveys and their relation to the changes in the stress field.

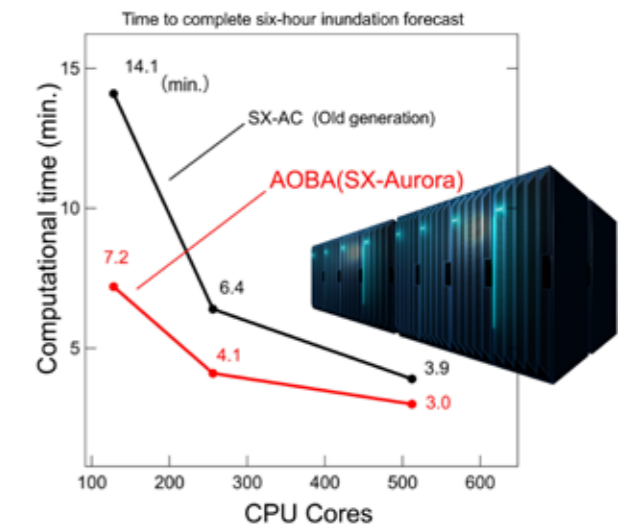


Coulomb failure stress changes on normal faults parallel to the Beppu-Heneyama fault zone



New "Real-time tsunami inundation forecast technology"

Fusing real-time computer simulations with sensing technology, our team is developing a disaster big data platform for national and community resilience. The real-time tsunami inundation and damage forecast system was launched in cooperation with the Cyberscience Center and the Graduate School of Science and started operations in 2018 as a function of the emergency response of Cabinet Office of Japan. A newly-founded university-born tech-startup RTi-cast is taking a role of offering and operating real-time tsunami inundation to government organizations, including emergency operations center, and commercial clients. In April 2018, we received the MEXT Science and Technology Award and in March 2019 the MIC Award at the First Japan Open Innovation Awards.



Mapping products of tsunami inundation forecast



Inundation forecast simulations with the supercomputer AOBA.

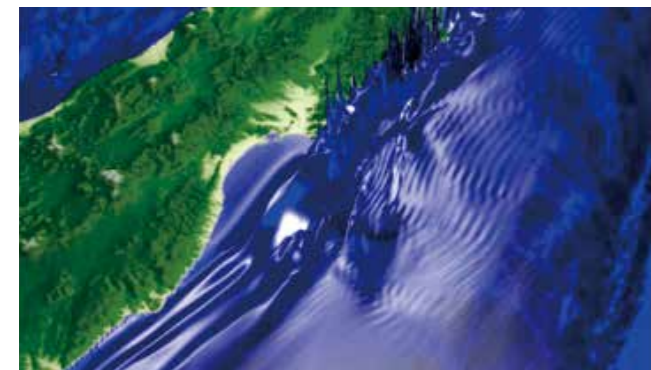
Elucidation of the 1611 Oshu Earthquake in Collaboration of Social and Natural Sciences

Social science and natural science researchers from different fields aspired to clarify the truth of the 1611 Oshu Earthquake in interdisciplinary collaboration. (Oshu is an old name for the eastern part of the Tohoku region.)

Interdisciplinary research analyzing historical documents and tsunami debris, and calculating simulations led to a comprehensive understanding of the earthquake 400 years ago, displaying a similar scale of the earthquake and subsequent destruction by a tsunami.



Historical document "Records of the Sunpu Government".



Simulation of the tsunami propagation.

Analyzing the "Power to Live with Disasters" utilizing Neuroscience

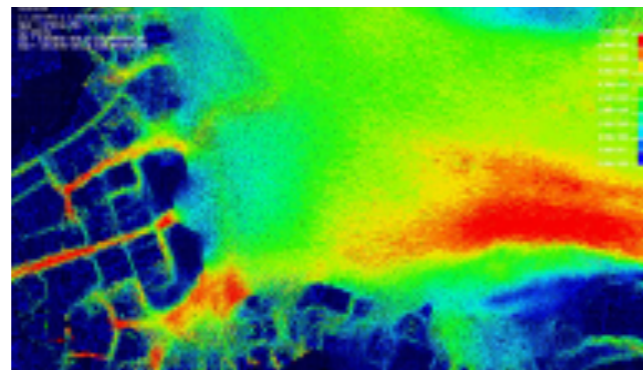
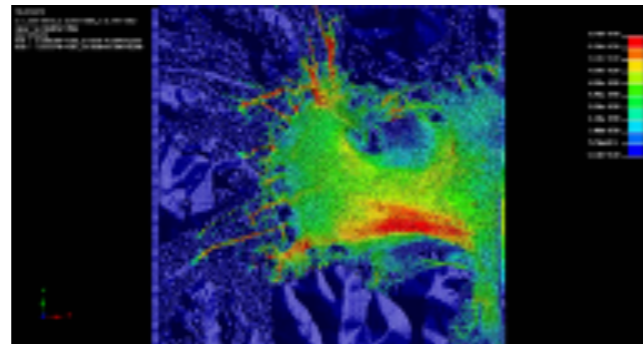
Asking 1412 survivors of the Great East Japan Earthquake and analyzing the survey, we concluded that individual character, chain of thought, or habits are essential to endure a catastrophe and summarized the results as eight "powers to live" (e.g. "leadership", "problem solving"). Each factor was considered relevant to overcome threats and difficulties at times of disasters and we also analyzed the neurological mechanisms behind them.



Development of a 3D Simulator Reproducing the Run-Up of the Tsunami

The International Research Institute of Disaster Science developed a three dimensional tsunami simulator in collaboration with Fujitsu Ltd. capable to reproduce the flooding process of the tsunami in urban areas and running upstream in detail. The damage by tsunamis can be estimated via simulation of the complex flow after the earthquake and the wave breaking along the coastline as well as the behavior of the overflow upstream.

This research combines the two dimensional simulation technology utilized for the calculation of the wide spread arrival times of a tsunami from the origin to the coastline developed by the institute with the three dimensional fluid simulation technology by Fujitsu and accurately displays how the tsunami floods the coast and complex urban areas, running upstream.



3D simulations of a tsunami.

Development of ICT Tools to Archive Disasters

An unprecedentedly large amount of data and materials on the 2011 disaster have been left as big data, including observation data, references and video images. To visualize and utilize this resource for future disaster risk reduction, necessary ICT tools have been developed and are now available to the public.

The site "How 3.11 Tsunami Inundation could be seen by human eyes" shows tsunami trace height of the Great East Japan Earthquake online. Switching between a bird's-eye view and a worm's-eye view of the event, one can realize actual tsunami heights and feel the fear of the catastrophe.

"Database to learn lessons from 3.11" introduces disaster lessons derived from academic surveys and studies in plain terms. Lessons are delivered every month, in conjunction with Twitter.

One can search disaster-related videos on the map through "Looking back 3.11 in Video." On the site, 3.11-related video images on the internet were gathered. Where those videos were taken have been specified and their locations are plotted on the map.

Other web sites have been created, including "Changing landscape of Michinoku towards recovery" which shows photos taken by a fixed point observation method, and "Database of lessons learned from the Great East Japan Earthquake" which is a search engine of disaster lessons found in academic papers and reports."



Integrated multi-dimensional visualization system for disaster science information

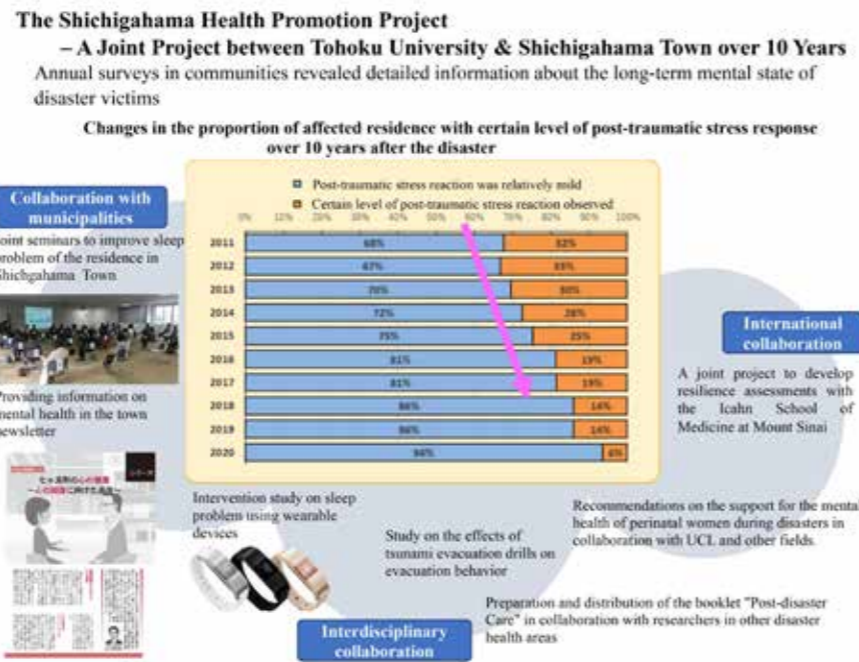
A variety of research outcomes produced from all the divisions in IRIDeS are integrated and visualized at multiple levels. The system

serves as a visualization platform that enables us to establish a new and practical framework for realizable disaster prevention and mitigation systems to encourage resilient societies.



Research into Disaster Related Stress to Develop Psychological Health Care Measures for Mitigation

By conducting surveys in disaster affected communities, we clarified the impact of disaster stress caused by the Great East Japan Earthquake on the mental health of disaster victims and identified factors that promote or impair recovery of mental health. We are also developing technology for evacuation drills using virtual reality and bio-sensing technology, and verifying the effects of disasters on sleep using wearable devices.



Passing on Disaster Memories

Analyzing the memory and the heritage of the experience to future generations from a folkloristic point of view is one important task for us. In the Sanzengouchi area of Ohta, Nagasaki, there exists the tradition of "Nenbutsu Ko Manju" (Buddhist Prayer Buns), retaining the memory of the landslide disaster 1860, and in Taishobashi, Osaka, the "Jizo Bon" keeps the memory of the 1854 earthquake and tsunami. Commemorating the dead taken by disasters on a regular basis is also a way to pass the disaster experiences and lessons to future generations.



Medical Care Support as Member of Tohoku University Hospital's Disaster Medical Assistance Team (DMAT)

To save as many lives as possible, Assoc. Prof. Hiroyuki Sasaki from the International Research Institute of Disaster Science (IRIDeS) has been registered as a member of the "Disaster Medical Assistance Team (DMAT)" since January 2016. In the event of the 2016 Kumamoto earthquakes, he was a member of Tohoku University Hospital's DMAT, one of the DMATs from the Tohoku area, and participated in medical support activities at South Aso, Kumamoto during April 17-19. He directed a mission to transport the sick from the Nursing House. Asst. Prof. Yohei Inaba of the IRIDeS is also registered as a DMAT member since December 2018.



Tohoku DMATs members discussing the disaster situation and the next day's mission

Rescuing Historical Documents Affected by the Great East Japan Earthquake

There are numerous historical documents left in local communities in Japan. Since 2003, we have worked with local municipalities and citizens mainly in Miyagi and Iwate to preserve those precious materials that show regional histories. Thanks to our cooperative relationship already built, approx. 60,000 historical documents were rescued after the Great East Japan Earthquake. Our activities include supporting recovery of the disaster-affected areas and rescuing historical records affected by the 2019 Typhoon Hagibis. We have addressed importance of preserving local identities based on the Sendai Framework for Disaster Risk Reduction in occasions such as UNESCO's Memory of the World Programme in December 2018 and other forums and seminars both in Japan and overseas.



UNESCO's Memory of the World Programme in December 2018



Rescuing of historical documents from a storehouse damaged by the 2011 disaster.

Collecting, Classifying, and Communicating Disaster Records – "The Michinoku Shinrokuden" Archive

Collaborating with private and public institutions, we collect all possible records, examples, and experiences of the Great East Japan Earthquake in the "Michinoku Shinrokuden" archive in order to share them with local and global communities and preserve the important information for the future. Since 2017, in addition to records from the Great East Japan Earthquake, we also provide records from the 2016 Kumamoto Earthquake, the 2018 Hokkaido Iburi Earthquake as well as the 2019 Typhoon Hagibis (known in Japan as the Reiwa 1 East Japan Typhoon). Based on these records, we advance research for measures and policies regarding low frequent mega disasters and utilize our achievements to prepare for the impending simultaneous occurrence of the Tokai, Tonankai, and Nankai Earthquakes. Technology and methods for digital archives are also distributed to other archiving organizations.

Currently the records, including items from natural hazards disasters such as the Great East Japan Earthquake, register more than 1 million entries, ca. 120,000 of which are publicly accessible. A small excerpt can also be found online (<http://shinrokuden.irides.tohoku.ac.jp/>).

The goal of Michinoku Shinrokuden is the preservation and communication of lessons from the Great East Japan Earthquake to the public. As such, in March every year we also organize an annual symposium called "Kataritsugi (Passing on)" with actress Keiko Takeshita to raise disaster risk awareness.



Tsunami Evacuation Project on World Tsunami Awareness Day

Through tsunami evacuation project conducted on World Tsunami Awareness Day, we encourage citizens to have their own evacuation program according to their local circumstances, combining methods such as evacuation by car, usage of electric cars and drones, and COVID-19 preventive measures. Repeating such tsunami evacuation exercises will contribute to problem solving of local communities, fostering “a culture of evacuation.” We have supported evacuation projects in areas including Iwanuma and Yamamoto in Miyagi, Iwaki in Fukushima, Rikuzentakata in Iwate, and Phuket in Thailand.



Evacuation training in a time of COVID (2020)



Training to search for survivors with drones (2019)



Evacuation training by car (2017)

APRU-IRIDeS Multi Hazard Program

The Multi-Hazards Program was established in 2013 in collaboration with Tohoku University and the Association of Pacific Rim Universities (APRU). APRU is a network of 60 universities from 19 economies around the Pacific Rim. IRIDeS provides its secretariat services as the regional program hub. Through various events such as the summer school and the symposium organized every year as well as an international journal (Progress in Disaster Science), the Program globally shares the lessons learned from Great East Japan Earthquake and Tsunami and the findings of cutting-edge disaster science researches. Furthermore, it contributes to international and regional discussions and policy making processes with various partners.



Tohoku University Disaster Mitigation Education - the “YUI” Project

As university located in a disaster stricken region, we collaborate with the Prefectural Boards of Education to organize “Onsite Disaster Mitigation Awareness Lectures” for ca. 17,000 children in 276 elementary schools in areas of e.g. Miyagi, Fukushima, Iwate and the Nankai Trough Areas as well as global lectures in foreign regions affected by disasters. We give out “Disaster Mitigation Handkerchiefs” in onsite lectures to all children participating in the event full of useful information at times of disasters. These handkerchiefs also functions as communication tools, protecting families from disasters.

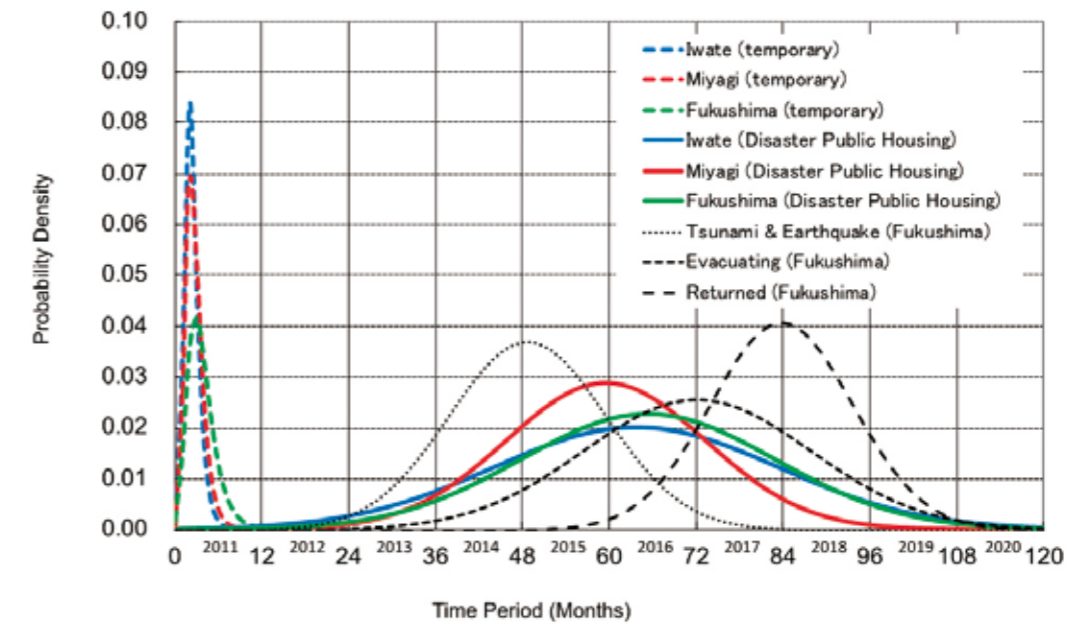


Onsite lectures at elementary schools.

Monitoring and quantitative evaluation of urban recovery processes

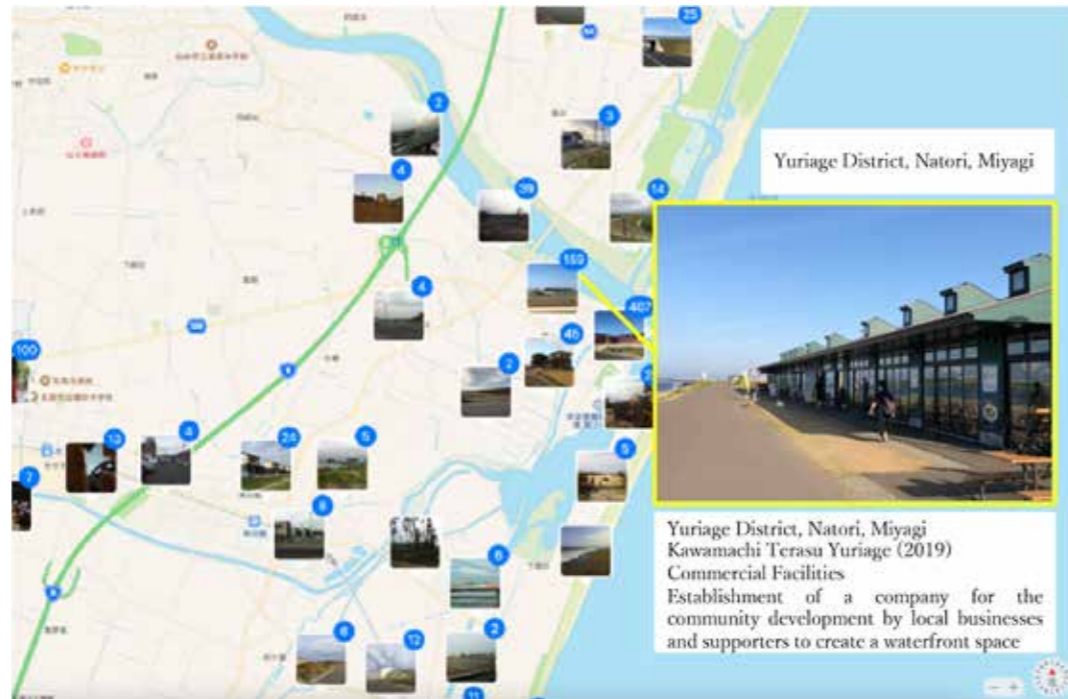
When assessing the damage of the 2011 Great East Japan Earthquake, understanding of formative process in the city (village) is necessary. Therefore, we have been monitoring and collecting information on the changes in residential location before the earthquake, the extent of damages, the development process of reconstruction plans and the state of reconstruction. As part of these efforts, for the purpose of quantitative

evaluation of post-disaster recovery process, we developed a method to create recovery curves by using data on the construction of temporary housing and disaster recovery public housing in the affected areas. In that way, we quantified the recovery process of Iwate, Miyagi, and Fukushima prefectures. These recovery curves enable us to know how long it had been since the disaster to provide many houses as well as the intensive degree of the construction. By standardized indicator like this, we can compare the post-disaster recovery processes in different times and regions affected by disasters. Moreover, we are able to discuss relation to the measures.



Constructing a post-disaster urban recovery database of the 2011 Great East Japan Earthquake

After the earthquake disaster, the affected communities worked on the recovery under the Build Back Better. We constructed the post-disaster urban recovery database of the 2011 Great East Japan Earthquake to archive the various efforts and to disseminate them to the world. The database will be completed in spring 2021.

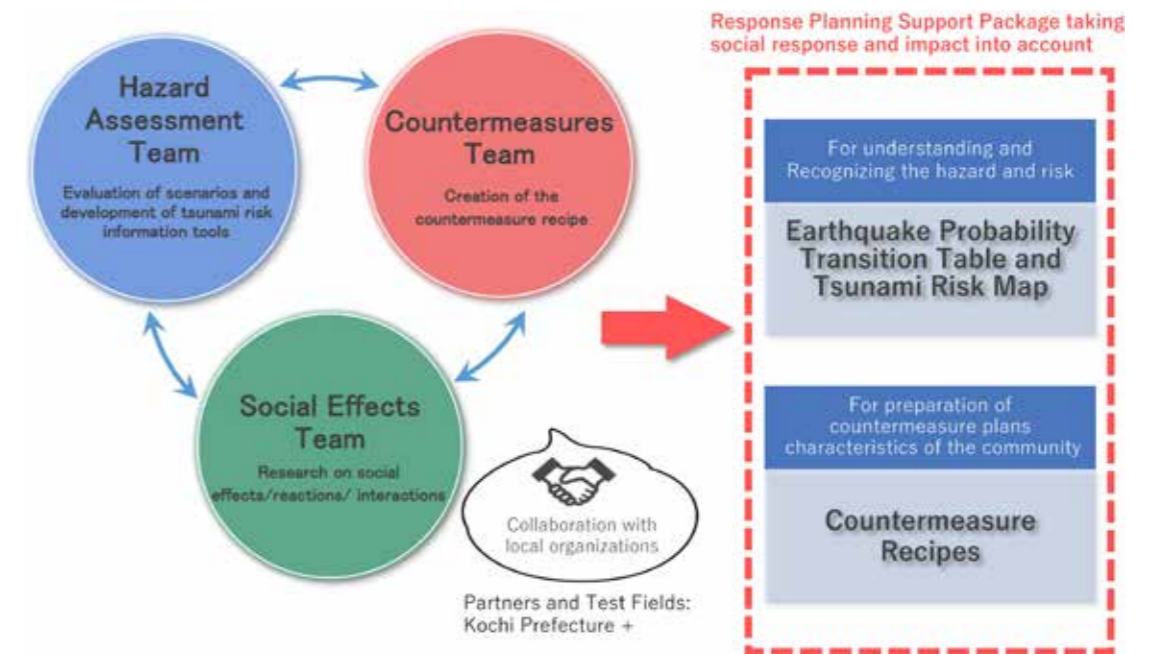


Interdisciplinary Project on Utilizing Information about the Nankai Trough Earthquake for Disaster Risk Reduction

The Japan Meteorological Agency announces warning information when the chance of having a Nankai Trough Earthquake becomes higher than normal. We collaborate and communicate with key organizations in local communities and companies to provide support for disaster mitigation. With the support from the SECOM Science and

Technology Foundation, researchers from science, engineering, sociology and medicine are working on "Hazard Assessment", "Countermeasures" and "Social Effects", in cooperation with the partners in Kochi Prefecture. We communicate our findings with the partner organizations and local communities, reflect their opinions, and deliver useful tools and knowledge for effective countermeasures. This interdisciplinary project is a model for "Practical Disaster Risk Reduction Science", the concept born from the lessons from 3.11.

Research Promotion and Output



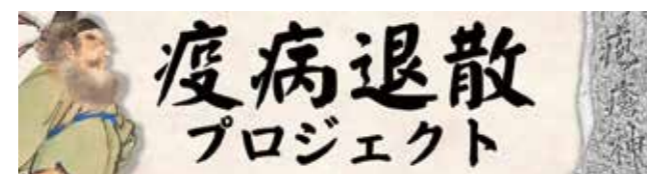
"Disaster Risk Reduction x Treasure Hunting Game"

We have cooperated "Disaster Risk Reduction x Treasure Hunting Game" held by the Katahira community development association. This event is both for children and adults, and also both for Japanese and non-Japanese residents, who would like to walk around the Katahira community of Sendai, learning about local disaster risk as well as its history and geography in the manner of a treasure hunting game. Having learned from 3.11 lessons, this event is regularly held as one of the community building activities of Katahira, bringing up the next generation of the community.



COVID Research Projects

The COVID-19 has seriously affected global communities. Seeing the pandemic as a disaster, 10 research projects started, learning lessons from the Great East Japan Earthquake and aiming at construction of the post-corona better world. Those topics include "Historical Changes in Socio-Cultural Perspectives on Infectious Diseases (Repel Epidemic Project)", "Improvement of Business Continuity Plans (BCPs) for Companies and Organizations Responding to New Coronavirus Infections", "Visualization and Reduction of COVID-19 Transmission Risks during Flooding in a Time of the Pandemic" and "The Power to Live through society with COVID-19", all of which are characterized by their interdisciplinary nature. Furthermore, in November 2020, an academic paper was published to show behavioral regulations as measures against COVID-19 led to motivation loss and anxiety among researchers.



Promoting the Formulation of Business Continuity Plans with the Knowledge from 3.11

By the Great East Japan Earthquake and Tsunami, many companies had serious direct damage, and in addition, indirect damage spread to not only nationwide but on a global scale by way of their transactions. Local authorities also had damage to their main government buildings and it caused the delay of their rescue operations. The International Research Institute of Disaster Science (IRIDeS) of Tohoku University conducted surveys and hearings with disaster affected corporations and researched on rescue actions of the local authorities, extracted points for early recovery, and have supported to formulate and operate Business Continuity Plans to overcome the damage of major disasters. The "BCP Induction Guide for Small and Medium Businesses" (122 pages) is currently available on the web page of a researcher of IRIDeS, and he organized six consecutive open lectures of BCP in 2019. Furthermore, IRIDeS supported organizations all over Japan with their Business Continuity Plans, including in Kumamoto, which suffered from the damages of the 2016 earthquake, and in Kochi, which would be highly affected in case of a Nankai Trough Earthquake occurs.



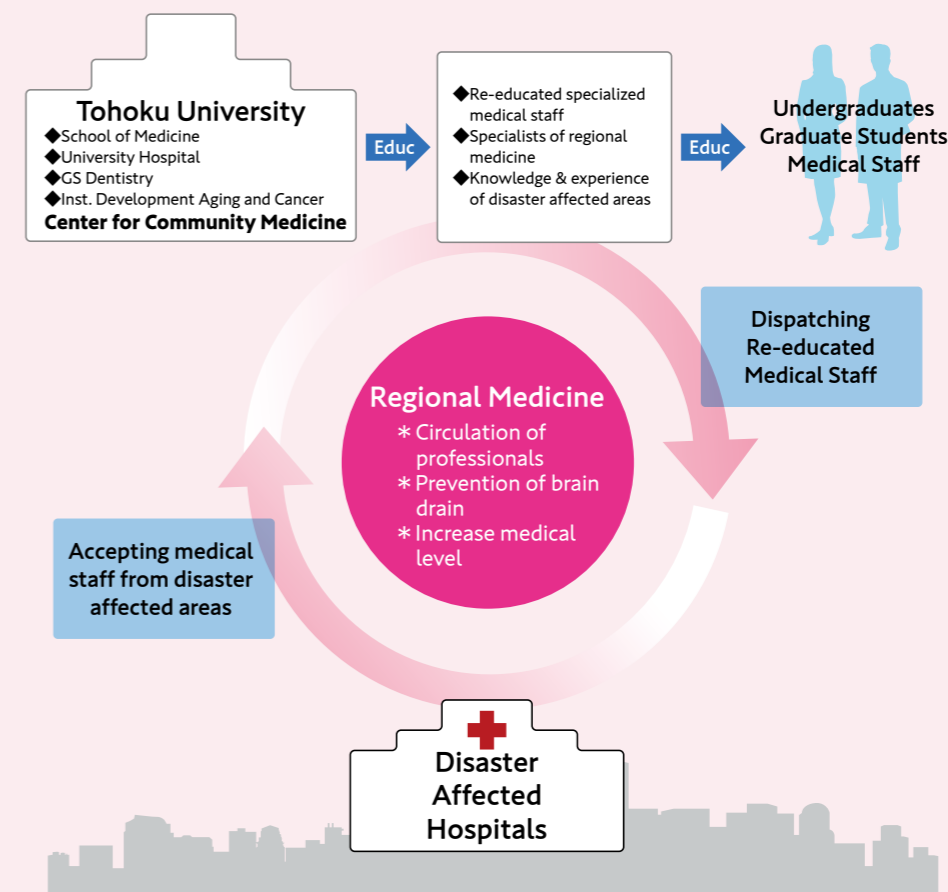
Project 02

Project for the Reconstruction of Community Health Care

Comprehensive Education Center for Community Medicine

At the Comprehensive Education Center for Community Medicine, we welcome medical professionals affected by the Great East Japan Earthquake, provide continuous training via cutting edge medical simulation at the Clinical Skills Laboratory, and established an education and delegation system in which these professionals return to their original community health care institution with an increased set of skills, thus supporting the local communities and the affiliated health care. Furthermore, we invite medical professionals as lecturers who experienced the catastrophe on site and were involved in the practical application of disaster medical care and construct a system, where the knowledge and experience of practical disaster medical care is passed on to the next generation, as well as scientific findings of cutting edge medical care is provided to said professionals so they are able to utilize the newest technology in the disaster stricken areas. This system supports the regeneration of medical care in local communities as well as the education of human resources who might be involved in disaster medical care and community health care in the future. Although already ten years have passed after the catastrophe, we cannot say that medical treatment has sufficiently recovered in disaster stricken areas. The COVID-19 pandemic also makes traditional learning and training difficult. The center took every possible precaution against infections and we will continue to support medical staff in the entire region and try to stop the loss of important personnel from disaster stricken areas.

Support Project by the Comprehensive Education Center for Community Medicine



Project Leader
Comprehensive Education Center
for Community Medicine
Director Hideo Harigae

The Comprehensive Education Center for Community Medicine was established after the Great East Japan Earthquake with the objective to restore and support community health care. The Skills Lab, which introduced state-of-the-art simulators to train medical personnel, is at the center of our actions to support regional health care. We also organize lectures where medical staff share their memories from 3.11 and their experience in disaster stricken communities, giving the next generation of medical experts the opportunity to obtain an important understanding of the situation in the field.

Many hospitals in the disaster region have recovered since 3.11, but there is still a shortage of important personnel and we have to continue our efforts to support regional communities as best as possible.

Project Activities

Project for the Reconstruction of Community Health Care
Comprehensive Education Center for Community Medicine

- 2012 1 Establishment of the Comprehensive Education Center for Community Medicine
- 3 Hands-on training of medical care in disaster stricken communities
- 6 Memorial Lectures for the opening of the "Comprehensive Education Center for Community Medicine" and the "Tohoku University Clinical Skills Laboratory"
- 7 "Disaster Dentistry" Lectures at the Faculty of Dentistry
- 7 Begin emergency airway management training
- 8 Begin acute heart failure simulations
- 9 Begin emergency response simulations
- 10 "Oral Health Care Consultations" at the Hibiki industrial park in East Matsushima
- 10 Special Lecture "The Role of Dentistry and Oral Health Care at Times of Disasters"
- 10 Begin surgery training on animals
- 2013 1 Eating and swallowing rehabilitation workshops
- 4 Begin simulations of percutaneous cardiopulmonary support devices (PCPS)
- 4 Begin simulation training course "SimMarathon"
- 10 Begin pathology workshop utilizing virtual slide systems
- 10 "Seminar for Kampo medicine useful for everyday treatment"
- 2014 2 Disaster dentistry symposium in cooperation with the West China School of Stomatology Sichuan University and on-site visit of disaster stricken areas of the Sichuan earthquake
- 2015 2 Lecture "Learning nursing basics for understanding patients with dementia"
- 3 Lecture "Basics of simulation education for nurses"
- 6 Special project "Learning chest compression and AED" at the Clinical Skills Laboratory
- 10 Lecture "Support of severely disabled people in need of medical care"
- 12 "On-site seminar for emergency response to children with food allergies"
- 2016 11 Public project "To save babies' lives - Understanding and preventing the sudden infant death syndrome"
- 2017 5 Heart auscultation training for non-cardiology doctors utilizing simulations
- 6 Hands-on seminar for peripherally inserted central catheter
- 7 Medical healthcare experience for middle-school students of the Miyagi area at the school of medicine
- 8 "A backyard tour - Medical Care in Action" at the Tohoku University Hospital
- 10 Oral health seminar
- 11 Lectures for nurses working in correctional facilities of the Tohoku region
- 2018 1-2 Lecture "Simulation for emergency responses in case of allergic reactions" for paramedics, teachers and nurses
- 3 "POT & FTP" seminar utilizing simulations for paramedics
- 6 Lectures for nurses working in correctional facilities of the Tohoku region
- 6 On-site Seminar for doctors in Kesenuma and "POT" training course for members of the Sendai Fire Department
- 8 Medical healthcare experience for middle-school students of the Miyagi area at the school of medicine
- 8-9 Simulation training course for nurse practitioners
- 10 "Simulation User Network" to utilize simulation technology in medical education in the Tohoku region
- 2019 1-2 Lecture "Simulation for emergency responses in case of allergic reactions" for paramedics, teachers and nurses.
- 8-9 "Workshop on Disaster Readiness Support for Home Ventilator Wearers" co-hosted by the Sendai City Support Center for Persons with Disabilities
- 2020 1 Workshop on PROST, a new educational system for ambulance-crew, held at the 28th National Ambulance-Crew Symposium
- 2 Response to the COVID-19 pandemic: Infection control activities in cooperation with local communities and the government
- 3 Response to the COVID-19 pandemic: Starting treatment of COVID-19 patients
- 4 Response to the COVID-19 pandemic: Providing ECMO training workshops



COVID-19 Response at the Tohoku University Hospital

On March 26, 2020, Tohoku University Hospital started treatment of the first COVID-19 patient. Until the end of November, we treated more than 30 cases of COVID-19, including 5 severe cases requiring ventilator treatment. We also collaborated with the Infection Management Office to assure safe operations and there have been no cases of infections among staff members. Due to the increased numbers of COVID-19 patients, during April 22 to June 8 and after November 23, 2020, we established a special section for COVID-19 treatment on the 15th floor of the east hospital building, providing treatment from both the Department of Respiratory Medicine and the Department for Comprehensive Infectious Diseases (Related news: <https://www3.nhk.or.jp/news/html/20201113/k10012710921000.html>)

Furthermore, we regulated entry to the hospital, organized temperature checks as well as medical questionnaires and established a PCR testing system for suspected COVID-19 patients, emergency hospitalizations and patients scheduled for general anesthesia surgery. Staff members are instructed to wear protective clothing when treating patients and follow a rigid protocol to protect themselves.

Measures against COVID-19

COVID-19 Response at the Tohoku University Hospital

<Measures to Prevent Carry-In>

- Restricting Entrances to 2 Places (Front & North)
- Time Restrictions (8:00-19:30)
- No visitors (only those whom the hospital asks to visit)
- No going out and staying overnight (unless special reasons apply)

<Measures for Early Detection>

- Outpatient Triage (collect information on contact history and behavioral history)
- Medical Questionnaire (1. Outpatients 2. Admissions)
- <Suspected Patients> X Ray and CT Scans
- Establishment of PCR Testing System within the Hospital

Measures for Early Detection

Entrance Poster



Special Entrance for Suspected Patients



Infection Control Actions in Collaboration with Local Municipalities and the Government

Cooperating with the municipalities of Miyagi and Sendai City, we provide infection control seminars for staff of elderly and disabled welfare facilities, kindergartens, schools, restaurants, lodging facilities and others. We also visit facilities when there is an outbreak of COVID-19 to help prevent further spread of infections. Additionally, collaborating with Sendai City and Tohoku Medical and Pharmaceutical University, we prepared the Sendai Handbook on the Prevention of the Spread of Infections for community members, and have participated in the activities of a research group of the Ministry of Health, Labor and Welfare to prepare a guide for COVID-19 treatment for medical personnel.



Guidebook for Preventing the Spread of Infections



Sendai Handbook on the Prevention of the Spread of Infections for community members

Surgery Training on Animals

The Advanced Medical Technology Training Center holds regular surgical training using pigs for initial trainees in the Tohoku region, focusing on general surgical techniques as well as thoracic and abdominal surgeries, in order to improve the surgical skills of the trainees in a very clinical-like environment. Furthermore, we also provide training in advanced endoscopic surgical techniques not only for residents but also for specialists, which is highly evaluated by the participants.



Clinicopathological Conference utilizing Virtual Microscopes and Video Conference Systems

In order to establish appropriate treatment and gain deeper understanding of the patient's condition, it is important for clinicians and pathologists to share information and work together. However, there is a severe shortage of pathologists in disaster stricken areas. We therefore utilize virtual microscopes and video conference systems to remotely discuss individual cases and support the people of those communities.

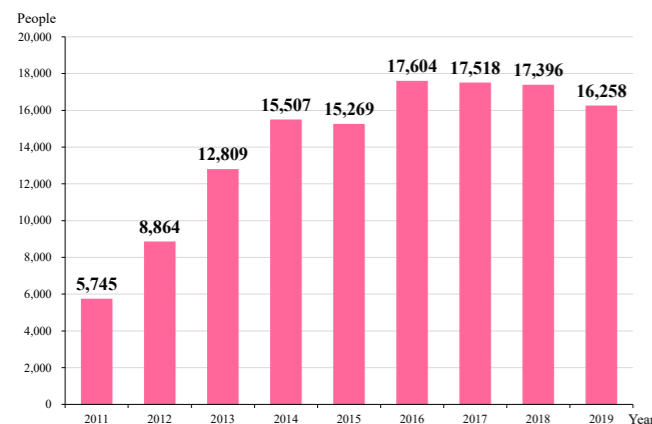


Open Interactions with Local Communities through the Tohoku University Clinical Skills Laboratory

In order to contribute to the recovery of the health care system in areas damaged by the Great East Japan Earthquake, we established the Tohoku University Clinical Skills Laboratory for open interactions with local communities in June 2012 with support from the government and the prefecture. We educate people in clinical skills utilizing medical treatment simulators and team training for medical safety, providing a practice oriented scenario based training. Since 2016, we had 16,000-17,000 participants, 1/3 of which were non-university members. We will continue our open community engagement to provide specialized training and practices.



Tohoku University Clinical Skills Laboratory Participants



Program for Kampo Medicine Useful for Everyday Treatment, Community Health Care, and Times of Disasters

Based on the experiences of the disaster medical treatment activities using Kampo medicine at evacuation shelters after the Great East Japan Earthquake, we organize workshops and seminars for utilization of Kampo medicine in various situations such as times of disasters as well as community health care since July 2011. Since July 2012, 48 seminars with a total of 734 participants and 27 training workshops with a total of 1077 participants were organized.



Training ECMO Treatment for Patients with Cardiopulmonary Dysfunction

In order to increase effectiveness and not rely on the skills of individual, experienced staff, we introduced team based training for treatment of patients with cardiopulmonary dysfunction. Paramedics of the region as well as medical staff involved in disaster medical care have the opportunity to receive training with extra corporeal circulation devices and experience various scenarios regarding priming, ECHO at cannulation and other methods, that will support their activities. In 2019, the course attracted about 150 participants. In 2020, we organized ECMO training workshops for treatment of COVID-19 patients.



Hands-on training of medical care in disaster stricken communities

Since July 2011, we provided a medical educational program within the areas damaged by the Great East Japan Earthquake in collaboration with regional hospitals for the medical students from all over Japan. The aim of this program is to provide opportunities to gain experience in disaster related medical care for the medical students. As of March 2019, the program attracted 141 participants and 17 students were involved in the regional hands-on training after 2017. Many participants expressed the training affected their attitude toward their studies and the decision for their future career paths.



Simulation of Extra Corporeal Circulation Devices

Although many extra corporeal circulation devices dealing with cardiopulmonary arrest have been introduced in recent years, the management and operation depends entirely on the skills and experience of the staff. We therefore developed specialized circuits and equipment to train staff involved in emergency and critical care of local communities to increase their skill level regarding treatment and operation of related devices.



“SimMarathon & SimNight : Real Simulation of Emergency situations”

Duty in emergency rooms or intensive care units require comprehensive decision making and swift treatment adequate to the patient's state. Treating emergency patients is often very stressful for medical staff. In order to provide opportunities to gain experience and training of these situations, we arranged real-life situations with high functional simulators for all members of the region involved in medical care. Participants have the opportunity to obtain experience that will help them to save more people during their activities. In 2019, the course attracted about 30 participants.



Crowd funding “With Corona! Fostering the Key to Community Health Care and Advanced Medical Care”

The Tohoku University Clinical Skills Laboratory has been providing educational support to health care professionals in disaster stricken communities after the earthquake, and is also developing a new training program for medical staff to treat COVID-19 infections since 2020.

However, many of the simulators and medical equipment currently installed for training purposes have been in place for about 10 years, and many are old or do not have the necessary functions to learn latest medical techniques. On the other hand, it is also difficult for universities to raise the high cost of updating the equipment on our own.

As a result, the School of Medicine decided to start a 15 million JPY crowd funding project on February 2, 2021. By using crowd funding to cover a parts of the cost of updating ECMO (external corporeal membrane artificial lung), ventilators, as well as doll-type simulators, we will be able to further enhance the training environment and support medical professionals who can save as many critically ill patients as possible.



Poster



Press conference (February 2, 2021)

Preventive Measures against COVID-19 in Practical Education by Introducing Portable Dental Units

Treatment using rotary cutting instruments is one of the most important basic operations in dentistry, but in the past, there was only one laboratory equipped with rotary cutting instruments for practical training, so about 50 students had to gather in one room during practical training using these instruments.

With the nationwide spread of COVID-19, and while promoting online classes as a measure to prevent infection, the urgent issue was how to avoid a highly dangerous situation in some practical training courses, which are difficult to conduct online.

Therefore, the Graduate School of Dentistry introduced 13 new portable dental units and placed them in another practice rooms to allow social distancing during practical education using rotary cutting equipment. As a result, we could maintain our standards in practical education and also assure a safe environment for our students during their training.

Furthermore, since the portable dental unit can be easily taken out of the training rooms, it can be used for medical rescue and oral health activities in the event of a large-scale disaster, such as the Nankai Trough Earthquake expected in the future, as well as equipment for emergency dental care in hospitals that respond to infectious diseases such as the recent COVID-19 crisis.



Portable dental unit: A suitcase-like mobile case that opens to become a dental treatment device.



Teachers being briefed on how to use the system before practical training.

New International Collaboration During the COVID-19 Pandemic

The recent outbreak of COVID-19 has had a profound impact not only on dental practice, education, and research, but also on international exchange. The Graduate School of Dentistry has been trying various approaches on how to maintain and develop international exchange activities during the COVID-19 crisis.

In March, we were informed of mask shortages and other medical supplies due to the outbreak in China, so we provided masks, medical gowns, and medical caps as medical aid supplies to one of our partner institutions, the Dalian Stomatological hospital. In late April, when serious mask shortages were expected in Japan as well due to the first wave of COVID-19, we received 12,200 masks in return by our partner institutions in China (Dalian Stomatological hospital, Dental Medical Devices Testing Center of Peking University School of Stomatology, and Fujian Medical University School of Stomatology) (Figure 1). The masks greatly contributed to the resumption of face-to-face training at the School of Dentistry in June, as well as to the early resumption of infection prevention measures for University Hospital staff and the dental departments.

Furthermore, we shared information with our partners in Asia about the state of dental education during the crisis. A guideline development committee was also established at the Association for Dental Education, Asia Pacific (ADEAP), chaired by Professor Hong, Director of the Division for Globalization Initiative, Graduate School of Dentistry. In collaboration with 12 dental colleges in the Asia-Pacific region, the “Guidelines for Dental Education under the-COVID-19 Pandemic” was established and released in June. These guidelines have not only served as the basis for the regulations and checklists of the Safety Office in the education of the Graduate School and as a guideline for the resumption of face-to-face education, but have also become the foundation for dental education at universities in the Asia-Pacific region.

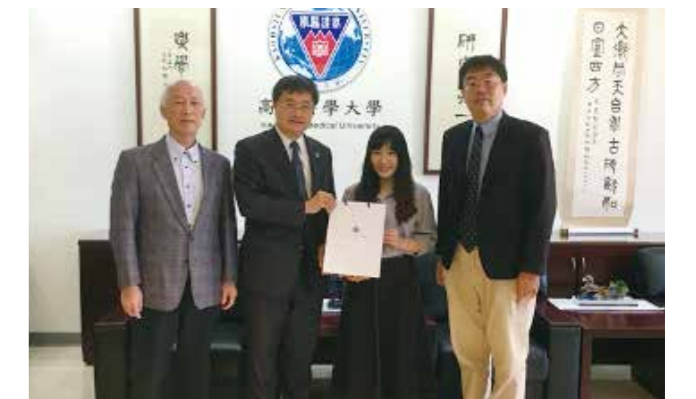
In the field of dental education, we introduced a hybrid model in which online and face-to-face classes are combined. For practical training in specialized subjects where practice is essential, it is however very difficult to use only the online method. Additionally, restrictions on overseas travel continued, and dental students from Taiwan was unable to return to Japan from her temporary visit. In that situation she could not participate in clinical skill training. Therefore, the Division for Globalization Initiative, Graduate School of Dentistry rearranged the educational program so that part of the clinical skill training could be conducted at our partner school, the College of

Dental Medicine at Kaohsiung Medical University in Taiwan. This initiative was highly praised by Kaohsiung Medical University as a new approach to the development of dental education through international collaboration, and was commended by Kaohsiung Medical University as a “good practice” for higher education during the COVID-19 crisis.

These efforts are not only a good precedent for international collaboration in the COVID-19 era, but also a model for overseas cooperation and educational collaboration in the event of large-scale disasters, and will greatly contribute to the construction of a resilient international joint education system that is resistant to both pandemics and disasters.



Receiving masks



From right to left: Dean Tzer-Min Lee, School of Dentistry, Kaohsiung Medical University; Ms. Liu (3rd year student at Tohoku University); President Yun-Jyh Jon, Kaohsiung Medical University; Lead Professor Ker-Kong Chen, School of Dentistry, Kaohsiung Medical University

Development of the original face shield "DATE Shield" in departmental collaboration

In spring 2020, the need for face shields increased in medical institutions as a countermeasure against COVID-19, making it difficult to obtain over-the-counter products. The Dental Laboratory at Tohoku University Hospital has been manufacturing face shields using 3D printers and supplying them to the University Hospital since the beginning of the strict infection control measures. However, due to the spread of infection, further increase in supply was required.

Therefore, as a response to the high demand from medical staff at the University Hospital, we developed the original face shield "DATE Shield" in collaboration with the Graduate School of Dentistry, the Graduate School of Engineering and the Graduate School of Biomedical Engineering, and provided the face shields to medical staff.

The developed face shield has the following characteristics:

- Use of high transparent and low cost OHP film for handwriting made by 3M
- Lightweight materials with necessary strength, weighing only about 30g
- No adhesives used to enable immersion disinfection
- Fixation with Rubber band significantly reduces stress on the user, such as headaches caused by prolonged use
- Readily available and inexpensive materials achieves low cost
- As an option, "Anti-reflection film moth-eye type" made by Dexerials Corporation was adopted to achieve ultra-high transparency and anti-fogging shield
- DATE symbolizes the medical-dental-engineering collaboration at Tohoku University

D: Dentistry

A: Alliance

T: Tohoku University

E: Engineering / Biomedical Engineering

We have produced about 800 face shields and use them not only at Tohoku University Hospital but also donated them to hospitals in regional communities such as the National Hospital Organization Sendai Medical Center, Miyagi Prefecture Dental Association, Miyagi Children's Hospital, Tohoku Medical and Pharmaceutical University Hospital, Japanese Red Cross Ishinomaki Hospital, Minamisanriku Hospital, etc. In the future, we will be seeking the cooperation of a wide range of related partners to transfer production of the newly developed face shield to the private sector in order to enable a larger supply.



DATE Shield
Top: Straight Type
Bottom: Round Type



Wearing the DATE Shield (Round Type)

Furthermore, inter-departmental collaboration of this kind will serve as a model not only for responding to COVID-19, but also for demonstrating our capabilities in a wide range of disaster situations.

Disaster Dental Healthcare Practice in Disaster Stricken Areas

This exercise was established in 2012 in order for students and interns to evaluate the necessary functions of medical care during times of huge catastrophes by talking to dentists and disaster victims on site, grow as a person possibly responding to disasters in the future, and to get a feeling of what is important to each and every one. Since 2016, we also have many students from other universities participating.



Nursing Skills Workshop for Visiting Nurses

We co-hosted a training session on nursing techniques such as CV port management, auscultation of respiratory sounds, and stoma care for visiting nurses with the Miyagi Prefecture Liaison Council of Visiting Nurse Stations.



Lectures on "Disaster Dental Science" at the Faculty of Dentistry

As the only comprehensive university experiencing one of the worst global disasters in history, we teach our students the importance of disaster dental care and treatment from a very early stage. Furthermore, during our lectures, we are acquiring, educating, and preparing young human resources who might be involved in future mega disasters. In 2014, the lectures were officially integrated in the curriculum and are also open to foreign students.



Workshops on Disaster Oral Health Science Preparing for Catastrophes

After the Great East Japan Earthquake, many issues and problems regarding oral health care became obvious. In order to prepare for future catastrophes and mega disasters, we deem it necessary to design an integrated system covering the communities and various organizations including universities, collaborate with municipalities and affiliate professions, and establish an information sharing system. Learning from the experiences of the disaster in 2011, we at the Graduate School of Dentistry analyzed and assessed the dental health care response after the mega disaster and organize workshops to reevaluate the details.



Global Communication of Disaster Dental Science from Tohoku University

As only comprehensive university struck by the Great East Japan Earthquake, we see it as part of our mission to pass our experience, knowledge, as well as the issues and problems on to the next generation. We proactively engage in global communication and organization of symposia with e.g. Sichuan University, which also experienced a great earthquake. Furthermore, based on a Japanese proposal, we are currently working to standardization of a global dental dataset and are participating in ISO.



Various Workshops for Disaster and Community Medical Care

The Graduate School of Dentistry provides on-site dental treatment, eating and swallowing rehabilitation, and perioperative oral management seminars. Although these are fields with very high demand in the current aging society at times of disasters, they are not sufficiently taught during undergraduate education. The workshops are organized in cooperation with other universities and have active participation by many students and affiliates.



Project 02

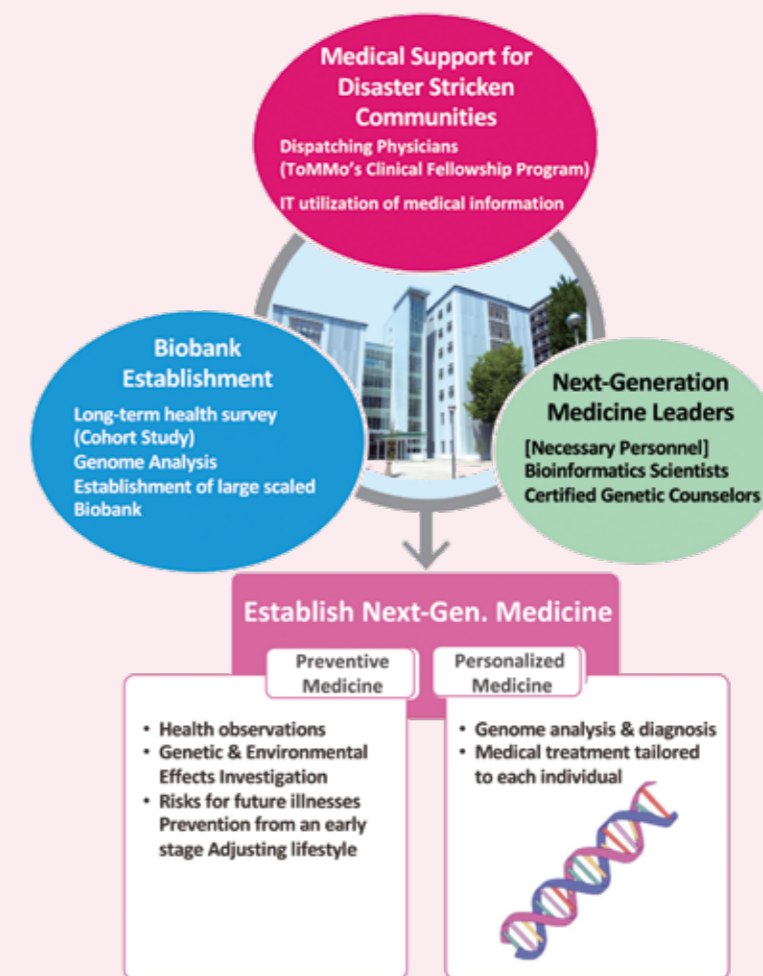
Project for the Reconstruction of Community Health Care

Tohoku Medical Megabank Organization

The Tohoku Medical Megabank Organization (ToMMo) was founded to recover community health care and regenerate medical treatment capabilities in disaster stricken areas damaged by the Great East Japan Earthquake, respond to the global trend to utilize large scaled medical information, and to establish a new system for medical care..

ToMMo conducts long-term cohort studies of 150,000 residents in total, accumulating the multiple information upon consent to obtain detailed data regarding their health including the genomic information. The information was then analyzed and utilized to establish personalized medicine, the ambition to provide necessary health care for each on everyone based on their genetic information and their everyday habits. Furthermore, we established an integrated biobank accumulating biological specimens, health data and detailed analyses and are sharing these specimen and information with nationwide scientists for the research purpose. In addition, we established the ToMMo Clinical Fellow System to provide education and circulation of physicians in disaster stricken areas and thus support medical institutions in regional hospitals of Tohoku's coastal area. We are also involved in training and education for various medical and related professionals, such as genome medical research coordinators, certified genetic counselors, data scientists and data managers who treats the big data in advanced life sciences.

We strive to establish Tohoku-made "Next-Generation Medicine" utilizing the analyses of the biobank as well as the support of the people.



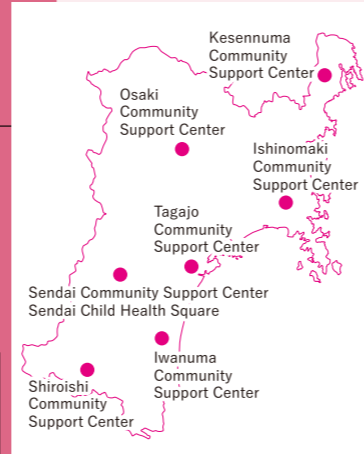
Project Leader
Tohoku Medical Megabank Organization
Executive Director
Masayuki Yamamoto

When the Great East Japan Earthquake brought unprecedented disaster to the region, our goal was to find some hope through our actions. As a consequence of intensive discussions, we have reached the idea of next-generation medicine and personalized health care. It has been 10 years since March 11, 2011. We have been supporting the community medicine in the tsunami devastated area, conducting two cohort studies of the Tohoku Medical Megabank Project, and established an integrated biobank. We always communicate our findings to the participants of our cohorts and also partners in the community. The obtained information has been vital for researchers not only in Japan but worldwide. We will carry on our contributions related to health care in disaster-stricken communities, utilize the power of the integrated biobank, and further develop personalized medicine and healthcare with the help of genome information to realize and practically implement the next-generation medicine.

Project Activities

Project for the Reconstruction of Community Health Care
Tohoku Medical Megabank Organization

- 2012
 - 2 Establishment of Tohoku Medical Megabank Organization (ToMMo)
 - 9 Cooperation agreement between ToMMo and the prefecture of Miyagi as well as all 35 municipalities
 - 10 Begin of ToMMo Clinical Fellow
 - 11 Begin of ToMMo Child Health Study (~2016.3)
 - 12 Setting up Community Support Centers in 7 places of Miyagi as base for health investigations
- 2013
 - 4 Symposium "A Healthy Miyagi Created by Everybody"
 - 5 Cooperation agreement of Tohoku University and Iwate Medical University
 - 5 Begin of TMM CommCohort Study and TMM BirThree Cohort Study
 - 11 Completing the high-accuracy whole genome sequencing analysis of 1,000 healthy Japanese people (up to 15 million new single nucleotide variants gathered)
 - 12 33 briefing sessions to explain result of TMM CommCohort Study to benefit community health care at various places in Miyagi (~2016.10)
- 2014
 - 7 Begin operation of ToMMo's Supercomputer System "Large scale genome cohort analysis system"
 - 7 Completion ceremony of the ToMMo Building and First Community Council Meeting
 - 12 Commercialization of the SNP array "Japonica Array™" optimized for Japanese people
- 2015
 - 6 Acquisition of the ISO9001 certificate at the Biobank of ToMMo
 - 8 Success of comprehensive high-accuracy whole-genome sequencing of 1,070 Japanese people, publication of result in Nature Communications
 - 12 Release of the locations and allele frequencies of all SNVs in the whole genome reference panel
- 2016
 - 2 Success in treatment effectiveness assessments of acute lymphoblastic leukemia using the whole genome sequencing
 - 4 Development of the Integrated Database "dbTMM", integrating the large scaled health survey data and the genome analysis information
 - 8 Release of the Japanese Reference Genome Sequence (JRG)
 - 12 Begin operation of remote security area for ToMMo Supercomputer System utilization outside ToMMo
- 2017
 - 2 Begin data distribution SNP array data of 10,000 people, etc.
 - 3 End up recruiting of TMM CommCohort Study and TMM BirThree Cohort Study
 - 4 Tohoku Medical Megabank (TMM) Project symposium "Medical Care in the Future and Recovery of Tohoku via Data Sharing"
 - 8 Second Community Council Meeting of the TMM Project in Miyagi
- 2018
 - 6 Adding the mitochondria and X chromosome to the genome sequencing of 3,500 people (3.5KJPNv2)
 - 8 The human metabolome data registered in jMorp2018 exceeds 10,000 people.
 - 12 Press conference regarding the bone density of participants of the cohort study who were heavily affected by the disaster in 2011
- 2019
 - 1 Brain-MRI project exceeds 10,000 data sets
 - 1-2 Public briefing and reporting of long-term health observations to participants and supporters of the study
 - 2 Release of the genome reference panel "JG1", that will provide a model for the genome analysis of Japanese people
- 2019
 - 4 Creation of iPS cells with long-term storage samples from the biobank
 - 9 Development of "Array™ NEO" and commercial services
 - 10 Third Community Council Meeting of the TMM Project in Miyagi
 - 12 Begin of health survey on developmental characteristics of 5-year-olds
- 2020
 - 3 Collaborative research with the Japan Pharmaceutical Manufacturers Association
 - 4 Collaborative research with the Takeda Pharmaceutical Company Ltd.
 - 8 New samples and information related to TMM BirThree Cohort Study, expanding information to distribute to the entire study of ca. 150,000 participants
 - 8 Releasing whole-genome reference panels based on the genome analysis data of 8,300 participants
 - 9 Releasing findings of accelerated aging related to long-term stay space, obtained in collaborative research with JAXA
 - 9 Establishing a visiting remote security area in the Nihonbashi Branch



◆◆ Actions Related to the COVID-19 Crisis

Due to the increasing spread of COVID-19, ToMMo's health survey was forced to slow down activities in order to take all possible measures to safely continue the survey. The biological specimens and information stored at ToMMo from before the pandemic are of special value and we have multiple collaborative research projects and activities to analyze the illness.

Furthermore, we are also working to communicate information to the general public about the largely unknown illness of COVID-19 including tie-ups with TV stations.



Professor Eiichi.N.Kodama appearing on TV.

◆◆ Utilizing Results from the Cohort Study in Collaborative Research with JAXA

Results from the cohort study have applications in many fields, one of which is research in space. In February 2019, ToMMo and JAXA concluded a cooperation agreement on the use of the Japanese experiment module "Kibo" of the International Space Station with the goal to contribute to the realization of a healthier and longer life. Comparing blood analyses with mice which stayed on "Kibo" with results from the cohort study, we were able to determine new findings, which were published in September 2020.

The possibilities from the cohort study data are endless and will not only be utilized in Tohoku or Japan, but the entire world, even reaching space.



Cooperation Agreement Ceremony

◆◆ Pilot Study on Return of Genomic Results the Cohort Study

It was our promise to participants of the cohort study that we will inform them of any useful health information obtained from the analysis of their genetic information. This also greatly contributes to our goal of personalized medicine and prevention. However, there have been almost no similar actions in the world and the psychological and emotional changes that may result from knowing results of genetic information are not well understood.

By September 2020, more than 380 people has participate for the pilot study related to "Familial Hypercholesterolemia" and "Genetic information on drug responsiveness (PGx)". If the test results reveal genetic information that should be reported, we refer the participants to Tohoku University Hospital or other institutions and analyze the psychological and psychiatric changes as well.



Explanation by clinical geneticist

Collaborative Research with the Japan Pharmaceutical Manufacturers Association

ToMMo started a collaborative research project with the Japan Pharmaceutical Manufacturers Association to share health information, genome information, and biological specimens of 150,000 people, with the aim of achieving “early practical application of preventive and preemptive medical solutions” as proposed by the Association. Through collaborative research such as investigating the relationship between questionnaire data on lifestyle, MRI imaging data, omics data, etc., we are promoting the social implementation of Next-Generation Medicine and the further creation of innovative drugs and medical technologies by acquiring and analyzing data based on needs for new drug creations. Through these kinds of collaborations ToMMo aims to contribute to the health of people in communities not only at home but also overseas.



Cooperation Agreement Ceremony

More than 120,000 People Participating in the Cohort Studies in Miyagi

Beginning in 2013, we organized large scaled cohort studies to investigate the long-term health status of residents in Miyagi. In particular, we prioritized the analysis of diseases and disorders with increasing numbers among community members affected by the Great East Japan Earthquake, examining the health status by blood and urine samples as well as various inspection equipment and questionnaire. By June 2017 we exceeded our goal of 120,000 participants (157,000 participants including Iwate), and received various of responds e.g. “I want to take better care of my health based on the health survey

results” or “I wish for new ways of medical treatment soon”. Based on the results, the risk for mental health problems such as depression or PTSD was higher in the coastal regions of Miyagi than in the inland and furthermore, we observed a correlation between treatment discontinuation for e.g. elevated blood pressure and the magnitude of the damage by the Great East Japan Earthquake in coastal regions as well. Considering the survey results, we also provided support by psychotherapists to more than 2,500 people at high risk. We wish to continue our investigation to bequeath our next-generation of children how prevention of diseases works and we will advance our research with the data and biological specimens gathered from these cohort studies to establish the foundation for Next-Generation Medicine.



Providing Important Health Information to Members of Local Communities

In order to make use of the results of the health survey, we held a total of 33 briefing sessions at ToMMo in Miyagi by October 2016, mainly for those who participated in the cohort survey. There were also seven project briefing sessions in 2018. A total of about 3,000 people attended the meetings.

The results of the survey are also reported to local municipalities and local medical institutions, and are used as a reference for administrative purposes. We will continue to support health care of people in disaster stricken communities and communicate our findings of our studies.



Presenting results of the project in Iwanuma city

Regional Support Through Cooperation Agreements with Municipalities in Miyagi

In order to attract participants and establish a basis for Next-Generation Medicine, the cooperation of local communities and municipalities is essential. In September 2012, we negotiated cooperation agreements between Tohoku University and the Prefecture of Miyagi, and afterwards between ToMMo and all 35 local municipalities. We are contributing to the health of the disaster stricken communities by reporting on the health trends that can be seen from the results of our study and utilize them in health policies.



Cooperation Agreement with municipalities in Miyagi



Signing ceremony of the cooperation agreement between Miyagi Prefecture and Tohoku University

Examination of over 30,000 People at Seven Community Support Centers in Miyagi

In order to conduct the cohort studies and support regional wellbeing, we at ToMMo established Community Support Center at seven places in Miyagi. During the TMM CommCohort Study, we measured bone density measurement and body composition, as well as examined oral health check-up and audiometry, inspected the ophthalmic structure and tested the respiratory functionality of more than 30,000 participants. Our main objective is to support health promotion and to function as an essential part in managing the wellbeing of the region, thus contributing to the everyday life in local communities.



Kesennuma Community Support Center



Oral health check-ups

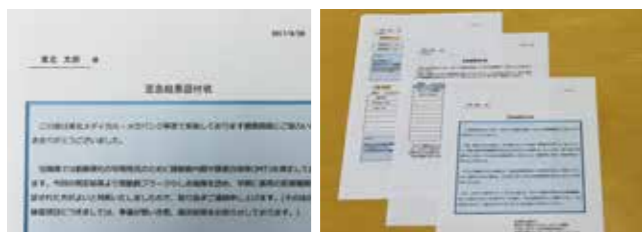
◆◆ Foundation for Next-Generation Medicine Based on One of Japan's Largest Biobank

A biobank is a system to conserve biological specimens administered for research purposes. The Tohoku Medical Megabank Project's biobank contains all the biological specimens (several million) e.g. blood, urine, saliva, provided by participants during the cohort studies. As one of the largest in Japan, our biobank can be utilized by a vast number of researchers, building the foundation for Next-Generation Medicine and contributing to the establishment of better medical treatment in the future.



◆◆ Emergent Return of Results to More than 850 Participants – Cohort Studies Outcomes Directly Connected to Health Management

The number of emergent return of results to participants of our cohort studies at ToMMo reached more than 850 cases by September 2020. Letters recommending medical check-ups were sent in cases of blood bone marrow diseases and provided referral form for a speedy examination process. We also had more than 260 emergency notifications in cases of suspected brain aneurysms and liver tumors after MRI examinations.



◆◆ Supercomputer System for Nationwide Access by Researchers

In order to analyze the data and samples provided by ca. 150,000 participants including residents of disaster stricken communities in Miyagi and Iwate, we are utilizing a Supercomputer System since 2014. In July 2020, we also established the Nihonbashi Branch for joint usage and as of November 2020 remote security areas (external terminal for utilization of e.g. big data) in 26 places in Japan are available so nationwide researchers can access this system.



Supercomputer systems essential to genome research

◆◆ Complete Whole Genome Sequencing of 8,300 People in Japan – Establishing a Whole-Genome Reference Panel

In August 2020, ToMMo announced the completion of the whole genome sequencing of 8,300 Japanese people and created a whole genome reference panel (8.3KJPN). This means we achieved the sequencing of 8,000 people, a goal set in 2013 after the release of 1,000 results. The panel will not only be the foundation of the genome analysis of Japanese people but also contribute important information to the development of Next-Generation Medicine rooted in the disaster stricken areas.



◆◆ Distributing Biological Specimens and Information about All 150,000 Participants of the Cohort Study

As of August 2020, we are distributing biological specimens and information obtained from long-term health surveys of ca. 150,000 people. Genome information integrated with information from cohort studies, such as data obtained from blood and urine samples, medical history from questionnaire, or information about the lifestyle, is the first of its kind of this magnitude in Japan.

We are expecting rapid progress toward the realization of personalized medicine and prevention as well as Next-Generation Medicine through the nationwide utilization of this information by researchers.



◆◆ Releasing Omics Information of 25,000 Participants on the Web

The Japanese Multilayer Omics Reference Panel (jMorP) was upgraded in August 2020 by conducting NMR metabolome analysis for 25,000 individuals and MS metabolome analysis for 3,000 individuals based on the blood samples received from the health survey. The database is open to the public so that researchers around the world can use it as a basis for a wide range of medical research.



◆◆ Fostering the Next Generation of Experts Including as GMRCs and Genetic Counselors

We educate and foster GMRCs (Genome Medical Research Coordinator), professional staff capable of conducting appropriate means to obtain informed consents (IC), and as of October 2020, 132 GMRCs are participating in our projects. Furthermore, we certified four genetic counselors, bioinformatics scientists, and data managers, all essential human resources for our projects at ToMMo.



◆◆ Support of Disaster Stricken Medical Institutions by System of Dispatching Physicians on a Rotation Basis

Due to the damages from the tsunami of the Great East Japan Earthquake, many medical institutions in the coastal region lost patients, staff, facilities, and medical records. We at ToMMo introduced the "ToMMo Clinical Fellowship Program (System of Dispatching Physicians on a Rotation Basis)" in 2012. The system dispatches young medical doctors in turns to medical institutions in disaster stricken areas for four months, where they are working energetically to support medical care in coastal regions.



Support by "ToMMo Clinical Fellows"
Photo: Kenichi Chiba

◆◆ Child Health After the Great East Japan Earthquake – Findings via Large Scaled Surveys

We conducted surveys for guardians of elementary and middle school children in Miyagi over fourth-year and gained the cooperation of 17,043 people in total. The number of children with suspected difficulties in everyday life was 2,386. 94 children had severe conditions of bronchial asthma, but did not receive any medical care or treatment. Clinical psychologists and public health nurses conducted telephone consultations with a total of 1,609 people as well as ca. 110 direct interviews.



◆◆ Health Care Events in Miyagi – Toward Health Awareness in the Entire Prefecture

Including events for mothers and children, we at ToMMo organized health care events in various places of Miyagi with high interest of local communities and many participants. Lectures regarding intestines or nutrition, talk sessions with celebrities, demonstration of health inspection equipment, or health gymnastics performed by cheerleaders of the local soccer club Vegalta Sendai were very popular aspects of the event.



◆◆ Misato Town Mayor Says “Health survey of the Tohoku Medical Megabank Project will contribute to the health of residents”

“The project makes significant contributions to improving the health of the town’s residents. To protect the health of the town’s residents, the town would like to cooperate with the project as much as possible.” (Misato Town Mayor Seiichi Aizawa)



Misato Town Mayor Seiichi Aizawa at a regional council meeting

◆◆ Permanent Exhibition about Genome Medicine at the Sendai City Science Museum

We began the exhibition “The Nano Travel of ATGC” in November 2013 at the Sendai City Science Museum on the topic of personalized medicine and prevention based on advancements in genome science. The permanent exhibition on the third floor of the museum displays a nano scale trip through a human’s body, displaying a story where visitors can learn e.g. that each and everyone’s genome differs, and entertaining more than 200,000 visitors each year.



◆◆ Tohoku University as Center for Next-Generation Medical Care and State-of-the-Art Research



“As President of the Miyagi Medical and Welfare Information Network (MMWIN*), I want to cooperate with this project. I wish for Tohoku to be a center of research for Next-Generation Medical Care.” (Kenji Kakazu, President of the Miyagi Medical Association at the time)

Kenji Kakazu, President of the Miyagi Medical Association, at a regional council meeting

◆◆ “An Open Heart to Accept All Facets of Patients”

“It is difficult to establish a relationship with patients who truly open their heart to someone. This is even more so with disaster victims. We therefore continue our dialogue to accept all facets of our patients with an open mind.” (Keiichi Kondo, MD, Ph. D. Tohoku University)

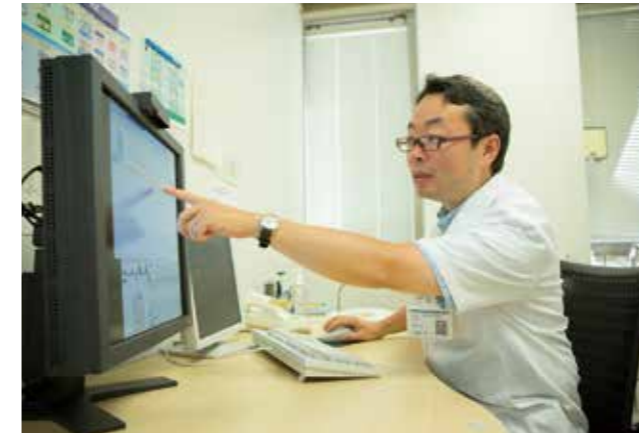


Photo: Kenichi Chiba

◆◆ Witnessing the Important Event of a “Childbirth”

“The work of a Genome Medical Research Coordinator (GMRC) involved in the cohort study appears at a singular instance in a participant’s life, witnesses the important event of the “childbirth”, and then fades away. I believe it to be a sincere honor.” (Hisako Kusano, ToMMo GMRC)



Photo: Kenichi Chiba

◆◆ Repeat Assessment of the Long-term Health Survey

In order to establish personalized medicine and prevention, a long-term observation of healthy individuals is necessary to obtain reference data comparable to patients with illnesses. As of 2017 we started repeat assessment center-based survey during second period. It has been almost 4 years since the first survey and we are asking participants again to submit samples of blood, urine and other details for the survey. Furthermore, we included children to analyze their development and monitor personal conditions.

◆◆ “Appreciation”



Photo: Kenichi Chiba

“Three years after the disaster, survivors are still grieving their losses. We have tried to support them in their grieving process and help them to relieve their psychological pain by offering telephone support. We feel great appreciation and admiration for the survivors who shared their stories, pain, and agony.” (Interview of Kotomi Shingu, M.A., clinical psychologist, ToMMo, 2014)

◆◆ Blessed with New Life

“After the disaster I met my husband and moved from Tokyo to Miyagi. Blessed with a new life, I had the opportunity to be with the ToMMo for 10 months and was rewarded with an adorable child. I wish for this child to grow sound and healthy.” (A message card at the UN World Conference on Disaster Risk Reduction.)



Message cards at the UN World Conference on Disaster Risk Reduction



Checking skin condition



iPS Cell Development from Blood Specimens of Long-term Health Survey Participants

In collaboration with Kyoto University's Center for iPS Cell Research and Application, ToMMo succeeded to create iPS cells from blood specimens of six participants of the long-term health survey. This established new possibilities to build iPS cells with special characteristics based on the detailed data of the 150,000 participants. Fortunately, many people from the region participated in the long-term health survey. And we are thankful to each and everyone for making the scientific progress possible.



Press release in collaboration with Kyoto University's Center for iPS Cell Research and Application



The Impact of Damage to Housing Through the Long-term Health Survey

In the course of the long-term health survey with more than 150,000 participants, many research results emerged, that will greatly benefit everyday life in the communities. As an example, we found a connection of the participant's bone density measurement to the damage of the housings during the disaster. Most notably, people whose houses were severely damaged, generally displayed a lower density than people whose houses were only lightly damaged. Compared with the first study, the effects had a greater impact on the people over time, suggesting a vicious cycle of "damage to the homes → lower daily step-count → lower bone density measurement". The long-term survey will continue to contribute to the everyday life of the people in the communities and, in the long run, will lead to the full, non-superficial recovery of the region.



Release of the "Japanese Reference Genome"

In order to conduct genome analysis, a reference is essential. Currently many researchers utilize the international reference genome, which has entries not suitable for the analysis of the genome of Japanese people.

The "Japanese Reference Genome" JG1 was created in 2019 based on the genome information of the people who participated in the long-term health survey, and JG2, with much improved accuracy, was released by ToMMo online in 2020. Employing this Japanese reference genome for further analysis, it will be possible to study causes of illnesses and establish new methods for medical treatment.



Assistant Professor Jun Takayama (second from right) received the AMED President's Award at the 3rd Japan Medical Research and Development Awards in recognition of his work on JG1.



Collaborative Research and Industry Cooperation

By adding the long-term health survey to our activities, we were also able to promote collaborative research with the industry. Among a variety of projects, we are currently analyzing the relation of disorders such as high blood pressure to data obtained from the everyday life in collaboration with OMRON HEALTHCARE CO., Ltd., utilizing tools such as urinary sodium-to-potassium radio monitoring device. Furthermore, we are analyzing the intake effect of lactic acid bacteria and the impact of the intestinal flora on the personal condition in collaboration with Yakult Honsha Co., Ltd.



Public briefing and reporting of long-term health observations to participants and supporters of the study, January - February 2019.

Executive Director of the Tohoku Medical Megabank Organization

Masayuki Yamamoto

Executive Director of the Tohoku Medical Megabank Organization since 2012 after steps as Lecturer at Tohoku University, Professor at the University of Tsukuba, Professor at Tohoku University and Dean of the Graduate School of Medicine. Specialization in medical biochemistry and oxygen biology.

The Tohoku Medical Megabank Organization is conducting a long-term cohort study with a total of 157,000 participants from local communities. Utilizing research results from one of the largest biobanks in Japan, we are planning to develop "Next-Generation Medicine" in Tohoku.

I am grateful that we have been able to promote the projects of the Tohoku Medical Megabank Organization (ToMMo) for the past 10 years. But it is also true that we are far from our goal and there is no time to reminisce about our feelings. ToMMo was established during the reconstruction process of disaster-stricken areas with the objective to realize next-generation medicine. We have established a good relationship to the participants and communities and have been communicating and updating our findings as much as possible. One of our salient achievements is the establishment of the integrated biobank, which integrates biological specimens, information of the health survey as well as the multi-omics analysis results. This biobank is not only a new research tool for the world to generate new ideas, but it is also an essential infrastructure for developed countries. The biobank is founded by the health information of the long-term cohort study. The real praise should go to the participants and contributors who cooperated with our project, as well as predecessors of our medical school, who

established the connection of trust with the local communities, and our members who worked hard on the detailed aspects of this project.

We wish to continue the Birth and Three Generation Cohort Study, aiming to follow-up pregnant women and their families for 30 years, as this way we will be able to see the children born in this study reach adulthood. The cohort with pedigree of this magnitude is unprecedented, so we are hoping to archive results unparalleled in the world. Based on these activities, we will be able to promote personalized medicine and healthcare in our society.

ToMMo has roots in disaster reconstruction and has been the fully supported by Tohoku University. Tohoku University wishes to contribute to disaster reconstructions from various aspects, including the reconstruction of regional health care in disaster-stricken communities. The reconstruction process may look different after additional years, but we will continue to be an organization that supports local communities and watches over people's health.

The Restoration and Recovery of Medical Care toward Next-Generation Medicine



Project 03

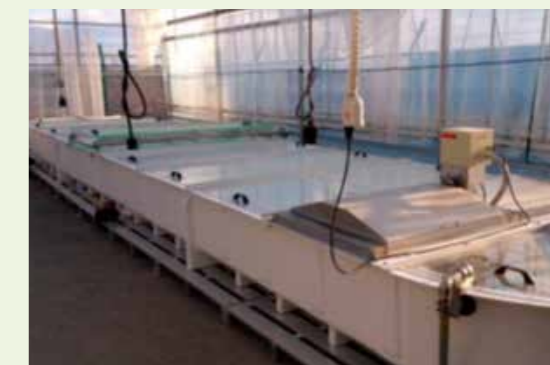
Project for Environmental Energy

This project aspires to create an alternative energy network independent from traditional infrastructures in disaster stricken areas which experiences long term blackouts during the Great East Japan Earthquake. We are developing renewable energy resources for the communities, as well as a system to manage the off-grid electric distribution.

Research and development is conducted at Tohoku University as core research center and we established the “Consortium for the Next-generation Energies for Tohoku Recovery” in collaboration with affiliated municipalities to promote new resources of energy and the necessary management system to society and lead the recovery of Tohoku. We have three main research objectives.

[Research Objectives]

- Objective 1 : R&D on Wave Power and Other Ocean Renewable Energies
Applicable to the Sanriku Coast
- Objective 2 : R&D on Algae Biofuels
- Objective 3 : R&D on Integrated Community Renewable Energy Control Systems to Enhance Human and Vehicle Mobility



Project Activities

Project for Environmental Energy

- 2012 9 "Kick-off Symposium for the Recovery of Tohoku and R&D of Next Generation Energy"
- 2013 3 "International Symposium for the Recovery of Tohoku and R&D of Next Generation Energy"
- 4 Joint research initiation ceremony of Ishinomaki and Tohoku University at Kazuma elementary school, Ishinomaki
- 4 Opening ceremony of the "Algae Biomass Technology Development Laboratory" at the Minami Gamou Sewage Treatment Plant, starting experiments on "R&D on Microalgae Energy Utilization"
- 7 Letter of appreciation presented by Ishinomaki for the installation of the EMS controlled solar power system in public facilities of Ishinomaki
- 7-8 Special exhibition at the Sendai Science Museum on fuel generation from algae
- 12 "Osaki-Tohoku University Forum", reporting on R&D achievement utilizing biomass and heat from hot springs
- 12 Presentation of recovery projects at energy mobility integrated management system testing facilities to Prime Minister Abe visiting Miyagi
- 2014 6 "Briefing and electric car testing session for residents" on Tashiro Island, Ishinomaki
- 7 "ene café METHANE" utilizing biogas energy resources in parking spaces in Naruko
- 10 "Presentation Ceremony of Solar Power Systems" on Tashiro Island, Ishinomaki
- 10 R&D overview and progress presentation to Prime Minister Abe at microalgae energy utilization testing site at the Minami Gamou Sewage Treatment Plant
- 11 Installation of tidal power generation devices at Sabusawa waterways in Shiogama
- 2015 3 Study tour of the UN World Conference on Disaster Risk Reduction presenting the microalgae energy utilization testing site at the Minami Gamou Sewage Treatment Plant and the multi-purpose power supply facility at Aobayama Campus
- 6 Development of new transformation methods for algae oils to transportation fuels
- 6 Power transmission from the tidal power plant of Sabusawa Island to refrigerators of the Fisheries Cooperative Association
- 12 "Special Good Life Award from the Minister of the Environment" at the Third Good Life Awards by the Ministry of the Environment for "ene café METHANE"
- 12 Presentation ceremony of the multi-purpose power supply station installed in the parking space of Kagobou Hot Spring Sakuranoyu in Tajiri, Ohsaki
- 2016 1 Completion of the wave power generator to be installed in Tamanowaki Area, Kuji, and release of important information to the press
- 5 Minister for Reconstruction Takagi visits the wave power generator installation site in Tamanowaki Area, Kuji
- 5 Official visit of the G7 Finance Ministers and Central Bank Governors' Meeting in Sendai to the microalgae energy utilization testing site at the Minami Gamou Sewage Treatment Plant
- 9 Installation of the wave power generator in Tamanowaki Area
- 11 Opening the wave power plant in Tamanowaki Area to the general public
- 11 Installation of EV power stations (V2H) at Kazuma elementary school, Ishinomaki, completing basic maintenance of necessary elements for the energy mobility management system
- 12 Closing Reports on the "Project for the Next-generation Energies for Tohoku Recovery"



Objective 1 : R&D on Wave Power and Other Ocean Renewable Energies Applicable to the Sanriku Coast



Realization of Tidal Power and Wave Power Generation in Disaster Stricken Marine Areas

After the Great East Japan Earthquake, we had numerous requests from communities of coastal regions which were affected by long-lasting blackouts to utilize the oceanic energy for power generation. In order to comply, we initiated the research project "Research and Development on Oceanic Renewable Energy such as Wave Power for Applications at the Sanriku Coast" and contributed to the recovery of Tohoku after the disasters of the earthquake and the tsunami. To demonstrate the possibilities of oceanic renewable energy, we developed power generation equipment in collaboration with local corporations, and accomplished the installation in marine areas and thus the support of power supply by 2016. During the advancements in oceanic energy we had to face not only technical problems, but also issues with regulations such as the Electricity Business Act and the Public Waters Reclamation Law as well as the understanding of local residents and affiliates of the fishery business of local communities.

In the course of our project, we solved one complication at a time and were able to equip Sabusawa Island in Shiogama, Miyagi, with a tidal power generator (5kW) in March 2015 and the Tamanowaki Area of Kuji, Iwate, with a wave power generator in November 2016, supporting the power supply for local communities. This was the first instance of grid-connection in Japan and the generated electricity is provided without cost to local fishermen's associations, contributing to the fishery and the communities of disaster stricken areas.

Based on our achievements, we aim to further increase our engagement and realize oceanic energy generation on an even larger scale.



Oceanic tidal power generation facility



Installing wave power generators



The First Grid-Connected Oceanic Energy Power Plant of Japan

In the Strategic Plans for the European Union published in 2016, the European Commission stated their goal to provide 10% of their power supply by oceanic energy generation by 2050 and the prospect of commercialization by 2030, displaying a global trend of advancements in oceanic energy utilization and promoting new businesses as well as measures against global warming.

Although the wave and tidal power generation plants developed by our project only have small output, they constitute a rare and valuable case of Japan's first oceanic power plant with grid-connection and are currently attracting attention as one example of power generation and utilization of local communities.



Tidal Power Plant



Modification and implementation of control programs.



Toward Efficient Oceanic Energy Generation

Since the Sabusawa waterways at the entrance of Matsushima Bay in Miyagi have a slower speed of tides due to the subsidence of the seabed and the outflow of sediment by the tsunami, we produced new-type wings out of light-weight aluminum honeycomb material and increased the number of wings in the tidal generator from four to eight. Furthermore, we developed a new power generation control method optimized for irregular waves and are currently verifying the efficiency.

With nationwide participation of 12 companies, we will continue our joint research and increase the efficiency of power generation in the marine area as well as the modification of control methods.



Power generation during a typhoon



Raising Public Awareness of Oceanic Energy

In order to raise wide public attention and awareness of tidal and wave power generation as well as the achievements, we organized public lectures, press events, and excursions. The tours were visited by the Minister for Reconstruction and affiliates of electric companies as well



Excursion with high school students.

as members of communities and high school students from Tagajo, Miyagi, and Muroran, Hokkaido.

We will continue to proactively announce our research achievements and organize excursions in order to raise public awareness regarding oceanic energy and ask for the support and understanding of the community toward further practical implementation.



Objective 2 : R&D on Algae Biofuels



Toward a New Sewage Treatment Model in Private Public Collaboration

In collaboration with Tsukuba University and the city of Sendai, we aimed to lower the energy costs for sewage treatment as well as to create and generate energy from this sewage at the Minami Gamou Sewage Treatment Plant, utilizing algae biomass. Since 2017, we are continuing the project in private-public cooperation with more involvement of private companies.

Our research is one of the projects in Sendai City's Earthquake

Recovery Program and was supported by local communities with a lot of attention.

Activities:

- Optimization of algae cultivation conditions based on genetic information, etc.
- Development of a wet extraction method for algal oil
- Studying practical applications of algal oil
- Development of ways to utilize algae culture products for purposes other than fuel



Maintenance of Pilot Outdoors Cultivation Facility

In order to cultivate algae not with artificial growth media but with sewage outdoors, issues such as contamination of micro-organisms or other foreign bodies occur. We established a pilot outdoors testing facility (2.5t) capable of filtering sewage water and applying simple elimination of bacteria for the cultivation of algae, and succeeded in maintaining similar cultivation results as indoors laboratories.

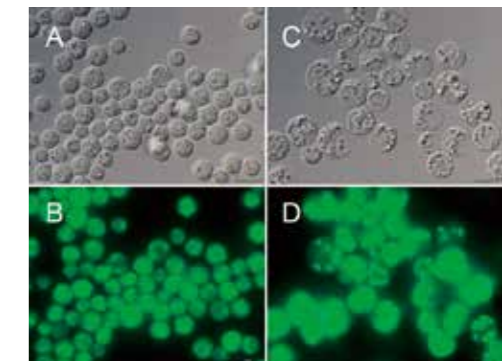


Pilot Testing Facility at the Minami Gamou Water Purification Center



Cultivation of Strains in Low Salt Concentration

In order to cultivate Aurantiochytrium, which are brackish water organisms, a certain level of salt concentration is necessary. However, salt leads to corrosion of piping and additional desalination equipment would be necessary when executing large scaled cultivation on plant level. We conducted acclimation experiments of wild strains over 700 days and succeeded in procuring strains which adapted to a low salt concentration environment and showed favorable growth even in a concentration of 1/6400 of ocean water.



Cultivation of Strains in Low Salt Concentration



Toward the Development of New Fuels

In order to utilize hydrocarbons obtained from Aurantiochytrium and Botryococcus braunii as substitute for gasoline or jet fuel, the volatility has to be increased by degradation. We developed a catalyst (Ru/CeO₂), which selectively disconnects the carbon-carbon bonds of low level squalene branching, degrading the hydrocarbon to a level of jet fuel, gasoline, or gaseous molecules with low molecular weight.



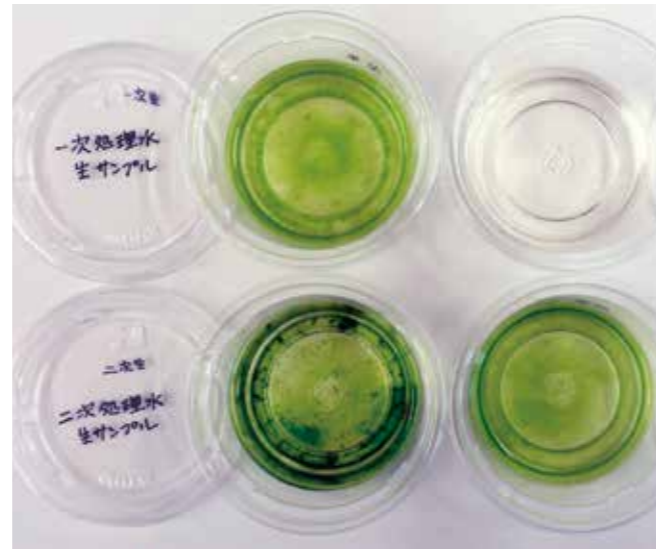
Aurantiochytrium and Botryococcus braunii attracting attention to substitute traditional fuel.



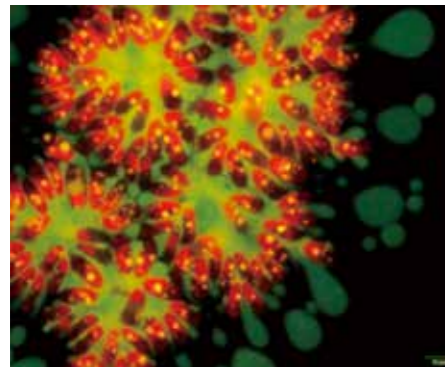
Toward Energy Generation from Sewage Treatment Plants

The Minami Gamou Water Purification Center which handles ca. 70% of Sendai's sewage was almost completely destroyed by the tsunami. In order to not just rebuild the facilities, but to lower the energy costs for sewage treatment as well as to create and generate energy from this sewage, "Research and Development on Algae-Based biofuels" was initiated at the center. The objective was the establishment of a new, environmentally friendly sewage treatment model. In this challenging task, we cultivated *Aurantiochytrium* and *Botryococcus braunii*, both hydrocarbon-producing microalgae attracting attention as fuel production resources to replace oil in the future, by utilizing inorganic and organic substances derived from sewage. For the extraction of hydrocarbon fuel, we had to work on a wide range of issues such as algae cultivation utilizing sewage or sludge lysates, the collection, extraction, and reutilization of residues by solubilization of cells, the modification of the extracted hydrocarbon, and the life cycle assessment in case of actual full operation.

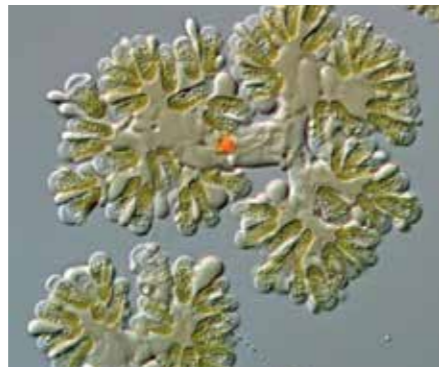
Our research as "New Energy and Energy Saving Project 'Realizing Sustainable Energy Supplies'" was one of ten projects in Sendai City's Earthquake Recovery Program (2011-2015) and was supported by local communities with a lot of attraction.



Microalgae cultivation utilizing sewage.



Botryococcus under a microscope

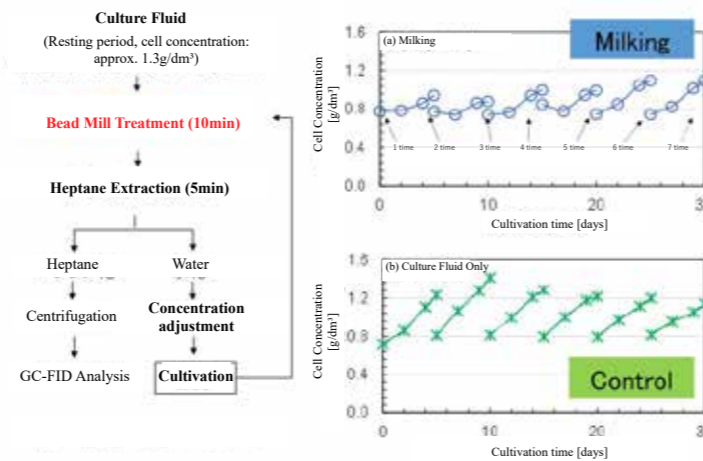


Minami Gamou Water Purification Center, Sendai.



Extraction Technology of Algae Oils

The traditional extraction of hydrocarbons from *Botryococcus braunii* utilized drying processes. However, the destruction of cells and the additional cost of energy was considered a huge problem. We applied heptane as extraction solvent with minimal repercussions on the cells and established a seven times per month milking process of extraction and cultivation.



Float chart of the established milking-cultivation experiment.

Objective 3 : R&D on Integrated Community Renewable Energy Control Systems to Enhance Human and Vehicle Mobility



Designing Local Energy Stations

We developed an autonomous power supply system based on rechargeable lithium-ion batteries, which can be supported in a variety of ways (e.g. solar power) both ordinarily and in times of emergencies, thus contributing to the functionality improvement of local disaster response centers. In ordinary times the system will use energy obtained from renewable resources, and in times of emergencies power shortages can be avoided by utilizing the vehicle to home (V2H) system of electric cars to provide power to evacuation shelters.



Energy supply utilizing an electric vehicle (EV) power station (V2H).



Solar energy station at Ishinomaki



Preparation for Disaster – Practical Implementation of Research Outcomes

We developed an integrative management system combining the information of electric vehicles as mobile power units and individual energy stations and implemented it in public offices of Ishinomaki, Miyagi. At the annual regional disaster response exercise, the city of Ishinomaki also integrated training sections using this system. The achievements of our research based on the experience of the disaster are certainly contributing to the design of a safe and secure city.



Practical implementation of the management system.



Promotion of the integrated management system



Operation Testing of Hybrid Methane Fermentation System

We developed a hybrid methane fermentation system utilizing the contents of cattle's rumen (first chamber of the stomach) offloaded from meat processing plants. The system achieved a conversion rate of 63% and an average of 4.5m³ biogas production per 12.4kg COD input per day. We also succeeded to generate electricity with the produced biogas, powering a small electric car or charging batteries.



Charging a small electric car with produced biogas fuel.



Disaster Resilient City Design via Renewable Energy Utilization

Due to the blackout and the suspension of energy supply in disaster stricken areas, the sole dependence on the currently existing energy grid is seen as a threat, and subsequently the utilization of renewable, unused energy resources attracted attention as a key feature of the new city design after the disaster, adopted by many communities in their reconstruction plans. However, renewable energy has many flaws such as low efficiency, unstable output, or high introduction costs, and propagation is going very slowly. Solar or wind power generation cannot sustain a stable enough power supply for grid-connection, meaning the continuous dependence on traditional power generation.

In order to create new options and to realize the utilization of renewable energy requested by disaster stricken communities, research to stabilize the currently unstable renewable energy production at low cost as well as development of a system spending all of the generated power without returning it to the grid are two main requirements.

Under the motto "Local Production for Local Consumption", we established a power supply system utilizing renewable energy independent from traditional electricity infrastructure and installed it to public facilities which are going to be evacuation shelters at times of disasters. In doing so, we were able to increase the response capabilities of local communities in case of emergencies and designed an advanced model promoting the utilization of renewable energy.



Installation of the new system in public facilities.



Signage content in real sites



Resource Circulation with Participation of Local Residents

We developed a high efficient methane fermentation system with a conversion rate of 85% which processes 12kg of raw garbage per day in Naruko, Miyagi. This system utilizes the disposed water from the hot springs as heat source and the raw garbage is provided by local residents. We were able to establish resource circulation with participation of community members by supplying collaborators with fermentation residue which can be used as liquid fertilizer. The operation of our system promotes the environmental education in the community as well.



Environmental education for elementary school children (at Naruko Hot Springs in Ohsaki, Miyagi)



Achieving ZEB 104% at the Eco Laboratory in the Graduate School of Environmental Studies

The Eco-laboratory of the Graduate School of Environmental Studies achieved the ZEB 104% (zero-energy building)* in March 2019. The improvements to achieve the ZEB status are part of the "Project for 100% Production of Renewable Energy" in collaboration with Enagia Inc.

*We achieved the ZEB 104% rating during the BELS evaluation of the Miyagi Building and Housing Center



A Regional Energy Utilization Example "ene café METHANE"

In July 2014 the "ene café METHANE" opened in Naruko, Miyagi, utilizing a small-sized methane fermentation system. The number of visitors already exceeded 2400 customers, becoming an attracting site in Naruko. "ene café METHANE" received the "Special Good Life Award from the Minister of the Environment" at the Third Good Life Awards by the Ministry of the Environment.



"ene café METHANE" in Naruko



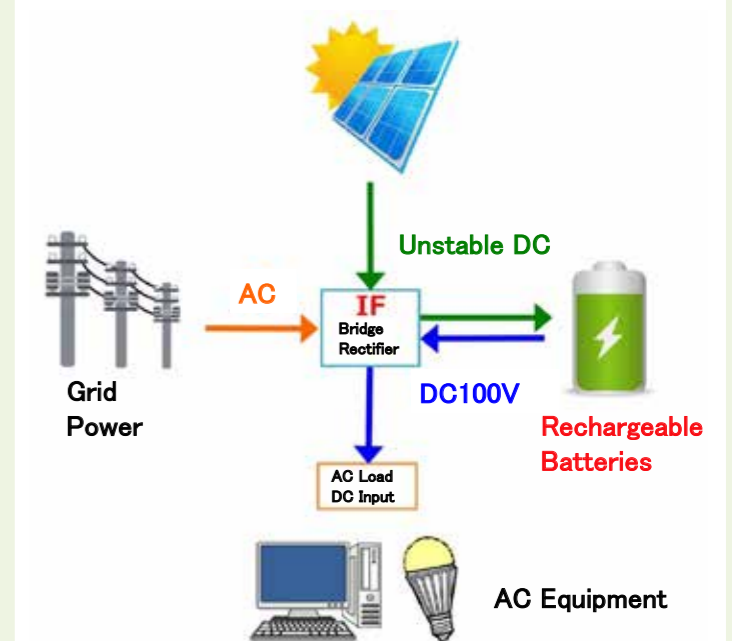
Re-utilizing Batteries of Hybrid Cars for Cheap PCS Alternative

In June 2019, the joint project "R&D for LIB Stabilizer Technology" with the Nomura Research Institute, Ltd. was selected by the "Project for the Development of CO₂-Efficient Recycle Technology" announced by the Ministry of the Environment. We aim to re-utilize old lithium-ion batteries (LIB) from hybrid cars - that will increase in numbers in the coming years - to establish stable solar power production. Currently the new system is tested at the experimental housings of HOKUSHU Co., Ltd. as alternative power conditioners to improve the quality of the power delivered to the equipment.



High Efficient Solar Power through the Re-utilization of Car Batteries

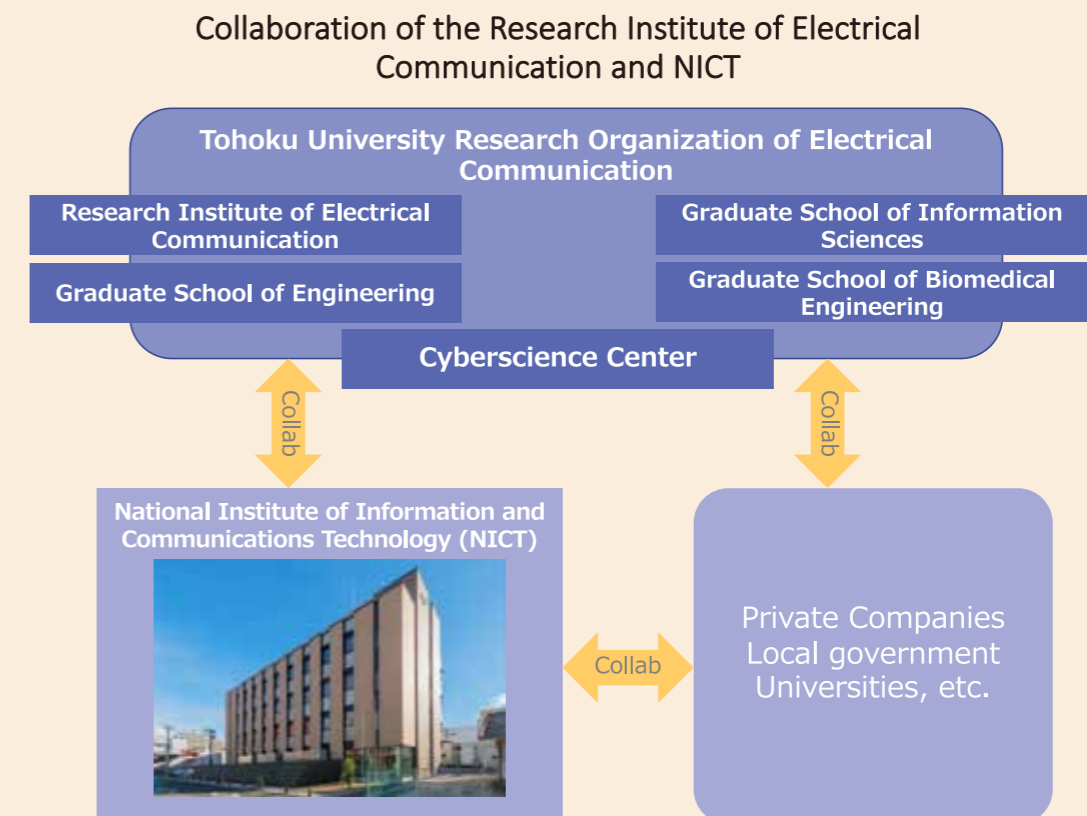
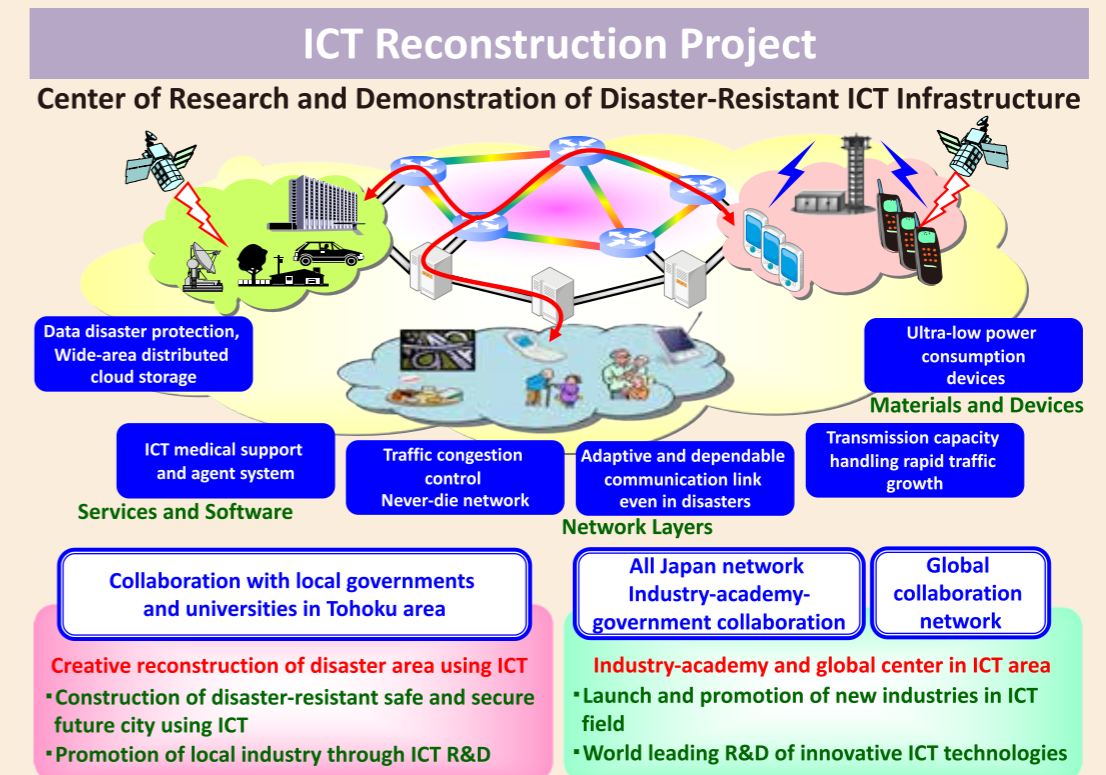
In August 2018, the joint project with Techno-Labo Co., Ltd. was selected by NEDO's "Project for the Development of New Energy Technology". We are currently experimenting with new ways to utilize lossless solar energy at the Eco-laboratory in the Graduate School of Environmental Studies. The project utilizes used car batteries and existing infrastructure to implement optimal energy conversion and low costs via minimalistic device structures.



Project 04

ICT Reconstruction Project

The Great East Japan Earthquake has highlighted vulnerabilities in information and communication technology (ICT), such as disruption of communication lines, inability to collect information, and lack of transmission information, and we have come to see issues that need to be resolved immediately. To meet these challenges, Tohoku University is working to develop and demonstrate disaster-resistant information and communication infrastructure, build safe and secure information and communication technology, and prevent urban disasters in the information and communication field. We aim to integrate research institutes and related industries that enhance our capabilities. In this project, we have established the Research Organization of Electronic Communication (ROEC), a cross-university organization centered on the Research Institute of Electronic Communication (RIEC), and are working to realize a "disaster-resistant information and communication network." In addition, we have concluded a comprehensive collaboration agreement with the National Institute of Information and Communications Technology (NICT), which is a public research institution that promotes research and development in the field of information and communication technology, and is one of the world's top level in Tohoku University. By establishing research bases and promoting joint research between industry, academia and government, we aim to realize disaster-resistant information and communications and revitalize economic activities in the affected areas.



Project Activities

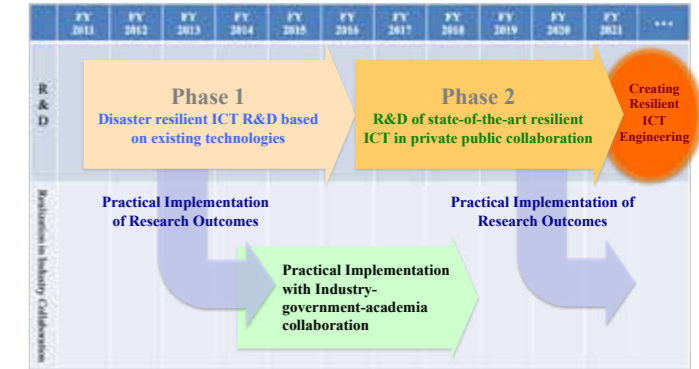
ICT Reconstruction Project

- 2011 10 Establishment of the Research Organization of Electrical Communication
- 2012 4 Establishment of the Resilient ICT Research Center in the National Institute of Information and Communications Technology (NICT)
- 10 Partnership agreement between Tohoku University and the Japan Agency for Marine-Earth Science and Technology
- 11 Demonstration of "R&D on multi-layered disaster information and communication systems integrating various methods of communication and broadcasting" funded by MIC
- 11 Demonstration of "R&D on fundamental integrated broadcasting and communication technology for swift communication of disaster information" funded by MIC
- 2013 1 MoU with France Télécom (now Orange)
- 2 Success of 2.5km message relays in urban areas with Wi-Fi function of smartphones
- 3 Development of ad-hoc network technologies via Wi-Fi in cases of communication line failures after disasters
- 3 "Disaster Resilient ICT Research Symposium and Demonstration of Disaster Resistant ICT - Connected & Never die!"
- 3 Symposium on the establishment of the NICT Resilient ICT Research Center
- 4 1st Orange-Tohoku University Workshop on Highly Robust Networks
- 7 ROEC Symposium "Toward the Regeneration of Tohoku via Disaster Resilient ICT"
- 7 First Issue of ROEC's "NEWS"
- 8 Demonstration of communication technology to transmit information from isolated areas in emergency situations (Success of demonstration of connection between with "Relay-by-Smartphone" and relay systems with unmanned aerial vehicles)
- 11 Tohoku University Tokyo Forum 2013 on Electronics and Information "From Recovery to Regeneration - Future Aspects of Information and Communication Technology"
- 11 MoU with the Industrial Technology Research Institute (ITRI) in Taiwan
- 2014 1 Connection between "Relay-by-Smartphone" and "ICT Car" (development of communication for the area far from evacuation center at a time of large-scaled disaster)
- 2 Demonstration of disaster resilient ICT R&D Project "ICT car to immediately recover communication network after Large-Scaled Disasters" funded by MIC
- 3 Demonstration of satellite communication networks at a time of disaster in Yamamoto, Miyagi
- 3 Development of communication system switching easily between mobile and satellite communication lines
- 4 Demonstration of power supply and efficient operation of network equipment at a time of disaster
- 2015 3 Demonstration of disaster resilient network technology in Kochi
- 7 Disaster response exercise with disaster response information system in Kashihara, Nara
- 10 Demonstration of Tohoku University's disaster response drill on SIP (disaster prevention & mitigation) Project
- 11 Demonstration in Cebu Island, Philippines on SIP (disaster prevention & mitigation) Project
- 2016 3 NICT Resilient ICT Research Symposium
- 8 Workshop with participation of the general citizen in San Remigio, Philippines on SIP (disaster prevention & mitigation) Project
- 11 Workshop with the Industrial Technology Research Institute (ITRI) in Taiwan
- 2017 6 Demonstration of "Relay-by-Smartphone" by Sendai Television Inc.
- 2018 1 Workshop with the Industrial Technology Research Institute (ITRI) in Taiwan
- 6 "Guidelines for a Disaster Resilient Information Communication Network" revised (vol.2)
- 7 Establishment of the innovation consortium for relay communication via smartphones
- 7 Participation in the Aqua LAN Consortium
- 10 Establishment of the JSPS R&D Committee "Realizing a Super Smart Society via Fusion of Power and ICT Networks"
- 2019 1 Workshop with the Industrial Technology Research Institute (ITRI) in Taiwan
- 3 Exchange about resilient ICT with the Technical University of Darmstadt
- 4 Operation of the "Tsunami SOS App" using "Relay-by-Smartphone" in Kochi
- 12 MoU with the Industrial Technology Research Institute (ITRI) in Taiwan
- 2020 6 "Guidelines for a Disaster Resilient Information Communication Network" update (vol.2.1)
- 10 First Public JST-OPERA Workshop "Creation of a convergence network technology for electric power and communication to realize the total optimization of an autonomous distributed cooperative DC microgrid"



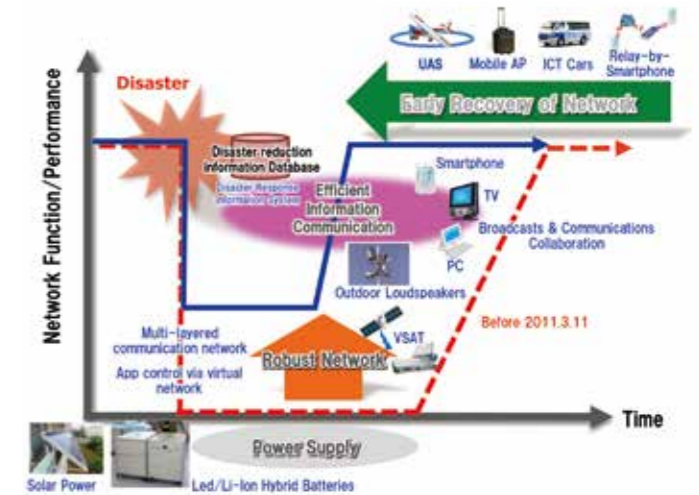
Research and Development Plan

In the first phase (5 years), we will develop activities for disaster-resistant ICT research and development based on existing technologies and social implementation through industry-academia-government collaboration, and in the second phase (5 years), we will develop cutting-edge resilience ICT. We are aiming to start research and development of resilience ICT engineering.



Phase 1: Disaster resilient ICT R&D based on existing technology

As disaster resilient ICT based on existing technologies, we conducted research and development on the following three topics: "Effective information acquisition and transmission systems at times of disasters", "Robust networks with enhanced disaster resistance", and "Ad-hoc networks for rapid network recovery"



Demonstration of "Relay-by-Smartphone"

We conducted a communication experiment using 27 smartphones at Tohoku University Aobayama Campus. Using the Wi-Fi feature on his smartphone, the email relay succeeded in sending and receiving the email without using the carrier's mobile phone line. As a useful communication tool in a disaster-affected isolated area,

you can freely build a network with just a smartphone. Aiming for social implementation of this relay-by-smartphone, a demonstration experiment was conducted in the center of Sendai City in 2013, and a email relay of about 2.5 km was successful. We held a participatory workshop for citizens to educate and disseminate to the general public that information can be communicated in the event of a disaster using the smartphone application that we usually use.

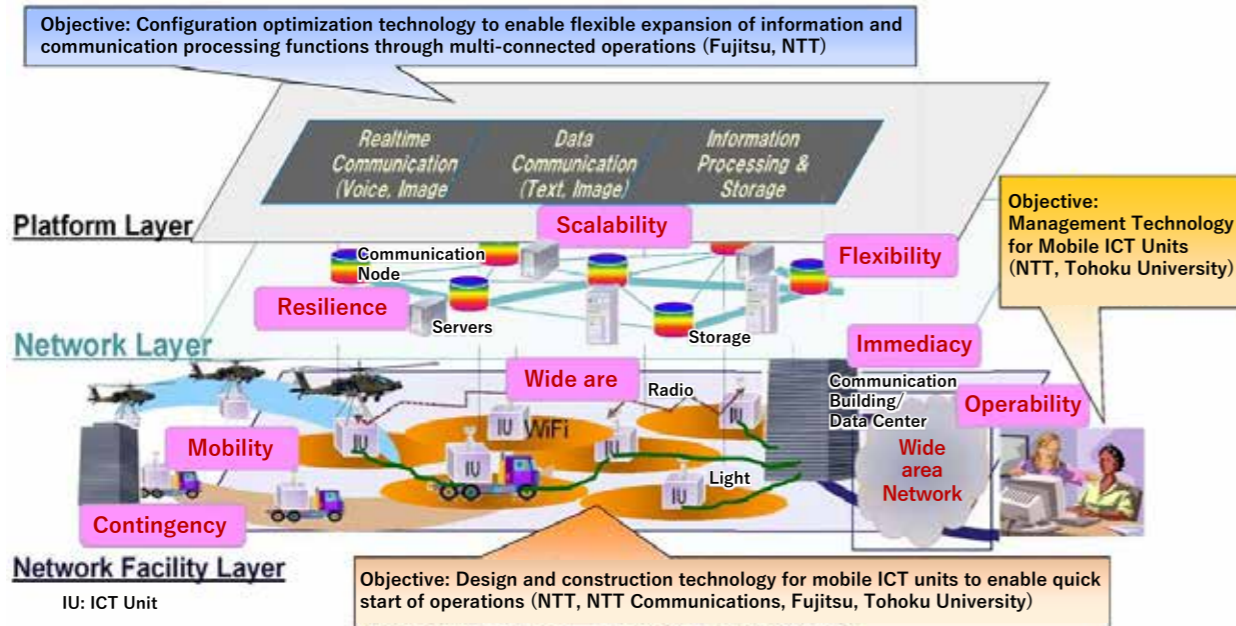
- Development of 2nd Generation Relay-by-Smartphone App.
- Currently only Samsung devices applicable. Generalization of the Wi-Fi controller for all Android devices.
- Discussing iOS support.



Workshop in San Remigio, Philippines.

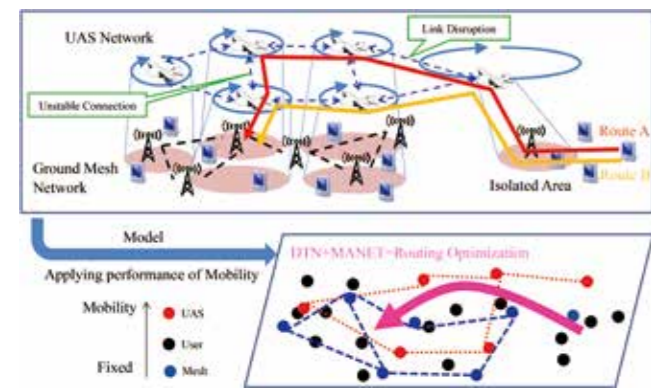
R&D of Portable ICT Units for Multiple Connections and Emergency Conveyance in Disaster Areas

We conducted research and development on a portable information and communication infrastructure (ICT unit) that enables the immediate launch of ICT services in the disaster area. We will improve mobility and wide area, and provide ICT services that can accommodate thousands to tens of thousands of users within two days of a disaster.



R&D of Shared and Collaboration Technologies between Radio Relay Systems of Unmanned Aerial Vehicles and Ground Networks

In order to cover the area affected by the disaster in a wide area and flexibly, we conducted research and development to quickly build a temporary network that integrates unmanned aerial vehicles and ground networks. It is expected to be used in event venues where communication lines are interrupted in isolated areas during a disaster or where communication is congested.



R&D of Disaster Prevention Information Database Systems for Disaster Response Support

Tohoku University, Kyoto University Disaster Prevention Research Institute and NTT Research Institute have conducted research and development of disaster prevention information database (DB) system. This database system enables disaster prevention personnel to share disaster prevention information and manage disaster response operations based on unified situational awareness, enabling prompt and fair support to disaster victims.



Satellite Communication Networks at Times of Disasters

We conducted research on technologies such as multi-mode aperture terminals, low energy mobile aperture terminals, and communication bandwidth optimization controls to secure satellite channels depending on the situation in disaster areas. Utilizing these technologies, we can secure communication lines even if ground networks are unavailable in the event of a disaster.



Excerpt from the "Disaster Resilient ICT Symposium" March 25, 2013.

Developments Toward Practical Implementations

During the first phase, we are conducting experiments in various places for practical implementation of R&D outcomes based on existing technology.



Demonstration of "Relay-by-Smartphone" by Sendai Television Inc.

In the period from June 12, 2017, to July 31, 2017, we held the disaster prevention and mitigation mystery event utilizing "AirBaton", temporarily implementing "Relay-by-Smartphone" in Sendai TV's news application in collaboration with Sendai Television Incorporated, NTT Docomo, and Kozo Keikaku Engineering Inc.. We demonstrated the practical functionality of messaging and services of the ad-hoc communication technology provided by "Relay-by-Smartphone" in this event. By conducting further demonstrations, we aim for practical use of our technology in the near future.



Excerpt from Sendai Television's web page.

Demonstration of Disaster Resilient ICT during Disaster Response Drill of Tohoku University's Headquarters

We demonstrated voice communication of smartphone via IP-PBX for emergency situations, web conferences and online camera monitoring to secure communication lines between Kawauchi and Katahira Campus with Portable Radio Communication Systems (FWA) and mesh networks, and tested communication during the Disaster Response Drill at the Headquarters (October 2015). We also demonstrated the e-mail message transmission via "Relay-by-Smartphone".



Demonstration of Internet Connection via Satellite Link in Evacuation Shelters

We demonstrated satellite communication networks during times of disasters, at the town office of Yamamoto in Watari, Miyagi, in March 2014, for practical use. We provided insight to this technology and presented the ease of establishing internet connectivity via smartphones by simply activating equipment at evacuation shelters as well as methods to obtain power supply for houses utilizing hybrid cars. Part of the demonstration was also to show that necessary operations can be performed by disaster victims themselves at evacuation shelters and do not need specialists on site.



Demonstration of Power Supply and Efficient Network Equipment Operation in the Event of Disasters

Theoretically estimating the duration of power supply with the electric storage via renewable energy power generation, we developed a design method for off-grid life. We verified that we can live off-grid for more than one year without blackouts by an independent electrical supply with electric storage and solar power.



"The off-grid power supply experiment by solar power exceeds one year. Uninterrupted power supply record updated."

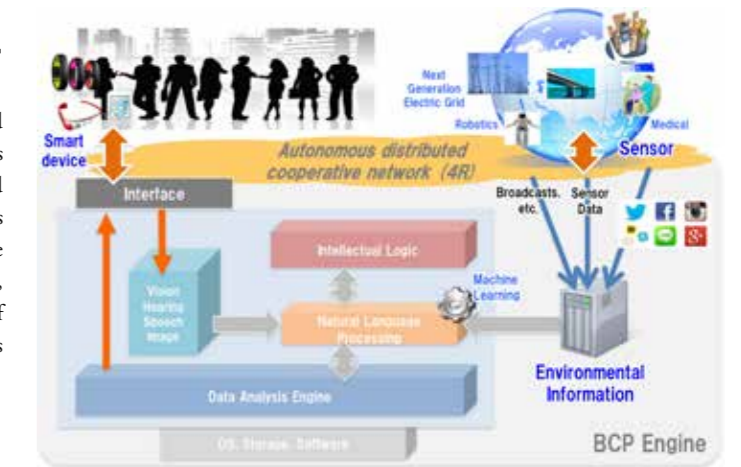
Demonstration of Disaster Resilient Network Technology in the City of Kochi

In cooperation with the prefecture as well as the city of Kochi, we demonstrated disaster resilient network technology in the city of Kochi in March 2015. We demonstrated to connect isolated areas which lost communication methods with areas still having some communication available via ad-hoc relays, presented the efficiency of broadcast and group communications to inform residents and organize emergency disaster responses, as well as exhibited the utilization of familiar smartphones as emergency response communication devices, and thus providing a low cost disaster communication system.



2nd Phase: R&D of Cutting-Edge Resilient ICT

We aim for the realization of ICT networks with drastically improved resilience in the event of a large-scaled disaster via analyzing various environmental information, recognizing the state of destruction and operational statuses of networks, and coordinating various ICT networks autonomously. We will realize the "BCP Engine" supporting the Business Continuity Planning (BCP) of the government, communities, corporations, and individuals, to drastically improve the resilience of social activities in the event of a mega-disaster via analyzing various information of the environment.



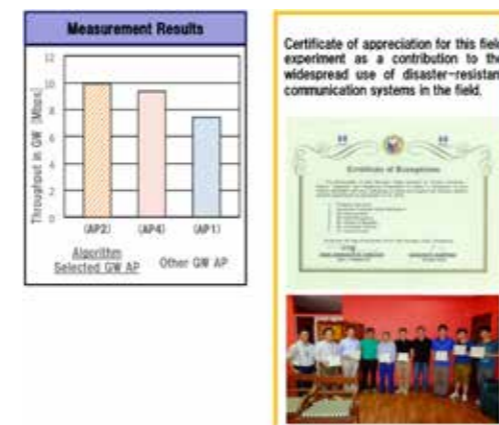
Workshop and On-the-Job training in Kashihara Utilizing the Disaster Response Information Systems

For the practical implementation of JST RISTEX's research results, we conducted a workshop and on-the-job training for disaster response in Kashihara, Nara, in July 2015. We presented research results to staffs of disaster response units and also got feedback for future research as well as practical implementation.



Demonstration of Optimization Algorithm for Network Function in Cebu

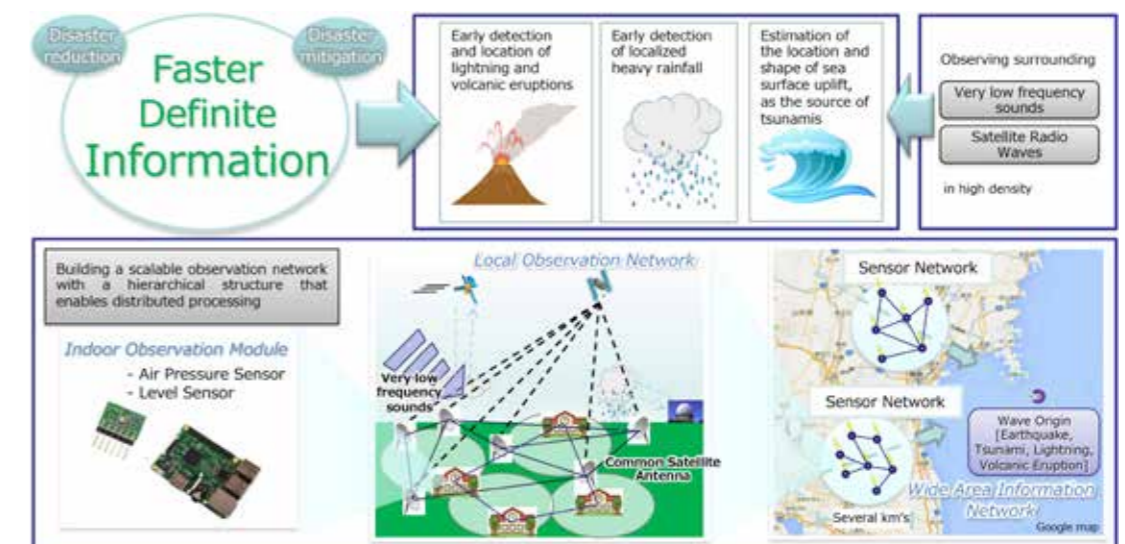
We demonstrated interconnected experiments of our "Optimization Algorithm for Network Functionality" with the disaster resistant radio communication system "Portable ICT Unit" developed by NTT Network Innovation Laboratories in Cebu Island, Philippines, in November 2015, and thus verified the feasibility. During the experiments, we succeeded in acquiring and accumulating important information regarding the safety of disaster victims outside the communication area at the disaster response headquarters.



R&D of Sound and Radio Wave Sensor Networks for Early Disaster Detection

Crustal deformation and meteorological phenomena leading to huge natural disasters have the tendency to manifest with atmospheric pressure changes accompanied by ultra-low frequency sound waves, not noticeable by human senses. Spatially accurate distribution maps

of rainfall are a valuable source of information to predict water and landslide disasters after locally torrential rain, increasing the recent years. We conduct research and development to prepare for these disasters and mitigate the damages with the sensor network of sound and radio waves common in our everyday life to obtain relevant information of signs related to approaching disasters.



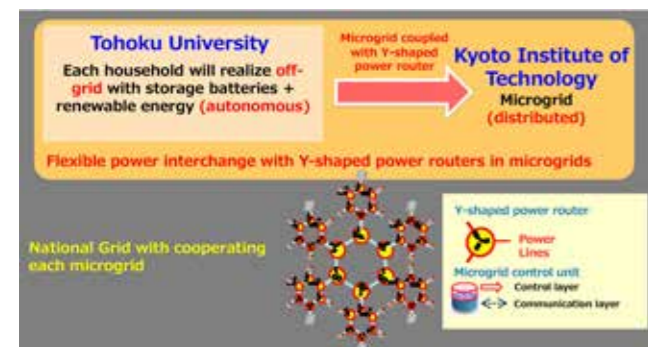
R&D of Communication Network Technology for the Effective Frequency Utilization of Unmanned Aerial Vehicle Systems

We design and develop resource allocation control algorithms that enable frequency sharing in multiple unmanned aerial vehicle systems operating in the same airspace. For efficient resource allocation, we construct and design the theory of resource allocation control algorithm based on position information, priority, resource requirement, etc., and evaluate the performance and resources in consideration of the actual usage scenario of the unmanned aerial vehicle system and the delay time caused by the allocation control algorithm. With this development, it will be possible to transmit the data acquired by unmanned aerial vehicles to ground control devices in real time, and it is expected that unmanned aerial vehicles will be used for agriculture, home delivery, bridge inspection, etc.

Research on Grid Systems with Emergent Synthesis Function on Recursive Structures

In order to strengthen the resilience of the power grid, we are conducting the following research and development to realize an autonomous decentralized cooperative power grid that is not the conventional hierarchical / centralized type.

- (1) Physical configuration method of the micro grid consisting of Y-shaped power routers and the national grid consisting of microgrids.
- (2) Coordinated control method of power distribution.
- (3) Cooperation with resilience ICT that transmits the above control signals.

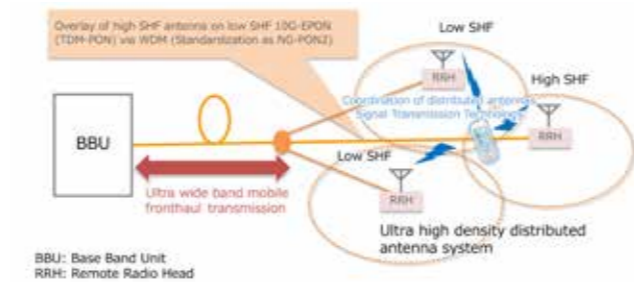


Participation in the Aqua LAN Consortium

In an underwater environment where only limited means such as sound waves can be used, the communication environment is harsher than on land. In developing disaster resilient ICT technology for LAN, microwave transmission, sensing and power supply, we are able to overcome the "digital divide" still present in many areas. This technology can also be utilized for seabed exploration during disaster recovery after tsunamis.

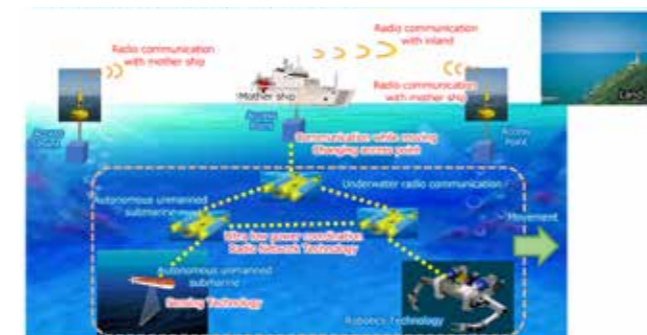
Research and Development of 5th Generation Mobile Communication System

In the 5th generation mobile communication system that enables "high speed / large capacity", "ultra-low latency", and "multiple simultaneous connections", we are researching distributed antenna coordinated signal transmission technology and ultra-wideband mobile fronthaul transmission technology. Development was carried out in a research commissioned by the Ministry of Internal Affairs and Communications (FY2014-FY2018), with the aim of improving system capacity (more than 3 times), reducing RRH transmission power (more than 3 dB), and highly efficient accommodation of RRH in BBU. Achieves a long extension (loss budget of 20 dB or more).



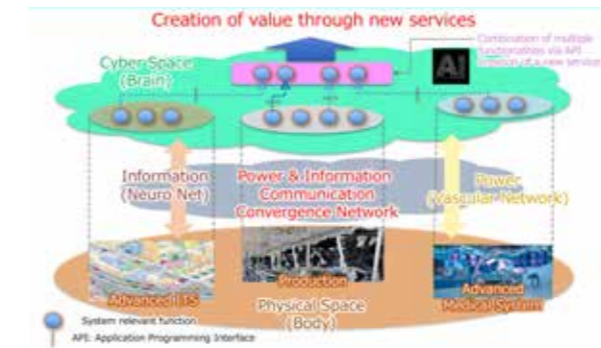
JST-Mirai Program

We will promote the research and development of the "event management and seamless crisis response platform" adopted as the JST Future Society Creation Project in FY2018, and each organization responsible for crisis response will be assigned to the system used in daily work. We are aiming to build an information environment that can be operated by easily adding functions according to the situation. Specific functions as app on KADAN developed by NTT. We will realize a crisis response support system that can be installed.



Establishment of a JSPS R&D Committee

Assuming that a resilient social infrastructure that integrates information and communication networks and electric power will be the key to the realization of an ultra-smart society, we will pursue academic omnidirectional research in the integration of electric power and information, communication networks, and develop technology through industry-academia-government collaboration. For the purpose, on October 1, 2018, the Japan Society for the Promotion of Science established the Research and Development Special Committee for "Ultra-Smart Society by Convergence of Power and Information and Communication Network Infrastructure" (October 31, 2018 press release).



Guidelines for a Disaster Resilient Information Communication Network (vol.2)

In June 2014, the Disaster-Resistant ICT Research Council announced the "Guidelines for Introducing Disaster-Resistant Information and Communication Networks," based on the experience of damage and obstacles to information and communication networks caused by the Great East Japan Earthquake, which hindered local government operations. However, in consideration of the subsequent technological development, etc., in cooperation with the local government, the guideline was revised from the "local government's perspective" and the second edition was formulated. Based on the subsequent development trends of new services, etc., we reviewed the disaster-resistant information and telecommunications network services described in ANNEX of the guideline and revised them as version 2.1 in June 2020.

- Contents of the Guidelines (Vol.2)
1. Objective & Purpose of Guidelines
 2. Importance of Risk Management
 3. Risk of Disaster & Communication Disruption
 4. Measures for Future Disasters
 5. Image of Information Communication Network in Communities
 6. Duties in Communities at Times of Disasters
 7. Government Support to Maintain Communication at Times of Disasters
 8. Communication Maintenance during Disruption (Examples)
 9. Issues and Solutions for Communication Maintenance (Presentation of Practical Information Comm. Networks & Services)

The digital file is available at the following URL
https://www.soumu.go.jp/menu_seisaku/ictseisaku/ictR-D/saigai/02tsushin03_04000414.html

Exchange with the Technical University of Darmstadt

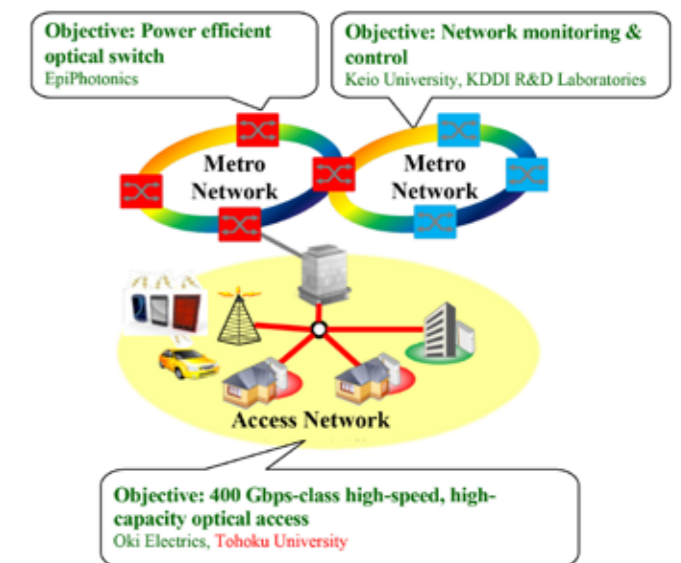
On March 11, 2019, we exchanged views on resilience ICT with Technische Universität Darmstadt.



Innovative Optical Network Technologies for New Social Infrastructure

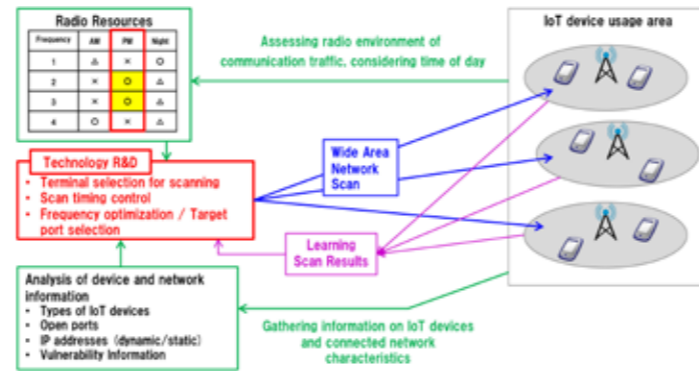
With the spread of IoT and the development of mobile systems such as 5G, it is expected that communication traffic will continue to increase in the future, and it is especially urgent to increase the capacity and efficiency of access metro networks applied to mobile fronthaul and backhaul. We will establish 400 Gbps-class high-speed and high-capacity optical access technology and network monitoring and control infrastructure technology to increase the capacity and efficiency of access metro networks.

Collaboration of Keio University, Oki Electric Industry, Tohoku University, NEC Corporation, KDDI R&D Laboratories, EpiPhotonics Corp.



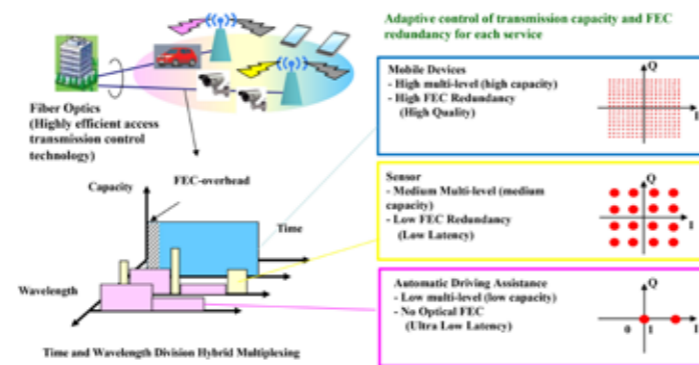
R&D of IoT Wireless High-Efficiency Wide Area Networks Scanning Technology

In order to scan the network over a wide area with high efficiency for the global IP address assigned to IoT devices all over Japan, the goal is to significantly reduce the amount of communication related to network scanning compared to existing technology. We are engaged in research and development of wide area network scan technology that automatically estimates usage status and wireless communication volume reduction technology for wide area network scan. communication volume reduction technology for wide area network scan.



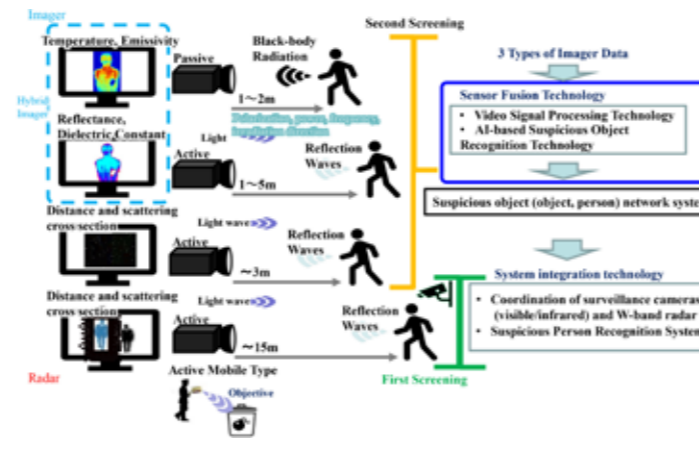
Research and Development of Advanced 5th Generation Mobile Communication System

While the introduction of 5G (5th generation mobile communication system) is progressing, mobile communication traffic is steadily increasing. In addition, after 2025, when 5G will permeate society, more diverse communication services will be deployed than ever before. In order to support such large-capacity and diverse communication services, further sophistication of 5G is required. In this research, we are working on research and development of wireless integrated control technology that realizes adaptive RAN (Radio Access Network) in order to provide highly reliable and diverse services that can respond to normal times, disasters, and emergencies.



R&D of radar technology for advanced recognition of moving objects to enhance security

Various types to ensure a sufficient security level without stopping the flow of people in subways, airport lobbies, large-scale customer attraction facilities (shopping malls, concert halls), etc. where an unspecified number of people gather and security is relatively loose. We are engaged in research and development of advanced recognition radar technology for moving objects to recognize suspicious persons and ensure security by processing data from sensors.



MoU extension and workshop held with Industrial Technology Research Institute (ITRI) in Taiwan

In November 2013, we established an MoU with the Industrial Technology Research Institute (ITRI) in Taiwan. We are promoting disaster resilient ICT research in collaboration with the Information and Communication Research Labs (ICL). The MoU was updated in 2016, strengthening our partnership.

On December 17, 2019, the MoU was updated again, and workshop was held to present and discuss the results of research projects in the field of resilient wireless networks for the era beyond 5G. We will continue our joint efforts and exchange ideas at regular workshops in the future.



Signing the updated MoU (December 17, 2019)

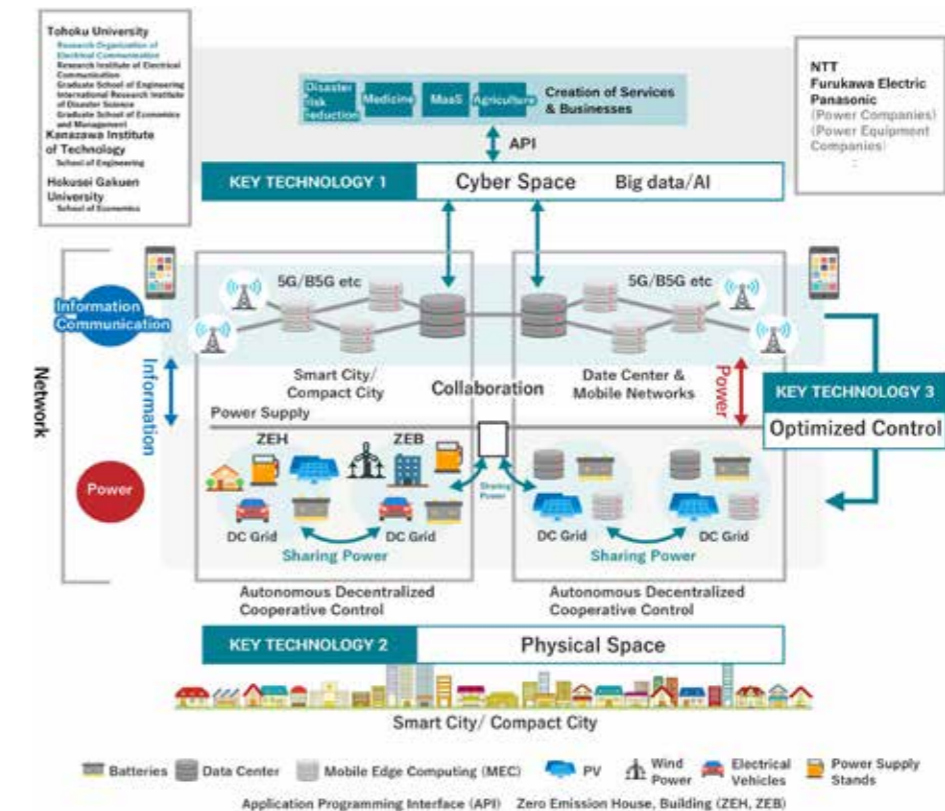


ITRI - Tohoku University - YRP Workshop (December 17-18, 2019)

Adopted as JST-OPERA co-creation platform development type

"Creation of Power / Communication Integrated Network Platform Technology to Realize Overall Optimization of Autonomous Decentralized Cooperative DC Microgrid" was adopted for 2019 JST Industry-Academia Co-creation Platform Joint Research Promotion Program (OPERA). With the aim of creating a sustainable and

resilient new-generation social infrastructure, that is essential for the ultra-smart society of Society5.0, we will build a new smart city / compact city network infrastructure that links information and communication networks and electric power networks, autonomous decentralized coordinated control of data traffic and power supply and demand between grids. We are working on the development of technology for overall optimization of power interchange through Big Data & AI through industry-academia collaboration.

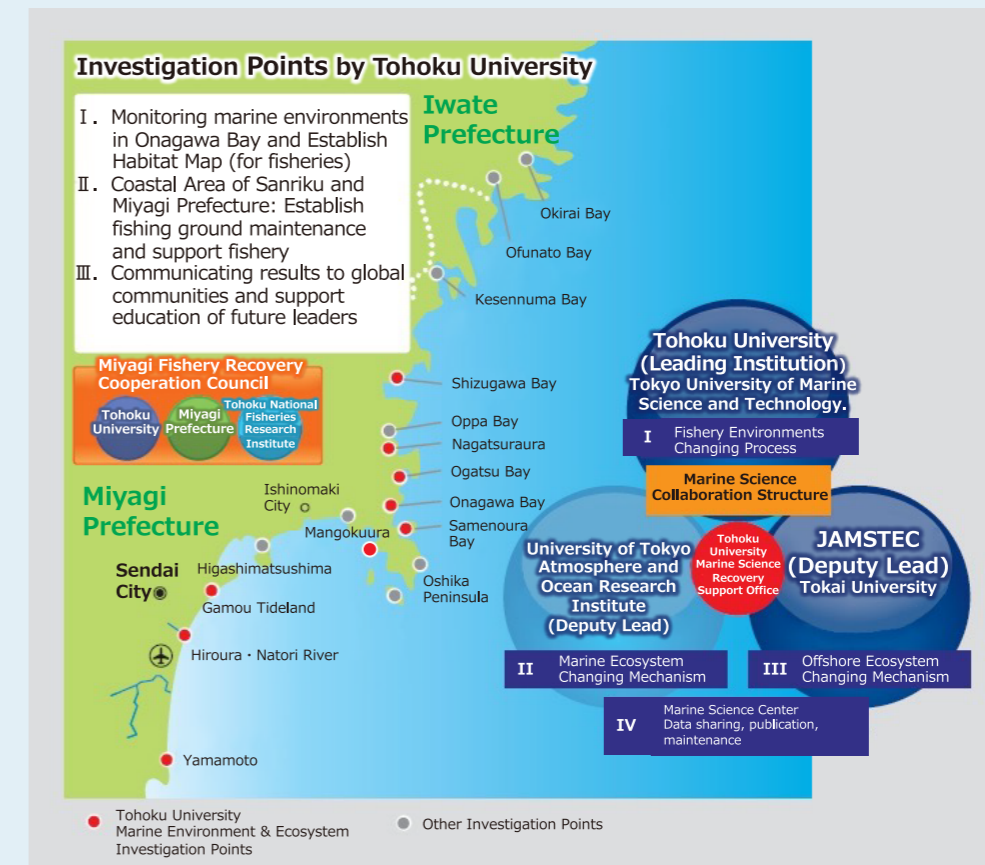


Project 05

Tohoku Marine Science Project

Due to the 2011 Great East Japan Earthquake and resulting tsunami, the coastal area of Tohoku and its wealth of bio-resources and services were tremendously damaged. In order to recover coastal communities, the restoration of the marine environment was essential. However, unlike the situation in land, the ocean cannot be observed directly. It was therefore crucial to obtain a detailed understanding of the marine environments as well as the changes to the ecosystems.

To regain the rich seas by the power of robust science, Tohoku University (lead institution), Atmosphere and Ocean Research Institute at the University of Tokyo (deputy lead) and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) (deputy lead) initiated a decade-long project called "Tohoku Ecosystem-Associated Marine Sciences" (TEAMS). Tohoku University engaged in the "Analysis of the Change Process of Fishing Grounds" and we were able to not only explore the marine environments as well as the ecosystems, but also establish means to restore the population of sea urchins in Sizugawa Bay, develop methods for aquaculture management of oysters, provide efficient means to cultivate scallops in Ogatsu Bay, support the cultivation of a prosperous marine environment and sea cucumber cultivation in Onagawa Bay, and help to restore fishery in the areas of Natori and Yamamoto. This year was the final year of the project, and as a result, we printed and bound a report summarizing the TEAMS activities and distributed it throughout Japan, presented the activities at a public symposium hosted by the Science Council of Japan, and held a report meeting in the disaster stricken town of Onagawa. We also engaged and collaborated with the community in public relations.



Project Leader
Graduate School of Agricultural Science
Professor Akihiro Kijima

It has been almost 10 years since the devastating earthquake and tsunami that struck the region on March 11, 2011. Since then, all of us who have participated in this project have always thought about supporting the recovery of the fishing industry, which is the key industry in the disaster stricken areas. The question is how to clarify the changes in the marine environments and marine ecosystems, which are the most fundamental elements, and how to utilize them for reconstruction. All of the participants made use of their respective specialties in their actions. I felt that each sentence in the report compiled this year was engraved with their thoughts. We have been able to continue this project for the past 10 years because of all the people who have worked with us on the research. I would like to express my sincere gratitude to everyone who has worked with us on this project over the past 10 years. Although we have not yet reached the point of complete reconstruction, I hope that we will continue to develop to a new stage, valuing "collaboration," "bonds," and "unity" that we have learned from the disaster. Thank you very much.

Project Activities

Tohoku Marine Science Project

- 2012 1 Establishment of the TEAMS Project (Research of Marine Ecosystems)
- 2012 2 TEAMS mini-symposium "Impact of the Great East Japan Earthquake on the Marine Ecosystems and Efforts for Reconstruction"
- 2012 4 Tohoku University - JAMSTEC joint symposium "One Year after the Great East Japan Earthquake - Lessons Learned and Best Practices"
- 2013 6 Conference of the TEAMS Project at the Multi-media Building in Kawauchi
- 2013 11 TEAMS public symposium on Investigation of the Marine Ecosystems "What Happened to the Sea along Tohoku?"
- 2014 3 The Japanese Society of Fisheries Science Symposium "Current State of Coastal Regions in Tohoku after Three Years of the Earthquake and Tsunami - Natural Disturbances by the Disaster and Anthropogenic Disturbances by Reconstruction"
- 2014 10 TEAMS public symposium on Investigation of the Marine Ecosystems "Toward Reconstruction - The Sea in Tohoku"
- 2015 3 TEAMS symposium "How Did the Great East Japan Earthquake Affect Marine Ecosystems?" in the public forum, the World Conference on Disaster Risk Reduction
- 2015 9 Co-hosting the 2015 Special Symposium of the Board of Directors of the Japanese Society of Fisheries Science, "The Sea of Tohoku: Research Results and Fishery Recovery Four Years after the Earthquake"
- 2016 3 International TEAMS Symposium on Restoration after Great East Japan Earthquake-Our Knowledge on the Ecosystem and Fisheries
- 2016 6 23th Pacific Science Congress (PSC) Session "Science for a huge Disaster-Lesson from Great East Japan Earthquake and others in Asian countries"
- 2016 9 MEXT Tohoku Marine Science Committee meeting to explain the progress of TEAMS activities
- 2016 10 Public TEAMS Symposium "The Future of Marine Science in Tohoku"
- 2017 3 The Miyagi Fishery Recovery Cooperation Council public symposium "Disasters and Oceans - Future Fishery and Aquaculture"
- 2017 6 Report on TEAMS activities at the preliminary field survey for the administrative review by the Reconstruction Agency
- 2017 6 Introduction of the TEAMS project at the APEC Economy Project Meeting
- 2017 11 World Bosai Forum session "Marine Ecosystem Disturbances by Earthquakes and Tsunamis"
- 2018 2 MEXT Tohoku Marine Science Committee meeting to explain the progress of TEAMS activities
- 2018 3 The Miyagi Fishery Recovery Cooperation Council public symposium "Disasters and Oceans - Changing the Oceanic Environment and Aquaculture"
- 2018 10 Public briefing of TEAMS's activities at the signing ceremony for the collaboration of the Graduate School of Agricultural Science with the town of Onagawa
- 2018 11 "Restore the Tohoku Sea! A Day with 'Marine scientists'" at Miraikan
- 2019 3 The Miyagi Fishery Recovery Cooperation Council public symposium "Disasters and Oceans - Changing Fishery toward the Future"
- 2019 6 Conference of the entire TEAMS Project
- 2019 12 Exhibition of TEAMS panels with the cooperation of the Japan Science Museum Association (explanations were given at the Mie Prefectural Museum and the Kuji Underground Aquarium in Iwate Prefecture).
- 2020 1-3 Exhibition of TEAMS panels with the cooperation of the Japan Science Museum Association (Explanations at Tokai University Marine Science Museum in Shizuoka Prefecture and Kochi Mirai Science Center in Kochi Prefecture).
- 2020 9 Exhibition of TEAMS panels with the cooperation of the Japan Science Museum Association (Explanation at Aquamarine Fukushima).
- 2020 11 Publication of the full report on the results of the TEAMS Project (research on marine ecosystems) and nationwide distribution
- 2020 11 Co-hosted the public symposium organized by Science Council of Japan "TEAMS Project and the Future of Fisheries Research: Toward a Prosperous Ocean with the Power of Science"
- 2020 11 Public TEAMS Symposium "The Future of Fishery"
- 2020 11 Publication of the summary version of the TEAMS report on the activities of the research group and distribution in disaster stricken areas
- 2020 11 Publication of the "Onagawa Bay Habitat Mapping" and wide distribution to fishermen, fishery-related people, local governments, elementary and junior high school students, and the general public.



Seaweed Beds in Shizugawa Bay

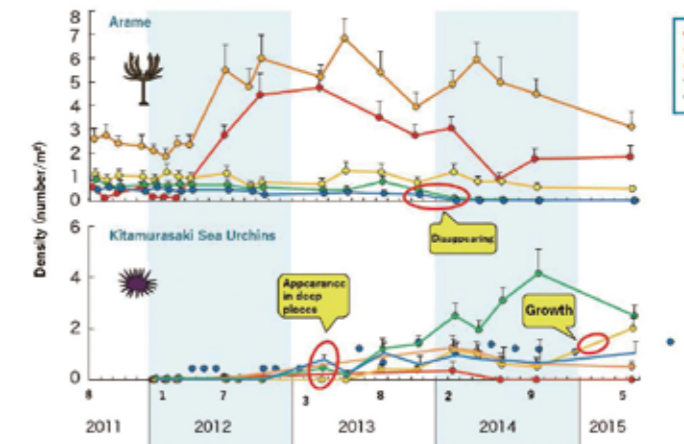
Seaweed beds comprising mainly Arame (*Eisenia bicyclis*, a sea oak species) were a common feature in the coastal rocky reefs of Shizugawa Bay. Kitamurasaki sea urchins are known to feed on Arame and the



Invasion of Kitamurasaki urchins in seaweed beds (schematic presentation)

Changes in Arame and sea urchin density in Shizugawa Bay

Measured at 5 depths in continuous observation area (1m² square frame, n=20)



harvest of the urchins is commercially important here. Although the Great East Japan Earthquake destroyed ca. 75% of the Arame beds, the affected areas almost fully recovered in the following year. However, due to dramatic increase in the urchin populations, it was revealed that about half of the seaweed beds were lost by 2015.

Kitamurasaki Sea Urchins in Shizugawa Bay

Due to the outbreak of Kitamurasaki sea urchins, it is a major concern of local communities that the reefs might be denuded and the quality of the urchin harvest deteriorates. We therefore collected the urchins with

local fishermen and cultivated them in baskets for several months to examine the quality of the urchin roe (gonads). We found that addition of kelp in the feeds increased the quality of the urchins both in taste and color. We now consider ways forward to apply these results for fishery operations in collaboration with local fishing communities.



Kitamurasaki Urchins feeding directly on Arame (Shizugawa Bay, Feb. 27, 2014)



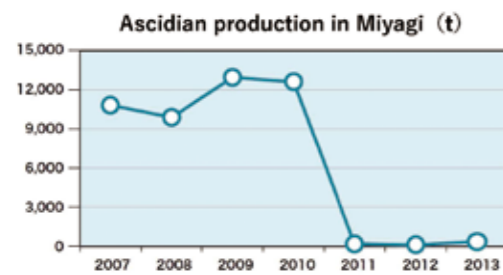
Efficient utilization of the urchin outbreak for cultivation (prevention of reef denudation)

Towards restoration of the Ascidian Cultivation in Samenoura Bay

Before the earthquake, about a third of Japan's edible ascidians were produced in Samenoura Bay, placing it in the first rank as well as being most important for the provision of ascidian seeds in Japan. However, all cultivated ascidians were destroyed by the tsunami, and almost no cultivation or production was made in Miyagi for three years after the earthquake. We aimed for the early recovery of ascidian cultivation and investigated post-tsunami spawning and larval distribution to estimate new locations of larval settlement using numerical simulations of particle transport and diffusion. We thus established efficient methods to extract seeding from surviving ascidians in collaboration with local fishermen.



Massive outbreak of ascidians similar to 2011.



Search for seeding places.

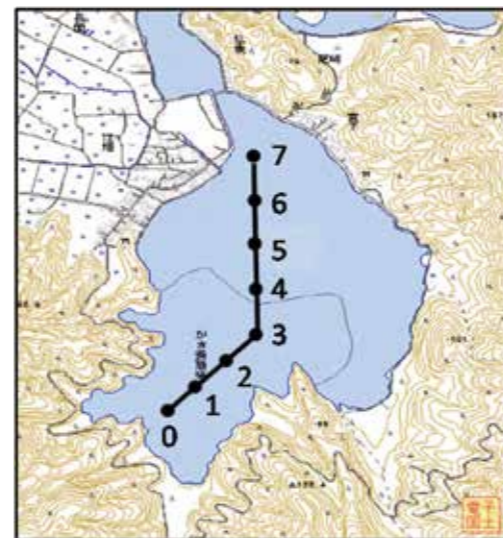


Environmental monitoring of Nagatsuraura

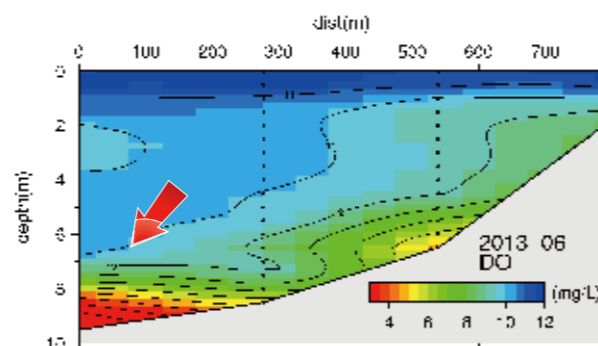
Environmental hypoxia was a common phenomenon in Nagatsuraura, often resulting in massive fatalities among cultivated oysters that are important to the local industry. Although the waterways expanded after the earthquake and tsunami, hypoxia still remains occurring during summer in deeper layers of the water. In order to establish a stable and sustainable oyster cultivation in Nagatsuraura, we conduct real time observations and routine environmental surveys by ship so that we can develop new farming methods in collaboration with local fishermen and thereby increase the production of the oysters.



Equipment for environmental observations



Sampling stations for the routine survey

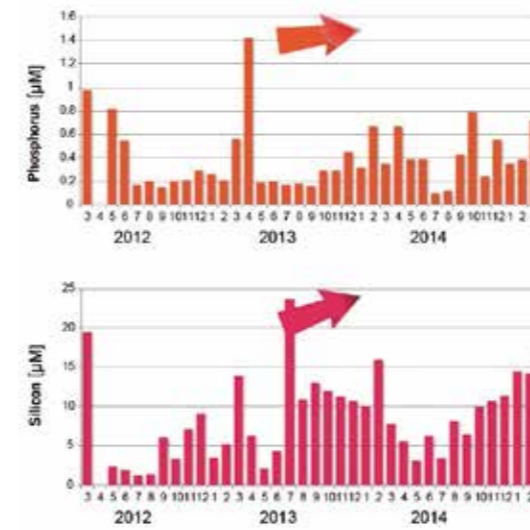


Hypoxia layer in lower depths of Nagatsuraura

Nutrients, Phytoplankton, and Zooplankton in Onagawa Bay

After the Great East Japan Earthquake, we started monitoring changes in nutrient loads and the abundances of both phytoplankton and zooplankton in Onagawa Bay because these interactions provide a basis for marine productivity. We found that the concentrations of nutrients sharply decreased immediately after the earthquake, yet the levels have been gradually recovered to date. The abundance of phytoplankton has increased accordingly, and a similar increasing trend

Changes in nutrient loads over time

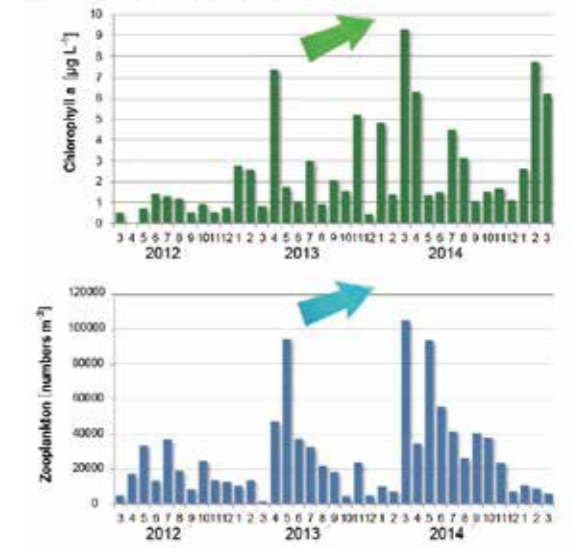


has also been observed for zooplankton. We will continue to monitor how the nutrient-plankton interaction changes over time in response to the recovery and expansion of the aquaculture operations in Onagawa Bay.



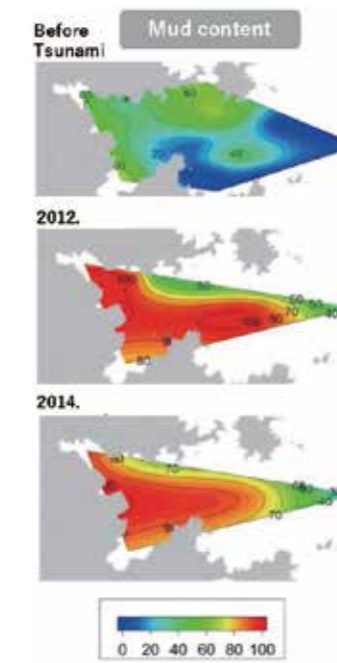
Marine food chain

Changes in phytoplankton/zooplankton abundances over time

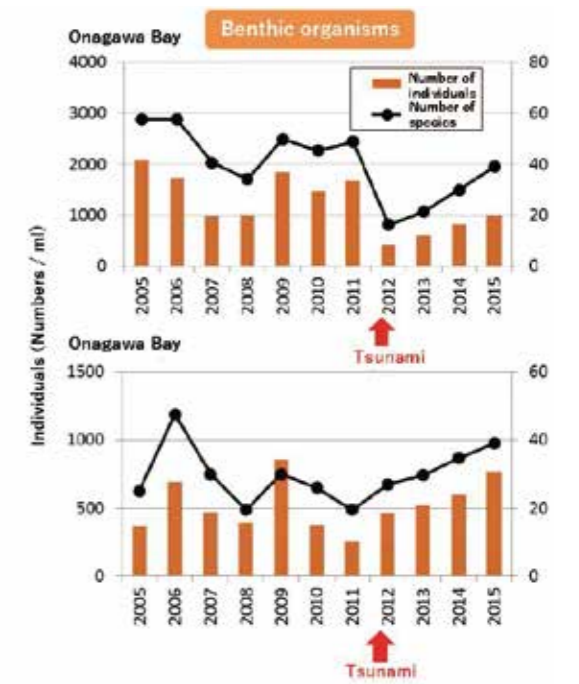


Alteration of the Seafloor Environment due to the Tsunami in Onagawa Bay

In Onagawa Bay, a significant amount of mud was accumulated on the seafloor after the 2011 tsunami, indicating an increased amount of organic and sulfide substances and a deterioration of the seafloor environment. Although the proportion of mud still remains high, the amount of mud has been gradually reduced in some places, and benthic organisms which drastically declined in numbers after the tsunami, have also been recovered accordingly. The diversity and abundances of benthos observed offshore did not, however, show as much pronounced change as those observed inshore seafloor environment, indicating that the impact of the tsunami on the benthic communities was most significant around the inshore harbor area.



Changes in mud proportions in Onagawa Bay

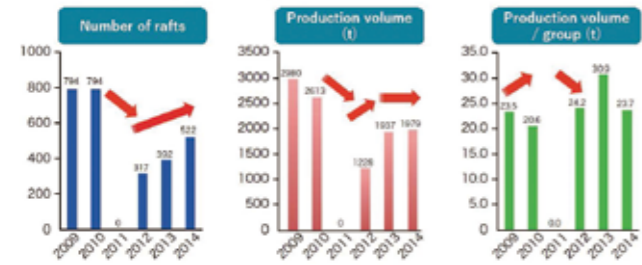


Changes in abundance of benthic organisms inshore and offshore Onagawa Bay

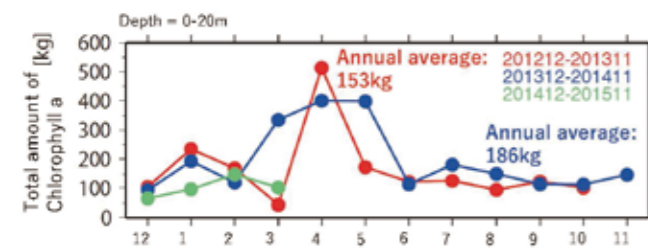
Scallop Farming in Ogatsu Bay

To assess the environmental conditions and carrying capacity of the fishery grounds after the 2011 earthquake in Ogatsu Bay, we investigate changes in production and growth conditions of cultured scallops. We also examine environmental data taken directly from the cultivation sites and analyze factors that affect the production and growth of the cultured scallops. Based on these results, we attempt to help restore the tsunami-affected fishery grounds and thereby contribute to implementing new and effective management of marine resources for the fishing communities.

Change in scallop production and cultivation facilities before and after the earthquake in Ogatsu Bay



Change in Chlorophyll a in the water column shallower than 20m

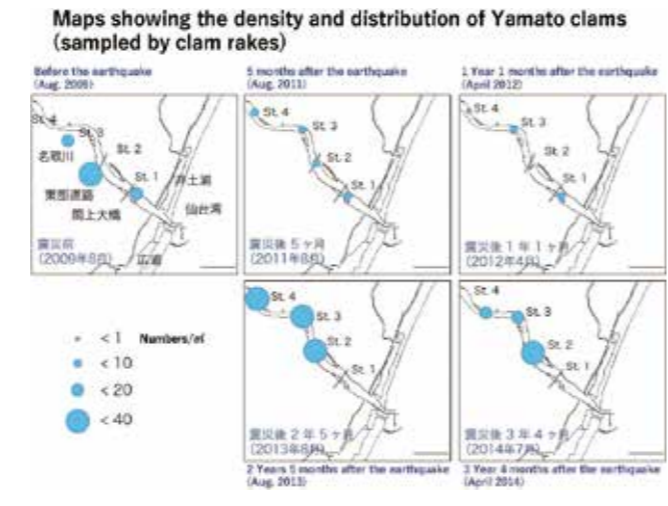


Yamato Clams of the Natori River

Yamato clams (*Corbicula japonica*) are an important marine resource harvested along the brackish water of the Natori River. The clam population decreased to a tenth after the 2011 tsunami, and further environmental surveys along the estuary revealed that their distribution also shifted ca. 1 km upstream. This was due to the subsidence after the earthquake, resulting in saltwater intruding further upstream. We shared the information with local fishermen and the clam population has recovered to higher levels than before the earthquake.



Map showing the distribution of Yamato and Manila clams in the Natori River (before the earthquake)



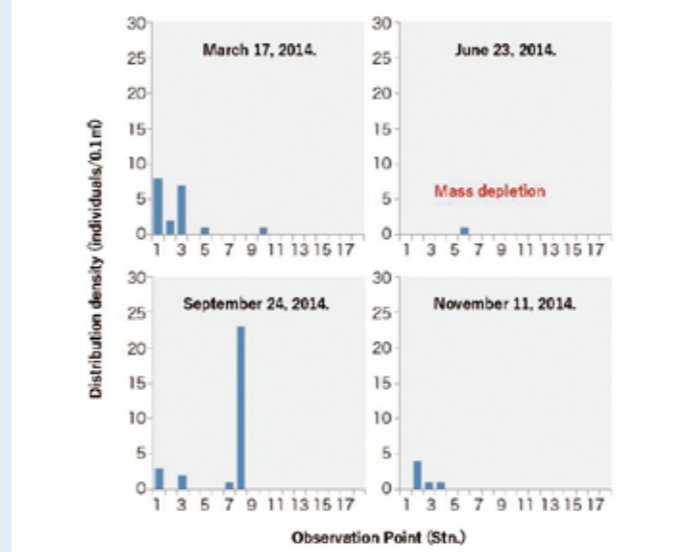
Maps showing the density and distribution of Yamato clams (sampled by clam rakes)

Manila Clams of the Natori River

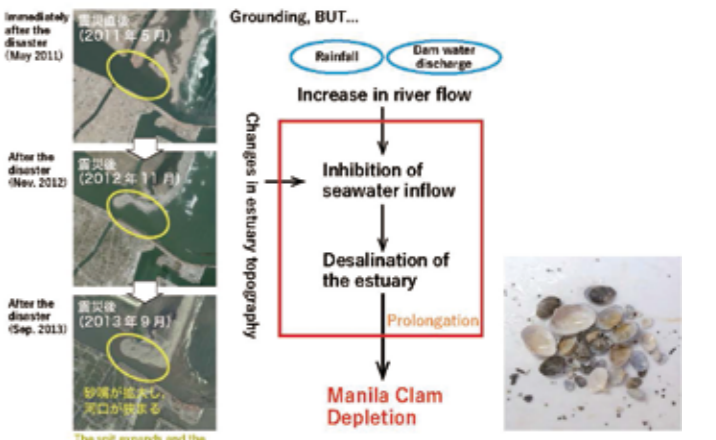
The abundance of Manila clams along the Natori River estuary was recovered temporarily after the earthquake. However, the occurrence of prolonged low salinity conditions causes depletion of the clam population, which hampers restoration of fishery operations. This

was caused by the subsidence and alteration of the beach morphology (sandspit), leading to retaining larger amounts of fresh water after any significant precipitation events. Our findings were reported to Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and we work together to remove the sandspit and restore the clam resources.

Manila clam density by sampling stations (2014)

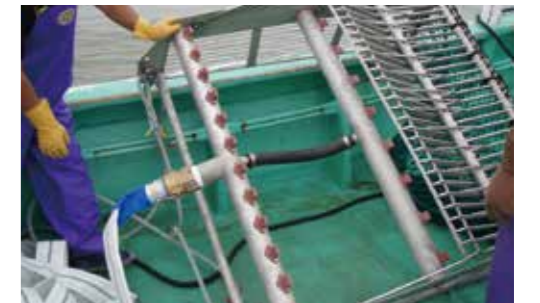


Mechanism of Manila clam depletion



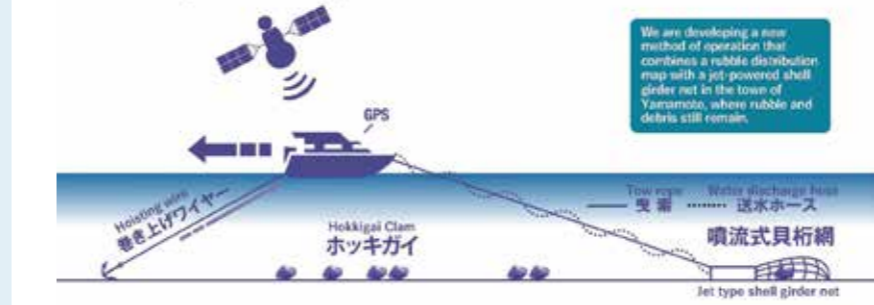
Development of new Hokkigai Clam Fishing Nets & Methods Adapting to the Tsunami Debris

Across the Hokkigai clam (*Spisula sachalinensis*) fishing grounds off Yamamoto, Miyagi, a lot of rubble and debris was washed in, which made it difficult to operate fishing activities. We therefore constructed a detailed debris distribution map to assist where to operate using GPS and developed an adaptive fishing method using new clam fishing nets combined with a water jet system. Effectiveness of the method has been tested in collaboration with fishermen and the Hokkigai fishery is almost ready to resume operations.

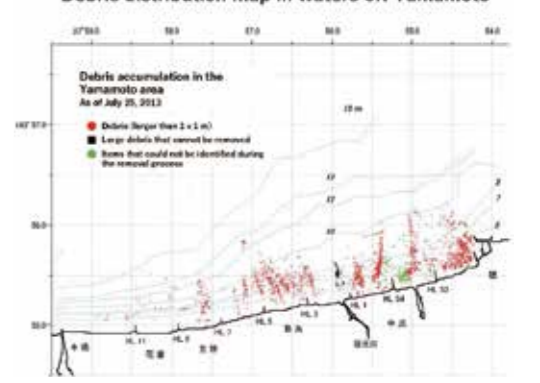


New clam fishing nets.

New clam fishery operation model combining the debris map and new clam fishing nets (schematic presentation).

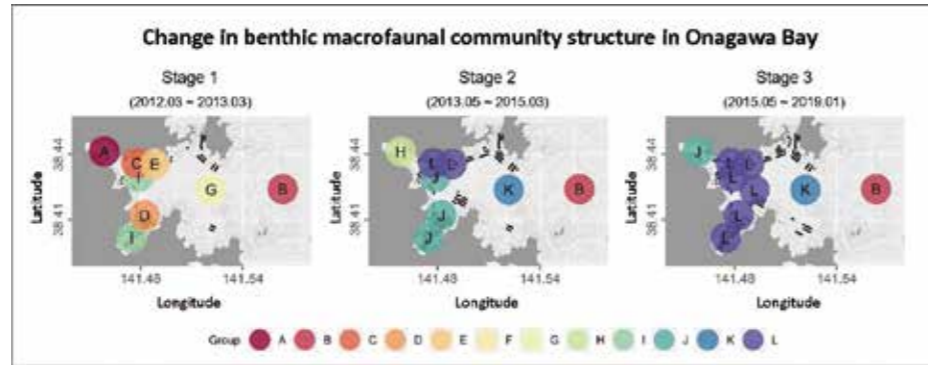


Debris distribution map in waters off Yamamoto



Creating a Habitat Map of Onagawa Bay

We collect significant amounts of environmental data through routine surveys by ship and real-time observations in Onagawa Bay since March 2012 and utilized the data for various research activities. Based on our findings, we were able to construct a multi-layered habitat map, beneficial not only for researchers but also for the general public.



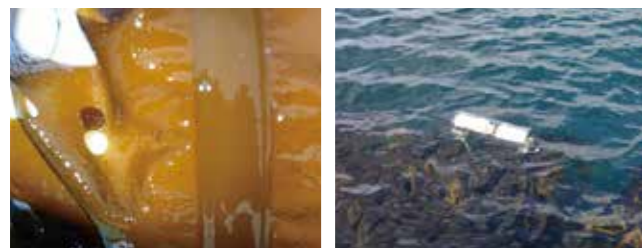
Change of the seabed habitation after the disaster in 2011.

Establishing Advanced Seaweed Aquaculture Technology

To prevent decoloration and accelerate growth of cultured seaweed, we are conducting blue LED exposure experiments by night in shizugawa Bay of Minamisanriku. Furthermore, it is suggested that the blue LED light has the benefits to protect the seaweed from marine vermin such as shellfish. Details are currently subject of additional investigation. For the future we are planning to establish and commercialize advanced seaweed aquaculture technology utilizing the blue light exposure.



Area of seaweed farming Installed blue LED lights



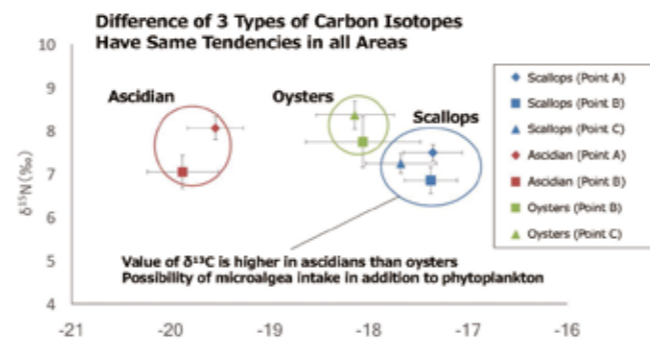
Recording seaweed growth Installed blue LED lights



Light of the blue LEDs

Efficient Droop Aquaculture at Onagawa Bay

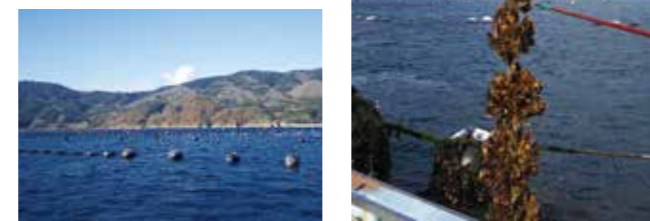
We are investigating the transformation of the aquaculture environment regarding plankton as food for scallops, oysters and ascidians in Onagawa Bay after the recovery from the damages of the tsunami. In particular, we utilize various methods i.e. DNA analyses to determine the origin of the cultivated species and advice efficient policies and strategies for sustainable and efficient aquaculture.



Stable isotope ratios of carbon and nitrogen in three species of aquaculture products



Droop aquaculture (Scallops)



Aquaculture at Onagawa Bay Droop aquaculture (Mallard)

Developing an Aquaculture System for the Cultivation of Sea Cucumbers

In recent years, there has been an increasing demand for the production of sea cucumbers. However, to properly manage the resources and avoid overfarming, the placement of seedlings has become essential to protect the environment. One important issue of the seedling production is the extermination of vermin such as copepods. For the extermination, we designed ballast water processing technology. Currently, we are proceeding further development and commercialization together with the town of Onagawa.



Breeding young sea cucumbers Cultivation of food (diatoms) for young sea cucumbers



Collecting young sea cucumbers Onagawa Field Center Breeding Facilities



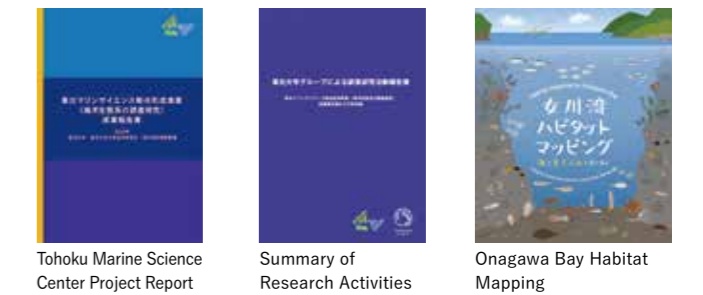
Cultivation facility for seedlings of sea cucumbers

Nationwide TEAMS Panels Exhibition

With the cooperation of the Japan Science Museum Association, a mobile panel exhibition was held at science museums and various public facilities throughout Japan to introduce the activities and research results of TEAMS. The mobile exhibition began in December 2019 and was held not only in the disaster area, but also in the Tokai region and other areas at risk of being hit by a major earthquake in the future. During the exhibition period, TEAMS researchers held explanatory sessions and talk shows at the Mie Prefectural Museum, Kuji Underground Aquarium Mogurampia, Tokai University Marine Museum, Kochi Mirai Science Museum, Aquamarine Fukushima, and other locations.

Publication of Tohoku Marine Science Center Project Reports

We published reports summarizing the activities of the TEAMS Project (research and study of marine ecosystems), which has been conducted from fiscal 2011 to fiscal 2020. A summary of the results has been printed and bound, and specific research details have been recorded on a DVD and appended. Furthermore, specific activities of the Tohoku University group included in the DVD were printed, bound, and distributed based on the requests of people involved in the fishing industry. We also published and distributed the "Onagawa Bay Habitat Mapping", an easy-to-understand book with illustrations and photos for elementary and junior high school students.



TEAMS Activity Results Report Meeting and Symposium

In order to widely communicate the results of the TEAMS Project, MEXT and TEAMS co-hosted an online public symposium sponsored by the Science Council of Japan titled "TEAMS Project and the Future of Fisheries Science Research: Toward a Prosperous Ocean with the Power of Science." We also co-hosted the "Tohoku Marine Science Base Formation Project (Research and Study on Marine Ecosystems) Outcome Report Meeting: Thinking about the Future of Fisheries" at the Onagawa Lifelong Learning Center, and distributed it online.



TEAMS mobile panel exhibition

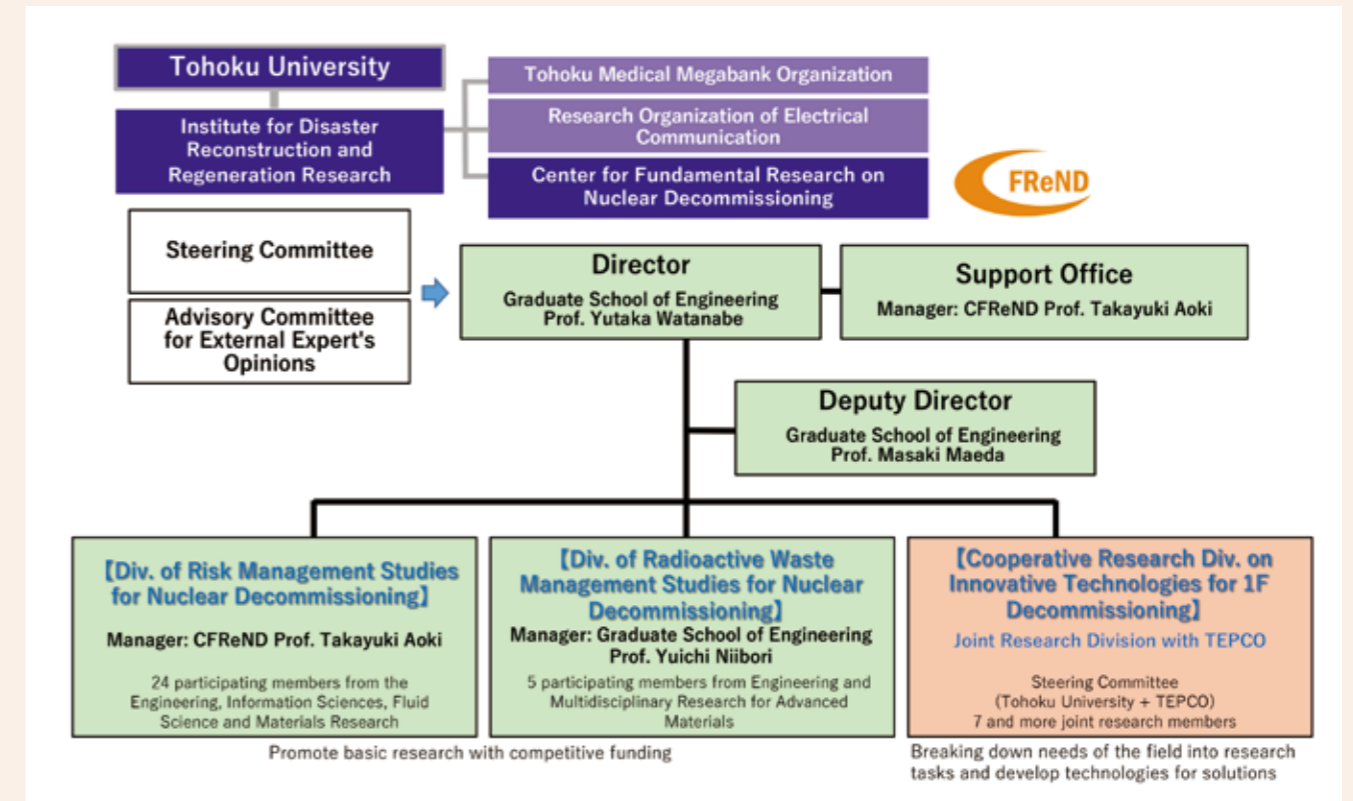
Project 06

Nuclear Decommissioning and Environmental Restoration Project

Center for Fundamental Research on Nuclear Decommissioning

After the Great East Japan Earthquake, we committed to become a central hub for research regarding nuclear decommissioning not only for Tohoku but also on a global scale. We initiated projects for fundamental research on nuclear decommissioning and human resource development.

In order to realize safe and steady progress for the decommissioning of Fukushima Daiichi Nuclear Power Station, it is important to consolidate a wide range of academic knowledge, expertise in engineering, and proficiency in technology as well as fostering the next generation of researchers and engineers who will continue the process in the future. Since this is an essential objective for the sustainability of our communities, we established the Center for Fundamental Research on Nuclear Decommissioning (CFReND) in December 2016 as a cross-departmental organization within Tohoku University. The main objective of our center is basic and fundamental research and technology development for ensuring safety in the decommissioning of accident-damaged nuclear power plants. In order to cover important research fields from this perspective, we started with two divisions, the “Division of Risk Management Studies for Nuclear Decommissioning” and the “Division of Radioactive Waste Management Studies for Nuclear Decommissioning”. In April 2020, we expanded our activities by establishing a joint research division with TEPCO (Cooperative Research Division on Innovative Technologies for 1F Decommissioning). The results of this research also have the potential to be applied to the decommissioning of normal nuclear power plants in the future. Furthermore, we are also committed to the education of young engineers and researchers who will lead future projects regarding nuclear decommissioning.



Project Leader
Center for Fundamental Research on Nuclear Decommissioning
Director Yutaka Watanabe

It has been more than ten years since the Great East Japan Earthquake and the unprecedented nuclear accident at the Fukushima Daiichi Nuclear Power Plants. The tense situation immediately after the accident has been overcome, and decommissioning and environmental restoration have made gradual progress. The decommissioning of the nuclear power plants will now finally begin to take on an even more difficult process. Research and development will play an increasingly important role in developing new technologies and responding to unexpected situations. It is also necessary to pass knowledge we have obtained and will obtain during this long and difficult project to the next generation of researchers and leaders. As a comprehensive university in the region where the nuclear accident occurred, we will continue to contribute to the safe and steady decommissioning of the Fukushima Daiichi Nuclear Power Plants through both basic and fundamental research and human resource development. We sincerely ask for your continued support in the future as we have in the past.

Project Activities

Nuclear Decommissioning and Environmental Restoration Project
Center for Fundamental Research on Nuclear Decommissioning

- 2012 8 Visit to Fukushima Daiichi Nuclear Power Station
- 2014 8 Started the Project "Fundamental Research and Human Resource Development for Nuclear Decommissioning" selected by MEXT.
- 2016 3 Visit to Fukushima Daiichi Nuclear Power Station and the Nuclear Science Research Institute of the Japan Atomic Energy Agency (JAEA)
- 3 Held the 1st Conference for R&D Initiative on Nuclear Decommissioning Technology by the Next Generation
- 10 Visit to Fukushima Daiichi Nuclear Power Station and JAEA Naraha Center for Remote Control Technology Development
- 12 Established the "Center for Fundamental Research on Nuclear Decommissioning (called 'CFReND')", Tohoku University
- 2017 2 Installed the Electromagnetic Ultrasonic Monitoring System developed by CFReND to Monitor Corrosion of the Piping at Fukushima Daiichi's Nuclear Power Plant
- 10 Visit to Fukushima Daiichi Nuclear Power Station and the JAEA Naraha Center for Remote Control Technology Development
- 11 Held the Fukushima Research Conference on "Corrosion Prediction and Mitigation for Key Components of Fukushima Daiichi NPS"
- 11 Started the PYRAMID project, a French-Japanese Joint Research, selected by MEXT to Piping system, Risk management based on wall thinning monitoring and prediction
- 12 Held the 1st memorial symposium of the Center for Fundamental Research on Nuclear Decommissioning "Challenging the Frontier of Basic Research for Nuclear Decommissioning"
- 2018 2 Presented an Overview of the Project "Fundamental Research and Human Resource Development for Nuclear Decommissioning" selected by MEXT at Tohoku University Institute for Disaster Reconstruction and Regeneration Symposium
- 5 Co-hosted the Seminar on Human Resource Development for Nuclear Decommissioning in the Next Generation
- 11 Co-hosted the 4th International Conference on Maintenance Science and Technology
- 12 Visit to Fukushima Daiichi Nuclear Power Station and the TEPCO Nuclear Decommissioning Archive Center
- 2019 2 Reported the Final Results of the Project "Fundamental Research and Human Resource Development for Nuclear Decommissioning" selected by MEXT at the Final Report Meeting.
- 3 Completed the above Project.
- 12 Held the 2nd Fukushima Research Conference on "Corrosion Prediction and Mitigation for Key Components of Fukushima Daiichi NPS" (FRC-Corrosion 2019)
- 2020 2 Received an "S" (Excellent) Rating for the Project "Fundamental Research and Human Resources Development Program for Nuclear Decommissioning" selected by MEXT in the Ex-post Evaluation.
- 3 Signed a Cooperation Agreement between Tohoku University Institute for Disaster Reconstruction and Regeneration Research and TEPCO
- 4 Established the Joint Research Division "Innovative Technologies for 1F Decommissioning" with TEPCO (until March 2025)
- 6 Published a textbook "Chemistry of Uranium (I) -Basics and Applications-" (Tohoku University Press)
- 10 Stated the project "Development of wide-area corrosion prevention in containment system under alpha, beta and gamma radiolysis: Development of new corrosion prevention technology using nanobubbles" selected by JAEA's Subsidy for Decommissioning Research Promotion "Problem Solving Decommissioning Research Program (General Research)"



Fukushima Research Conference

At the Center for Fundamental Research on Nuclear Decommissioning we gather necessary knowledge from around the world for the safe shut down of reactors after the power plant accident. We have proposed to establish the Fukushima Research Conference for related research activities as well as to educate leading human resources and cooperate with Collaborative Laboratories for Advanced Decommissioning Science (CLADS), Japan Atomic Energy Agency (JAEA). In November 2017 we have cooperated with CLADS/JAEA to organize the "FRC on Corrosion" in Tomioka, Fukushima. The main focus was "corrosion", being a major factor during the long-lasting decommission process of the damaged nuclear reactor. We had intensive discussions with leading researchers from over the world about mechanisms and countermeasures regarding corrosion and members of our center presented research outcomes as well as future plans and aspects of relevant research based on the newest findings.



One Year Anniversary Symposium of the Center for Fundamental Research on Nuclear Decommissioning

In December 2017 we held the One Year Anniversary Symposium "Challenges toward the Frontier of the Fundamental Research on Nuclear Decommissioning". We presented our mission, goals, and role as well as current principles of our activities and showcased detailed action reports to concerned parties. Afterwards we exchanged thoughts and ideas for collaborations and cooperative actions for fundamental research on nuclear decommissioning. A large group of guests from affiliated ministries, universities, research institutes, and industries, as well as foreign experts and specialists participated in the dialogue.

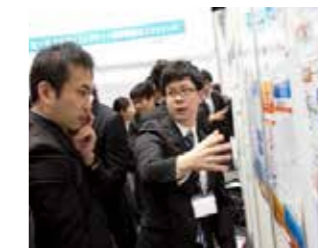


Presentation by Executive Vice President Hara



1st Conference for R&D Initiative on Nuclear Decommissioning Technology by the Next Generation

As one of seven institutes part of MEXT's "Project for Fundamental Research and HR Development Toward Nuclear Decommission" we organized the "1st Conference on Next-Generation Initiatives for Decommission Technology" at our Aobayama Campus to foster HR education of students. Nationwide Graduate and undergraduate students as well as students from technical colleges interested in research of decommission technology participated in the conference, listening to presentations of research outcomes regarding e.g. facility maintenance during decommission (inspection, corrosion evaluation, repairs, etc), remote control technology, as well as nuclear debris assessment and proper disposal of nuclear waste. There were also numerous participants from the industry, displaying the high interest and needs for nuclear decommission research in the future.



Presentation of research outcomes at the conference.



Opening remarks by President Satomi.

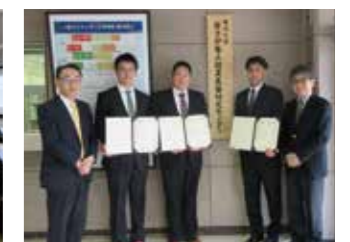


Permanent Education Course "Program for Nuclear Decommissioning Engineering"

In order to nurture core human resources who will lead the long-lasting process of nuclear decommissioning, we established the "Program for Nuclear Decommission Engineering" in 2015, aimed at graduate students of the School of Engineering and Graduate School of Information Sciences. To prepare the students for the varying situations during the decommission process, this program provides 1) problem solving skills going back to basics and applying principles, 2) the knowledge and capability to recognize the essence of problems, and thus the ability to provide fundamental solutions, and 3) communication and collaboration skills to develop resolutions in cooperation with specialists from other fields. Graduates of the program (so far 5 Ph.D. and 57 M.Sc.) are conferred a certificate, many of which find employment in associated institutions organizing the nuclear decommission.



Lectures at the decommissioning seminar



Program graduates (March 2017)

Electromagnetic Ultrasonic Monitoring System for Corrosion of Piping at Fukushima Daiichi's Nuclear Power Plant

During the nuclear decommission process at Fukushima Daiichi's Nuclear Power Station, the maintenance of the cooled standstill state of the reactor is of utmost importance to prevent another meltdown until the nuclear fuel and waste is removed. However, the piping of the cooling system is vulnerable to corrosion and its corruption would mean a loss of cooling capabilities, possibly leading to an emission of radioactive material to the environment. On the other hand, inspections under high radiation within the power plant's facilities present severe risks to operators. Currently we are employing well known electromagnetic ultra-sonic resonance methods for maintenance to measure the thickness of the pipes for the storage pool of spent nuclear fuel in the fourth reactor building of the nuclear power plant. This system allows the remote and automated continuous observation from the maintenance building with low levels of radiation. By monitoring the thickness of the pipes for a long term, we can observe the corrosion process and introduce necessary countermeasures, resulting in an improvement of the piping and its reliability, and preventing the risk of radioactive materials entering the atmosphere.



Monitoring system for pipe thickness observation

Awards at NDEC-3 and NDEC-4

In order to provide a platform for young researchers to exchange thoughts and ideas on nuclear decommissioning, the Conference for R&D Initiative on Nuclear Decommissioning Technology by the Next Generation (NDEC) is organized annually since March 2016. In March 2018, 4 Master students and 1 Bachelor student received conference awards at NDEC-3. In March 2019, 3 Master students received conference awards at NDEC-4.



Meeting with Experts from Various Technical Fields

In order to communicate with academics from different fields and various specialists from JAEA, the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDC), TEPCO, nuclear power plant providers and other institutions affiliated with the decommission process, we established the "Specialists Conference". Outcomes and achievements from the exchange will be utilized to promote and accelerate decommission research. Furthermore, the conference serves as training place for students and young researchers to communicate with experts from different fields and specialists from the industry, providing valuable opportunities to reinforce personal networks and obtain career advice from others experiences.



Expert Conferences

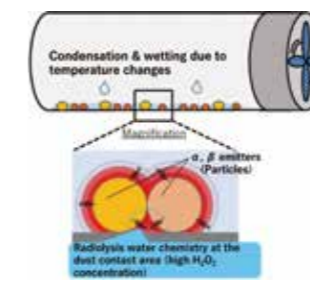
Co-hosting the International Conference ICMST

From October 23 to 25, 2018, the Center for Fundamental Research on Nuclear Decommissioning co-organized the joint international conference ICMST-Tohoku 2018 with a total of 240 participants (47 participants from 9 overseas countries). The conference focused on assessing and evaluating the safety of a system and discussed new methods for the safe decommissioning of the Fukushima Daiichi Nuclear Power Plant.



Promoting Fundamental Research and Human Development Using Competitive Research Funding

We promote the Project for Promotion of Nuclear Science and Technology and Human Resource Development, which brings together knowledge of MEXT (responsibilities have been shifted to JAEA/CLADS from FY 2018). The "Program for Basic Research and Core Human Resource Development on Reliability Maintenance of Containment Vessel and Building and Waste Treatment and Disposal for Decommissioning" was selected to strengthen decommissioning research and human resource development, and was given the highest S score (excellent results worthy of special mention) in the post evaluation in 2019. Currently, we are working on "Piping system, Risk management based on wall thinning monitoring and prediction" as part of the "Japan-France Joint Research Program for Nuclear Decommissioning", and on "Realization of wide-area corrosion protection in containment systems under the influence of $\alpha/\beta/\gamma$ radiation radiolysis: Development of new corrosion protection technology using nanobubbles" as part of the "Problem Solving Decommissioning Research Program".



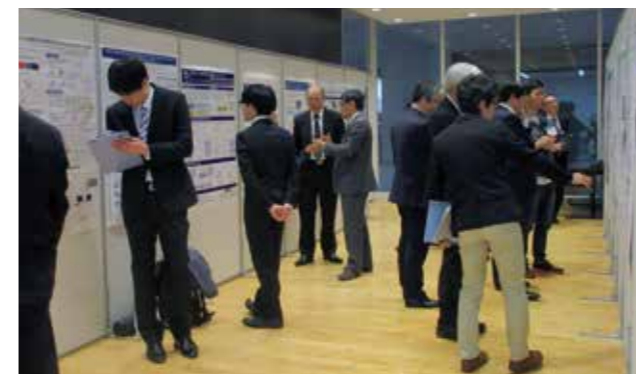
Realization of wide-area corrosion protection in containment systems under the influence of $\alpha/\beta/\gamma$ radiation radiolysis: Development of new corrosion protection technology using nanobubbles



Program for Basic Research and Core Human Resource Development on Reliability Maintenance of Containment Vessel and Building and Waste Treatment and Disposal for Decommissioning

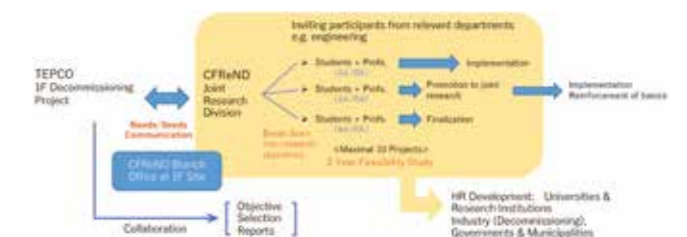
Presenting Results of the Program for Nuclear Decommissioning Research and Human Resources Development

On February 25th 2019, we organized a presentation event of the Program for Nuclear Decommissioning Research and Human Resources Development. More than 70 people including MEXT representatives and experts from the industry participated to listen to the presentations given by university members. There was a lively Q&A session as well as a poster session for students with very active discussions.



Cooperative Research Division on Innovative Technologies for 1F Decommissioning

In April 2020, we established the joint research division "Cooperative Research Division on Innovative Technologies for 1F Decommissioning" in collaboration with TEPCO. Through direct collaboration between TEPCO and Tohoku University, we aim to effectively contribute to the development of new technologies required for the safe and steady decommissioning of Fukushima Daiichi NPS, and to develop human resources in this field. Based on close communication between TEPCO's engineers and our university's experts, this initiative aims to extract needs from decommissioning sites, break them down into research issues, and develop technologies to solve them. The aim of this project is to utilize the university's research potential in a wide range of fields to solve problems at decommissioning sites and to develop human resources through student participation in research.



Division for Supporting Fundamental Research for the Nuclear Decommissioning of the Fukushima Daiichi Nuclear Power Plant

Project 06

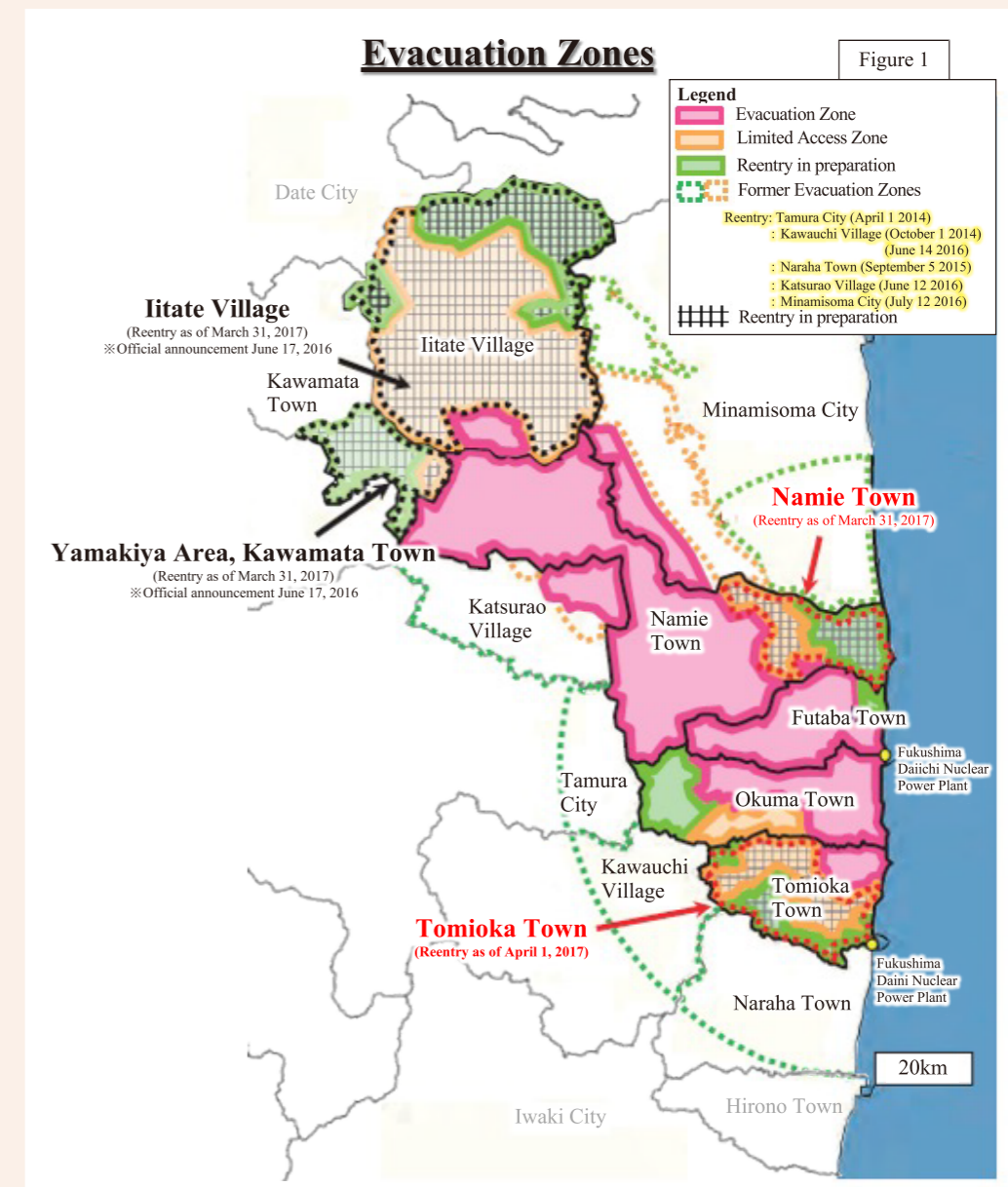
Nuclear Decommissioning and Environmental Restoration Project

Technology for Decontaminating the Environment

After the accident at the Fukushima Daiichi Nuclear Power Plant, radioactive materials were released into the environment, contaminating living environments at homes, fields, forests, or schools. In addition to concerns regarding the health of local residents, the radioactive contamination greatly impacts agriculture, forestry, and fishery products, and thus the lives of producers and consumers.

We established the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes and aspire to develop technology for the restoration of living environments contaminated with radioactive materials, e.g. decontamination technology for soil, technology effectively utilizing collected radioactive materials, methods for the cultivation of non-radioactive crops, or non-destructive (whole) monitoring technology for gamma radiation. These outcomes will be systematized and classified as Nuclear Disaster Remediation Engineering.

As of 2016, we modified the project from “Development of Technology for the Restoration of Living Environments Contaminated by Radioactive Material” to the current name and are continuing the research at the Research Center for Remediation Engineering of Living Environment Contaminated with Radioisotopes.



Decontamination and volume reduction of contaminated soil



Decontamination of schoolyards of elementary schools and kindergartens in Marumori, Miyagi



Project Activities

Nuclear Decommissioning and Environmental Restoration Project Technology for Decontaminating the Environment

- 2012
 - 5 Initiation of the Project "Development of Technology for the Restoration of Living Environments Contaminated by Radioactive Materials"
 - 7 Radiation monitoring at Kanayama elementary school in Marumori, Miyagi, and Matsukawa, Fukushima.
 - 8 Radiation monitoring at multiple points in Fukushima and Miyagi
 - 12 Establishment of the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes, decontamination experiment at local homes in Iitate, Fukushima
- 2013
 - 3 Presentation at the "13th International Conference on Particle Induced X-ray Emission" (PIXIE2013) in Gramado, Brazil
 - 6 Presentation at the "21st International Conference on Ion Beam Analysis" (IBA2013)
 - 8 Joint announcement of the continuous non-destructive contamination monitoring system for food with the Ishinomaki Harbor, Miyagi
 - 9 Completion of the common design for the non-destructive contamination monitoring device, initiation of regular inspections in more than 20 places in Fukushima, contributing to the safety and relief of Fukushima's communities regarding food
 - 10 Invited lectures at Academia Sinica, Taiwan, regarding the current state at Fukushima and projects of the center
- 2014
 - 4 Contamination monitoring of bamboo shoots in Marumori, Miyagi
 - 5 Presentation at the "23rd International Conference on the Application of Accelerators in Research and Industry"
 - 6 Contamination monitoring of fish in Ohtsu Harbor, North Ibaraki, and Onagawa Harbor, Miyagi
 - 7 Installation of a non-destructive contamination monitoring device for crops at the Yakurai Souvenir Center in Kami, Miyagi
 - 9 Presentation at the "7th Bio-PIXIE International Symposium" in Bled, Slovenia
 - 9 Installation of a whole body counter for children at the Azuma Hospital for Neurosurgery
 - 12 Installation of unmanned radio monitoring systems for detection of radioactive cesium 137 in the countryside of Fukushima (24 devices) and Miyagi (2 devices) to assess the effects of decontamination measures and automated monitoring
- 2015
 - 1 Presentation of projects regarding the state of recovery after the nuclear accident at the Fukushima Daiichi Nuclear Power Plant at the City University of Hong Kong
 - 4 Installation of a whole monitoring device in the Kosai area of Marumori, Miyagi
 - 6 Presentation at the "22nd International Conference on Ion Beam Analysis" (IBA2015)
 - 7 Fourth "Workshop on Nuclear Facility Testing and Decontamination of Fukushima"
 - 12 Development for Cs monitoring for surfaces of trees without felling, joint investigation with the Ohira Branch of the Miyagi Prefectural Forestry Technology Institute
- 2016
 - 3 Installation of unmanned monitoring devices for instant detection radioisotopes on the rooftop of the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes and monitoring of radiation
 - 4 Initiation of the project "Development of Technology for the Restoration of Environments Contaminated by Radioisotopes"
 - 4 Establishment of the Research Center for Remediation Engineering of Living Environment Contaminated with Radioisotopes
- 2017
 - 5 Discovery of low contaminated wild vegetables (below $137\text{Cs}20\text{Bq/kg}$) growing on high contaminated soil ($137\text{Cs}20000\text{Bq/kg}$) within the restricted area in Iitate, Fukushima
 - 5 First demonstration of radioactive cesium absorption in the surface of sediment particles via autoradiography, presentation of the result in the Journal of Nuclear Science and Technology Cogent Engineering (2017),4: 4 titled "An analysis of radioactivity distribution in soil particles using an autoradiogram method"
 - 5 First Successful Imaging of Radioactivity Distribution in Contaminated Soil Particles Using Imaging Plates. Releasing results in the international journal Cogent Engineering, Vol.4, 2017, issue 1
 - 5 Vegetation analysis in the highly contaminated Iitate area, Fukushima, regarding radiation. Most of the plants values were below 100Bq/kg .
 - 10 33rd PIXE Symposium, publishing result regarding elution of alkalines and alkaline earth metals from tea leaves
- 2018
 - 1 Publishing results regarding clay barriers in decontaminated fields at the 9th PIXE Symposium
 - 1 Publishing self-cleansing effect of radioactive cesium in rain in the international journal Cogent Engineering
 - 9 Collecting fish contaminated with strontium 90 in Odaka, Minamisoma, Fukushima.
 - 11 Publishing results regarding the accumulation of alkaline earth metals in shitake mushrooms at the 34th PIXE Symposium
- 2019
 - 3 Publishing results regarding the elution of radioactive cesium and nonelution of strontium from tea leaves
 - 9 Published results about infiltration of radioactive Cs in marsh sediments in Cogent Engineering (2019), 6: 1662573
- 2020
 - 3 Restoration of the "B-01P1 Radioactivity Monitoring System for Agricultural Products" (installed at the Kosai Community Development Center in Marumori, Miyagi), which was flooded and submerged by Typhoon No. 19 in October 2019.
 - 7 Successful development of an instrument using a double proportional counter that can detect strontium 90 by measuring beta rays from yttrium 90 and publication in the journal of the Radiation Division of the Japan Society of Applied Physics "Radiation" volume 45, issue 3, p.116-121 (2020) with the title "Development of a 90Y monitoring equipment using the coincidence measurement between two proportional counter tubes"
 - 9 Investigation of Strontium-90 Contamination of Underwater Insects Preyed upon by Fish in Odaka, Minamisoma, Fukushima



Establishment of the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes

In order to promote the project "Development of Technology for the Restoration of Living Environments Contaminated by Radioactive Material" we established the "Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes" in the Aobayama Campus within the disused old Cobalt-60 Laboratory Facilities of the Department of Quantum Sciences and Energy Engineering at the School of Engineering in December 2012.



Reutilization of disused facilities (old Cobalt-60 Laboratories)



the Center for Remediation Engineering for Living Environments Contaminated with Radioisotopes



Unmanned Wireless Telemetry System for Radiation Dose Rate by Radioactive Cesium

We installed wireless telemetry devices for automated monitoring of Cs137 in the countryside of Fukushima (22 devices) and Miyagi (2 devices) to assess the weathering effects including rain on decontamination in December 2012.



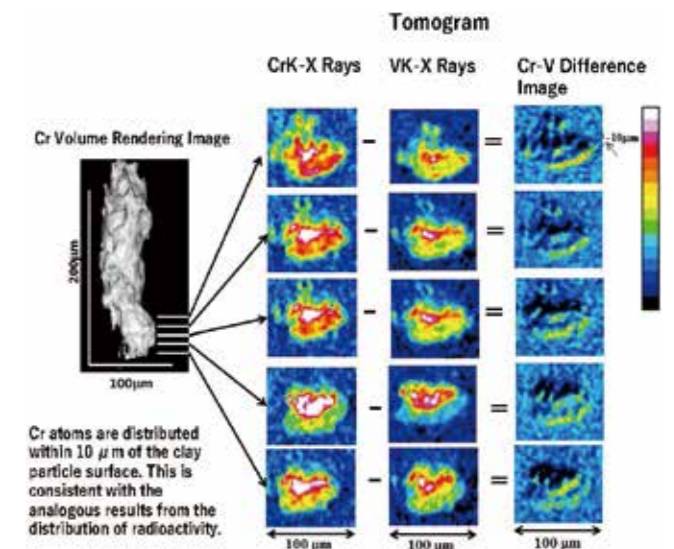
Decontamination Experiments

The main reason for increased space dose rates in contaminated areas is the absorbed radioactive cesium in the surface of the soil. The space dose rate in these regions can be decreased by removing the contaminated surface layer of the soil. We organized decontamination activities in Fukushima and Miyagi after the nuclear reactor accident and in December 2012, we tested the effectiveness of high efficient decontamination methods with the cooperation residents from Iitate, Fukushima, and the collaboration of Kinki, Kyoto, and Hokkaido Universities to decrease the space dose rates.



Analysis of Contaminated Soil Particles

Immediately after the accident at the Fukushima Daiichi Nuclear Power Plant, based on specific radioactivity of various grain sizes we pointed out that radioactive cesium was absorbed in the surface of soil particles and proved this fact by micron CT utilizing ion beams from accelerators. We published the research outcome at the "22nd International Conference on Ion Beam Analysis" in June 2015.



Analysis of Contaminated Soil Particles

Non-destructive Radioactive Contamination Monitoring of Food As-a-whole

Conventional methods for radioactive cesium measurement in food blended the subject and monitored the values of the juice. However, in collaboration with the city of Fukushima, we developed a non-destructive method to monitor contamination of food "as a whole", contributing to the industry of Fukushima. Currently more than 20 devices are operating in the prefectures of Fukushima and Miyagi (3 in Marumori, 1 in Kami), contributing to the safety and relief of residents.



Development and installment of non-destructive radioactive contamination monitoring of food "as a whole".

Periodic Monitoring of Space Dose Rates

Due to the accident of Fukushima Daiichi's nuclear power plant radioactive cesium was dispersed in the atmosphere, resulting in increased radiation space dose rates. We organized periodic observations after the accident and monitored space dose rates in Sendai, Natori, Iwanuma, Watari, Yamamoto, Kakuda, and Marumori (Miyagi) once

a week after April 2012 (currently once a month) and communicated the results to the general public via e.g. Tohoku University's web page. Since there were observation points in Fukushima, where the space dose rate exceeded 10mSv/year, we organized comparative observations to assess the safety of the region and found spots in Guarapari, Brazil, with space dose rates of 76mSv/year in nature.



Space dose rate monitoring in Guarapari, Brazil (March 2013)



Volume Reduction of Contaminated Soil

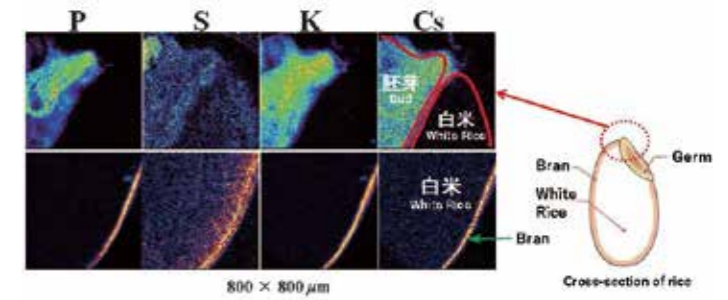
Utilizing the fact that radioactive cesium is absorbed in the surface of soil particles, and by aqueous cleaning of contaminated soil, we developed a method to reduce the volume of contaminated soil to a tenth of its original and applied the technique to decontaminate the schoolyards of two elementary schools and playgrounds of two nursery schools in Marumori, Miyagi. We also succeeded in designing a mini-plant condensing radioactive cesium with similar volume reduction rates.



Mini-plant design for volume reduction of contaminated soil by aqueous cleaning.

Analysis of Contaminated Vegetation

Immediately after the accident at the nuclear power plant, it was indicated that radioactive cesium was adsorbed in the surface of soil particles and difficult to dissolve in water, and thus possibly transferred to the vegetation. Furthermore, radioactive cesium absorbed by ion-exchangers or organic materials contained in small amounts within the soil is known to transfer easily, contaminating the vegetation and crops. In this project we analyzed the transfer coefficient of radioactive cesium in the natural vegetation of Iitate, Fukushima, and confirmed the low value of 0.02. We made this research outcome public at the "23rd International Conference on the Application of Accelerators in Research and Industry" in May 2014. Additionally, regarding contamination of rice, we were able to visualize the adsorption of cesium in the bran of rice by the Micro PIXE Analysis utilizing accelerators. This result was published at the "International Conference on Particle Induced X-ray Emission" in March 2013.



Analysis of elemental distribution in rice reveals that cesium accumulates in the bran and germ.

Spatial chemical analysis of a rice grain by Micro PIXE Analysis Method utilizing accelerators.

Contamination Analysis with Belt Conveyor Type Non-destructive Individual Continuous Contamination Inspection Machines

We developed equipment for non-destructive radioactive contamination inspection of fish unloaded at harbor markets (belt conveyor type non-destructive individual continuous contamination inspection machines) and commissioned the production at disaster stricken small and medium sized businesses in Ishinomaki, Miyagi. This equipment swiftly examines the radioactive contamination level of fish and provides support for the fishermen as well as safety for the consumer. The machine is currently used at fish markets in the harbors of Ishinomaki, Onagawa (both Miyagi) and Ohtsu (Ibaraki) for the radioactive contamination inspection of fish as well as the examination of bamboo shoots in Marumori (Miyagi).



Installation of the belt conveyor type non-destructive individual continuous radioactive contamination inspection machine.

Health Assurance and Security for Children

It is said that the effects of radioactive exposure on children is about twice as it is the case with adults and there is continuous anxiety of parents after the accident at Fukushima Daiichi's nuclear power plant. In this project we developed a whole body counter for children and organized measurements at two places in the city of Fukushima, providing relief regarding radiation and contributing to the health assurance of children.



Whole body counter for children (Azuma Hospital for Neurosurgery)



Whole body counter for children (Fukushima Health and Welfare Center).

Organization of Workshops

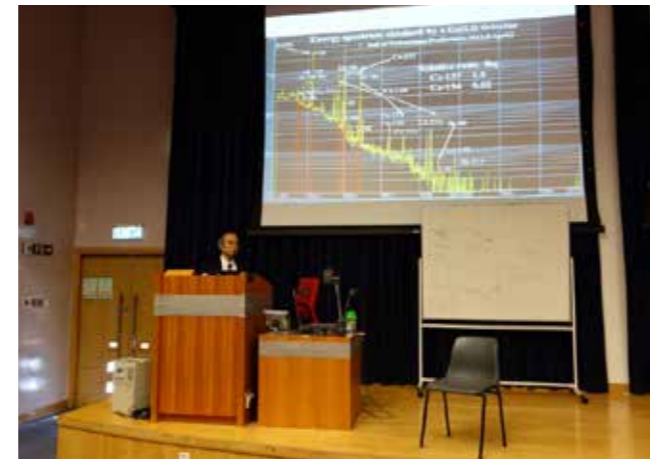
In the years from 2012 to 2015, we organized the annual "Workshop on Nuclear Facility Testing and Decontamination of Fukushima" (participants from the universities Tohoku, Hokkaido, Tokyo Tech, Nagoya, Kyoto, Osaka, Kinki, Kobe, and Kyushu) in July and



Fukushima Decontamination Workshop (participants from 8 universities).

Promoting International Exchange

In October 2013, we held invited lectures at the Academia Sinica in Taiwan. We also had the opportunity to expand and promote international exchange and relationships at the City University of Hong Kong in January 2015, where we reported the status and progress of recovery of the Fukushima Daiichi Nuclear Power Plant, and we are continuing to internationally publish and communicate the contents as well as outcomes of our projects.



Lecture on contamination in Fukushima at the City University of Hong Kong.

conducted decontamination tests and experiments in Iitate, Fukushima. In December 2013 and February 2016, we held an international workshop with the topic "Recovery after the Nuclear Catastrophe in Fukushima" gathering participants from five countries and having lively discussions as well as evaluations and advice for our projects.

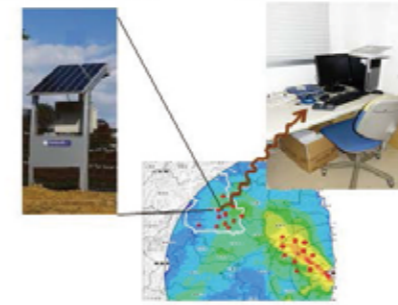


Organization of international workshops.

Natural Cleansing and Decontamination Effect of Radioactive Cesium

We established an observation system, to monitor the radioactivity of cesium and the weathering effect from rain in remote areas and mountains by transmitting radiation data via radio waves to the laboratory in Sendai. Currently 23 locations including Marumori, Fukushima, Iitate, Minamisoma and Namie are under observation.

Unmanned radiation measurement Data accumulation & analysis in Sendai

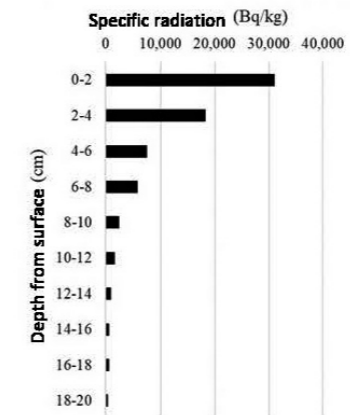


Installation in remote areas of Fukushima

Investigating the Vegetation in Highly Contaminated Areas

We Monitored the specific radioactivity of cesium in highly contaminated areas of Iitate, Fukushima. Although the soil displayed values of 30000Bq/kg 2cm from the surface, the intensity decreased exponentially with the depth. The vegetation displayed values below 100Bq/kg.

Radioactive cesium distribution in soil



Specific radioactivity from cesium

Species	Soil Bq/kg	Plant Bq/kg	Transition
Bracken	33488	87.4	0.0026
Aralia elata	30919	71	0.0023
Petasites japonicus	30629	166	0.0054
Fern	30629	311.2	0.0102

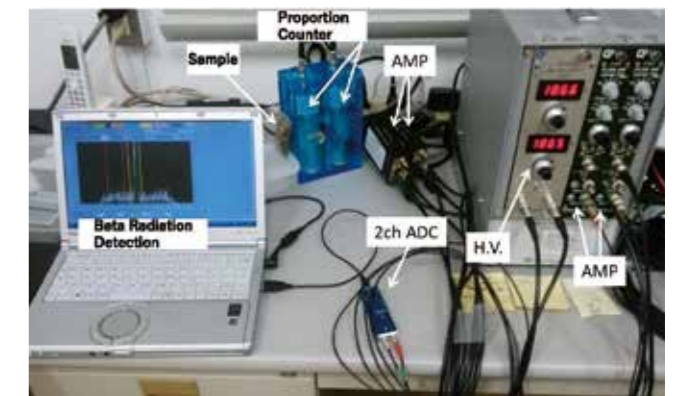
Natural separation of contaminated soil and successful development of simple Sr90 detectors

As a result of analyzing contaminated soil deposited on the bottom of swamps in seven locations (Iitate, Soma, Fukushima), we discovered, when contaminated soil flows into swamps from mountains and fields, soil with a large particle size at the water surface was deposited on the bottom of the lake near the mouth of the river, while soil with a smaller particle size was deposited on the bottom of the lake farther from the mouth. Therefore, in swamps, contaminated soil was naturally separated.

The main radioactive material scattered around Fukushima is cesium-137, but there is also about 1/100th of the amount of strontium-90, which is extremely dangerous and accumulates in bones when ingested. In areas where radiation is high and still under evacuation, this cannot be ignored. However, the analysis is usually done by very time-consuming chemical separation. Therefore, we have developed a simple strontium-90 detector that utilizes the fact that when two sets of proportional counters are detected simultaneously, the radiation has to be beta radiation. This will allow a new strontium-90 contamination survey to be conducted in Fukushima.



Sampling of marsh bottom sediments



Simple Strontium 90 Detector

Project 06

Nuclear Decommissioning and Environmental Restoration Project

Evaluation of Radiation Effects on Animals

Background

After the accident at the Fukushima Daiichi Nuclear Power Plant people around the world were concerned about radiation exposure and possible effects on their health.

Long-term exposure to radiation from trace amounts of radioactive materials has become a problem.

Issue

In the past, research has mainly been conducted on the issue of external radiation exposure. There was also a lack of scientific knowledge due to low-dose and low-dose-rate radiation exposure from trace amounts of radioactive materials. Reasons:

- ◆ Administering radioactive substances to animals is difficult
- ◆ Besides pure physical effects, there is also a biological component depending on each individual, resulting in different effects of radiation.
- ◆ Research has to rely on cases of accidents in order to obtain data

Effect of our project

- ◆ Establishing a global standard for analytical research by building an archive on samples that will serve as the basis for research on the effects of low-dose and low-dose-rate exposure and internal exposure on living organisms
- ◆ Accurate conversion of the physical unit Bq (Becquerel) to Sv (Sievert), which expresses the impacts on the human body. This provides means to communicate necessary information to the general public.
- ◆ Utilizing the archive, we are able to engage with international research groups to advance research regarding internal radiation exposure of low-level radiation and provide opportunities for education
- ◆ We are able to provide basic data for the safe decontamination and recovery of Fukushima, making recommendations regarding evacuation zones and suggest health observations

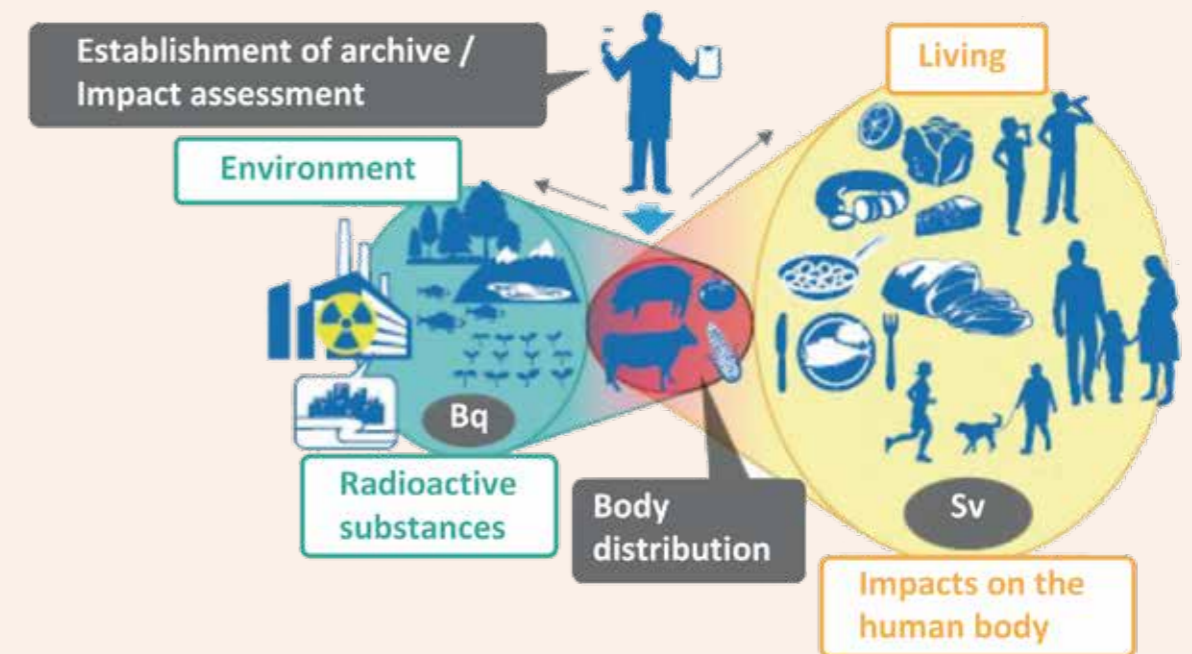
Effects of radiation on the body can only be studied from cases of accidents



Fukushima

After the accident at the Fukushima Daiichi Nuclear Power Plant, radioactive materials were released into the environment. It is necessary to scientifically understand how the long-term continuous exposure to radiation might affect human health and the ecosystem.

This project aimed to correctly understand the effects of radioactive substances to living organisms and to contribute radiation protection of humans. We are collecting the biological samples from livestock and wild animals of the ex-evacuation zone in a 20km radius of the nuclear power plant and analyzing them. Furthermore, we are organizing the sample archive in which both collected samples and the data are contained for future scientists to analyze.



Project Leader
International Research Institute of
Disaster Science
**Senior Assistant Professor
Masatoshi Suzuki**

We have continued our research on the effects of the Great East Japan Earthquake, especially on the environment and living organisms caused by radiation disasters, mainly in the Hamadori area after the accident at the Fukushima Daiichi Nuclear Power Plant. The data shows that the amount of radioactive substances in the environment and wildlife has decreased in the 10 years since the accident, and that they are steadily recovering. On the other hand, it is still required to continue research on the long-term effects specific to radiation disasters, such as trace amounts of radioactive substances remaining in the environment and decommissioning work. In this project, we will continue to conduct field surveys and use the archived materials we have collected to pass on lessons learned about radiation disasters to the future in the form of reconstruction knowledge. We would like to express our gratitude to the local communities and partners for their continuous cooperation in wildlife surveys and related activities, and to all those who have supported this project.

Project Activities

Nuclear Decommissioning and Environmental Restoration Project Evaluation of Radiation Effects on Animals

- 2011 8 Initiation of the Project for the Comprehensive Radiation Assessment of Disaster Affected Animals
- 2011 11 First publication of findings about the internal distribution of artificial radionuclides in body of disaster affected cattle in The Nikkei and Asahi Shimbun
- 2012 4 "Kick-off Meeting of the Project for the Comprehensive Radiation Assessment of Disaster Affected Animals"
- 2012 9 Multiple sessions related to the nuclear accident at "The 55th Annual Meeting of the Japanese Radiation Research Society" at the Tohoku University Kawauchi Campus organized by Prof. Fukumoto (IDAC)
- 2013 1 Publication of findings related to internal distribution of artificial radionuclides in disaster affected cattle by Asso. Prof. Fukuda (GS Agri. Sci.) and Asso. Prof. Kino (GS Sci.) in the journal PLOS One
- 2013 5 Presentation of project activities by Prof. Fukumoto (IDAC) as Keynote speaker in five international meetings held in Germany (May, 2013), India (Nov, 2014) and Japan (May and Jul, 2015 and Jun, 2017)
- 2013 6 Japan Pathology Award for Prof. Fukumoto (IDAC)
- 2013 7 Production of a French documentary film about contents of the project
- 2013 10 Publication of findings related to the impact of artificial radionuclides on testicles of disaster affected cattle in the journal Scientific Reports by Asst. Prof. Yamashiro (Niigata University)
- 2014 3 "Workshop on Research for the Comprehensive Radiation Assessment of Disaster Affected Animals"
- 2014 4 Achievement Award by the Radiation Effects Association (2014.4.) and Sugawara Award by the International Association for the Sensitization of Cancer Treatment (2014.6) for Prof. Fukumoto (IDAC)
- 2014 10 Workshop on research related to disaster affected animals at "The 57th Annual Meeting of the Japanese Radiation Research Society" by Asst. Prof. Suzuki (IDAC) and Asst. Prof. Yamashiro (Niigata University)
- 2015 5 "The 1st International workshop on Sample/Tissue Archiving of Radiobiology STAR2015"
- 2015 9 Presentation of project activities by Prof. Fukumoto (IDAC) at the "59th Annual Meeting of the Japan Society of Nuclear and Radiochemical Sciences" organized by Prof. Sekine (GS Sci.)
- 2015 10 Best Presentation Award for Asst. Prof. Suzuki (IDAC) at the "First Radiation Workshop"
- 2015 12 Management of the Fukushima Special Edition of the Journal of Radiation Research by Prof. Fukumoto
- 2016 3 Presentation of our research results in the NHK and BS1 TV Specials "The Exposed Forest"
- 2016 4 Publication of research result regarding radioactive strontium in teeth of disaster affected cattle in the journal Scientific Reports by the group of Graduate Student Koarai (GS Sci.)
- 2016 5 Publication of research related to eight blood plasma components highly correlated to internal exposure of cattle in PLOS ONE by Research Fellow Urushibara
- 2016 10 Best Presentation Award for Graduate Student Koarai (GS Sci.) at "The 59th Annual Meeting of the Japanese Radiation Research Society"
- 2017 8 "Workshop on Impact of the Nuclear Accident on Peripheral Organisms" for four years in a row by Prof. Fukumoto (IDAC)
- 2017 9 Best Young Scientist's Award for Graduate Student Koarai (GS Sci.) at "The 61st Annual Meeting of the Japanese Radiation Research Society"
- 2018 3 Special Researcher Award for Graduate Student Kaneko (GS Sci.) at the 19th Environmental Radiation Conference
- 2018 3 Publication of research result regarding radioactive strontium in teeth of disaster affected cattle in the Journal of Environmental Radioactivity by the group of Graduate Student Koarai (GS Sci.)
- 2018 6 Young Scientist Poster Prize for Asst. Prof. Oka at the "EPR BioDose 2018"
- 2018 9 Asst. Prof. Oka presents new methods to measure low radiation doses in dental enamel in the Nikkan Kogyo Shimbun
- 2018 11 Achievement Award by the Japanese Radiation Research Society for Prof. Fukumoto
- 2018 11 Publication of radiation effects on wild Japanese macaques by Asst. Prof. Urushihara (School of Medicine) in the journal Scientific Reports
- 2018 11 Workshop on research related to insoluble cesium at a workshop of "The 61st Annual Meeting of the Japanese Radiation Research Society" by Asst. Prof. Suzuki (IDRRR)
- 2019 3 Hirama Award for undergraduate student Ono (GS Sci) for research on the distribution of radioactive cesium and evaluation of radiation effects in wild animals.
- 2019 3 Publication of results regarding the absorption of radioactive cesium by intestinal bacteria by graduate student Saito (GS Agri.) in Frontiers in Veterinary Science
- 2019 5 Presentation of research achievements in the Hokkaido Shimbun by Prof. Fukumoto and Sen. Asst. Prof. Suzuki (IRIDeS)
- 2019 11 Publication of "Low-Dose Radiation Effects on Animals and Ecosystems - Long-Term Study on the Fukushima Nuclear Accident" by Prof. Fukumoto as editor, compiling the results of surveys and research on the effects of the Fukushima nuclear accident on living organisms and the environment. The book showcases research results at Tohoku University from Prof. Fukuda (Iwate Univ.), Sen. Asst. Prof. Suzuki (IRIDeS) and Researcher Koarai (JAEA) and 7 other research collaborators.
- 2020 3 Asst. Prof. Oka's results of electron spin resonance analysis of tooth enamel of wild Japanese macaques to assess the cumulative external radiation dose were published in "Radiation Measurements".
- 2020 10 Sen. Asst. Prof. Suzuki (IRIDeS) presented results of the 9 year project at a workshop held at the 63rd Annual Meeting of the Japanese Radiation Research Society

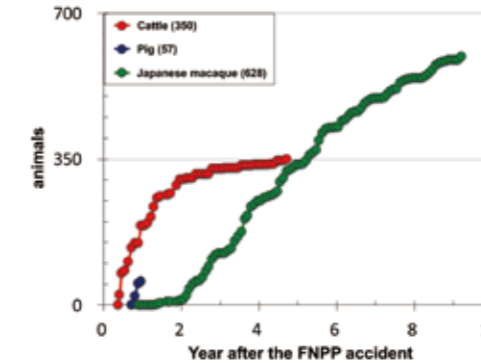


Investigation of Disaster Affected Animals to Analyze the Effects of the Nuclear Power Plant Accident in Fukushima

After the nuclear power plant accident in Fukushima, livestock and wild animals (disaster affected animals) left in the ex-evacuation zone were effected by long-term external and internal complex exposure to radiation. In our project, we sampled blood and organs of disaster affected animal which were euthanized for administrative reasons and conducted radioactive measurements, biochemical investigations, and pathological as well as molecular biological analyses to gather important data and investigate the effects of radiation on animals.



Disaster affected cattle.



Number of samples collected in the years after the accident.



Investigation of affected animals in the former evacuation zone.



Storage of Disaster Affected Animal Samples and Data Archives of Analysis Samples

In order to enable possible further analyses of collected samples in the future we are maintaining a system in which samples can be stored over a long period without deterioration. We currently have samples from 628 wild Japanese macaques (as of December 2020), which are biologically close to humans, and are able to distribute them to researchers as necessary. Our archive links stored samples with information such as the results of measurements and analyses to date, and can provide this information for research purposes. The distribution already started for various joint research projects.



Data archives of analysis samples

Findings from Disaster Affected Cattle Samples

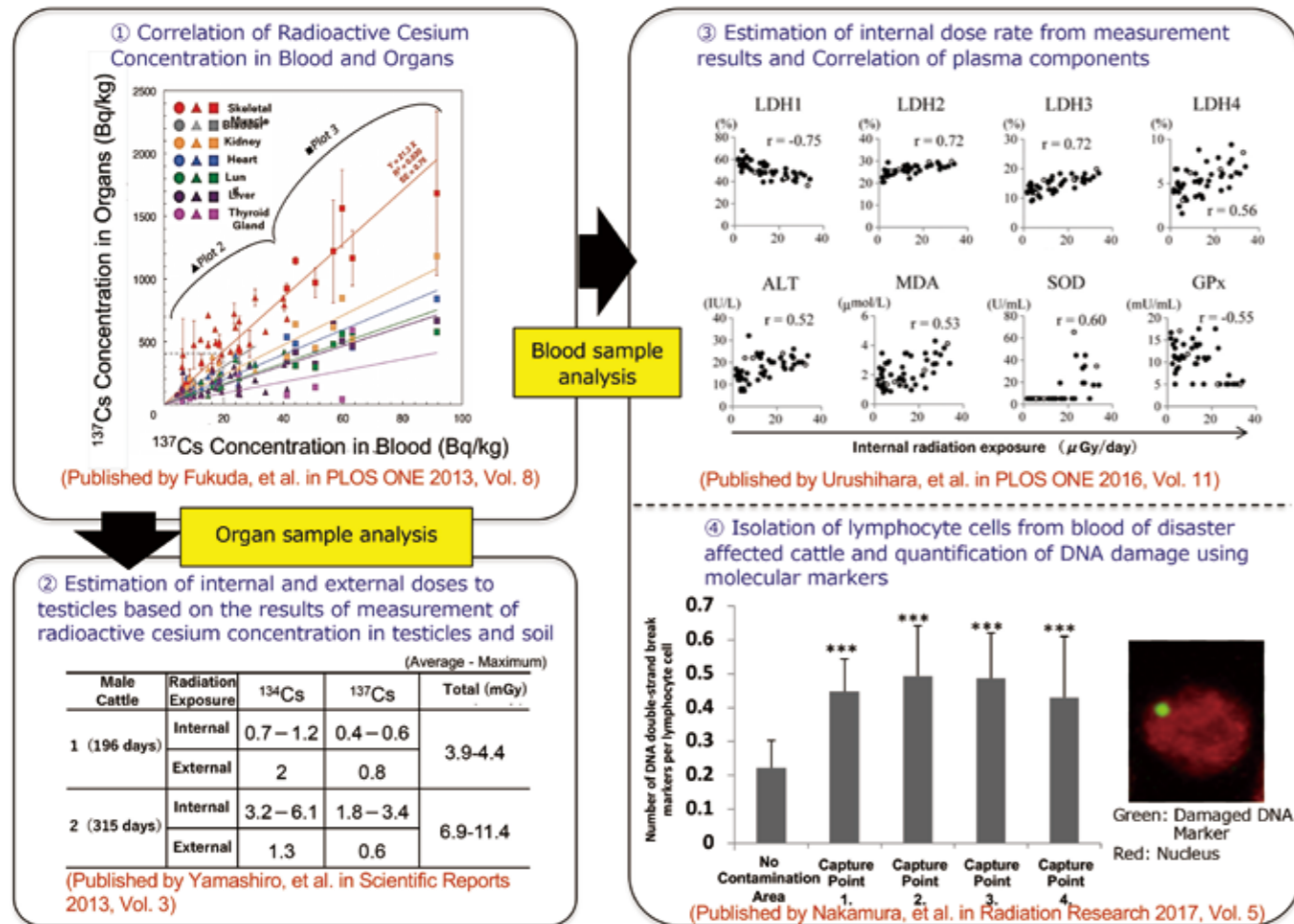
So far we established the following findings from our analyses of disaster affected animal samples.

- The concentration of radioactive cesium in organs of disaster affected cattle is proportionate to the concentration in the blood. (Details in later topics)
- Examining radiation sensitive testicles of bulls and field mice (*Apodemus speciosus*), we could not find any anomalies in spermatogenesis although there was increased cellular turnover. (Details in later topics)

- The concentration of radioactive cesium in blood or organs of cattle depended on the capture point and the food.
- Compared to the control group, lymphocyte DNA of disaster affected cattle was slightly more damaged, but recovered in time after the nuclear power plant accident. The damage to the DNA was also caused by age, unrelated to external radiation exposure.
- Biochemical examination of cattle's plasma revealed slight oxidative stress related to internal radiation exposure.

These results are thought to be valuable indicators for low level and low dose rates of radiation.

Findings from Samples of Disaster Affected Animals

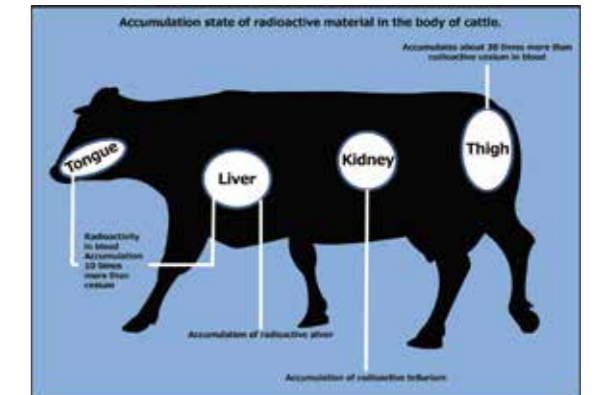


Findings from Disaster Affected Cattle Samples

20 ~ 30 Times Higher Radioactive Exposure in Muscles Compared to Blood – Escaped Cattle in the Evacuation Zone

In this project, we investigated internal radiation exposure of escaped cattle within the former evacuation zone of the nuclear power plant accident. The investigation began in August 2011, when we started to examine radioactive substances contained in blood, muscles, and organs of euthanized cattle which were dissected with their owners' permission. During the course of our investigation, we found that cattle with 60Bq/kg blood showed 1800Bq/kg from the thighs and the concentration of radioactive cesium in skeletal muscle was 20 to 30 times higher compared to blood. Although the concentration in tongues or livers was lower than in muscles, it was still about 10 times higher compared to blood and we could detect almost no radioactive cesium in thyroids. Furthermore, we found that "radioactive silver 110m" was accumulated in livers, and "Tellurium 129m" with high chemical toxicity accumulated in kidneys, where the concentration of radioactive silver was almost 25 times higher compared to the concentration in blood.

These results are also valuable when considering animals with internal radioactive exposure of muscles and other organs, and show possibilities for applications on humans to estimate the accumulation of radioactive materials in muscles and organs by extrapolating the concentration of radioactive cesium or silver in blood.



Accumulation state of radioactive material in the body of cattle.

No Effects of Cesium to the Spermatogenesis in Testicles of Bulls and Field Mice (*Apodemus speciosus*)

Since Testicles are highly sensitive to radiation, the radiation exposure was assumed to have an impact on the status and functionality of testicles. Therefore, we examined testicles of bulls and field mice affected by the nuclear power plant accident. In particular, we examined a 11-month old bull apprehended in September 2011 within a 20km radius of the Fukushima Daiichi Nuclear Power Plant, an 8-month male fetus, and a 12-month old bull caught in January 2012. We also captured field mice in Namie from 3 places with different air dose rates. According to our results, radioactive Cesium 134 and Cesium 137 accumulated in all organs almost on similar levels, although skeletal

muscle showed values much higher than the average. We examined the testicles by microscope, but could not find any anomalies of the internal structure and the number of sperm cells was also normal. Furthermore, we investigated the process of sperm cell production via cell division but could not find any anomalies compared to the control group. Examining field mice populating an area exposed to $\mu\text{Gy/hr}$ -levels of low dose rates, we verified that spermatogenesis was unaffected, although the cellular turnover of sperm progenitor cells per seminiferous tubule was increased depending on the dose rates. Based on our findings, we were led to the conclusion that radioactive cesium from the nuclear accident emitted to the environment did not affect the testicles of the spermatogenic functionality of cattle. We published our outcomes regarding cattle in Nature's "Scientific Reports" and the results regarding field mice in the American Research Journal "Radiation Research".

Methodology to Evaluate Radiation Exposure of Japanese Macaques

In order to investigate the causal relationship between the changes occurring in affected animals and radiation exposure, it is important to estimate the exposure dose. We therefore developed two types of evaluation systems to assess radiation doses under conditions suitable for wild Japanese macaques.

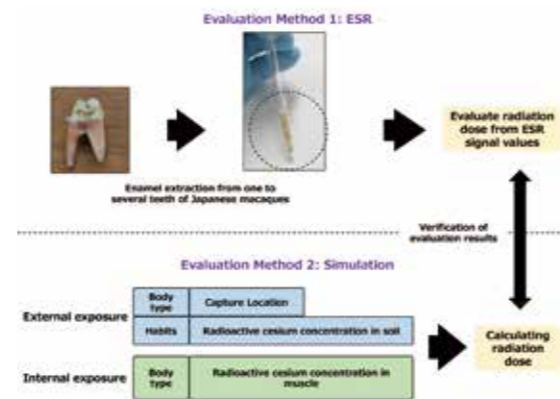
The first is to evaluate the accumulated exposure dose by analyzing the teeth of Japanese macaques using the electron spin resonance (ESR) method. The ESR method is used to detect and quantify the traces of radiation exposure that remain in the enamel that makes up the teeth, and to evaluate the radiation dose. Through interdisciplinary research, we improved the extraction of enamel under less artificial stress and are analyzing the weak signals. As a result, it is now possible to accurately evaluate the cumulative exposure dose of wild Japanese macaques in the range of about 40 mGy or more from the enamel of one to several teeth of Japanese macaques, which are about one size smaller than human teeth. The lower limit of our measurement indicates that the ESR method we established can be adopted to evaluate lower dose as Japanese Macaque in Fukushima exposed. Since the ESR method can be used to accurately estimate exposure doses based on measurement data, it is expected to be widely used as a suitable method



for assessing exposure doses of wild animals whose behavioral history is unknown. The method can also be applied to the estimation of human exposure doses in the event of radiation disasters.

The second method we established, evaluates radiation dose and dose rate by simulations optimized for Japanese macaques inhabiting the ex-evacuation zone, taking into account their body shape, behavioral habits, and the dynamics of radioactive cesium in soil. As a result, it is possible to evaluate exposure dose and dose rate for external and internal exposure in a relatively short time based on the information on the capture sites of Japanese macaques or the measurement results of radioactive cesium concentration in their muscles.

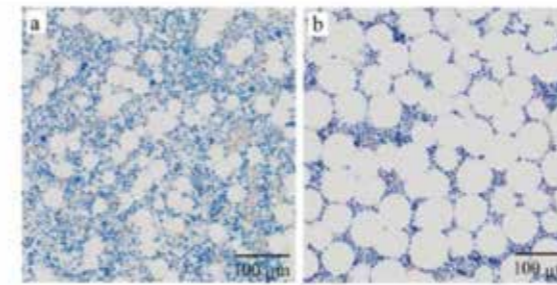
According to the dose evaluation by independent two methods, it became clear that the samples collected in this project are in the range of dose and dose rate for which current scientific knowledge is not sufficient.



Findings from Samples of Disaster Affected Japanese macaques

Although not abnormal, wild Japanese macaques from the evacuation zone displayed decreased numbers of hematopoietic cells depending on the internal dose rate. This shows the effect of radiation on the hematopoiesis. Furthermore, we observed an increase of oxidative stress in cattle blood depending on the presence of internal exposure to radiation. These findings are valuable indicators to evaluate and assess the exposure and effect of radiation in the future.

Effects of internal radiation exposure in bone marrow: Lower numbers of blood cells (blue) and increased fat (white)



a and b have similar external exposure to radiation However, the internal exposure of b is 18 times higher

Communications for Global Communities

Senior Assistant Professor Masatoshi Suzuki (IRIDeS) presented his findings at the Second World Bosai Forum in November 2019 at the session “Toward Restoration after Fukushima Daiichi Nuclear Accident”.

In his presentation, he explained the effects of radiation seen in animals living in the ex-evacuation zone of the Fukushima Daiichi Nuclear Power Plant accident and made a statement that continued research and studies are needed to clarify how radiation will affect future health.

Since the effects of exposure to low dose of radiation, such as those caused by the Fukushima Daiichi Nuclear Power Plant accident, are different from those caused by exposure to high doses of radiation, such as those caused by the Chernobyl Nuclear Power Plant accident, it is important to widely communicate the research results and inform global communities.



Publication of Research Activities and Achievements

After the first findings about the internal distribution of radioactive substances in disaster affected cattle was reported in The Nikkei and Asahi Shimbun in November 2011, our research activities and achievements were presented by numerous newspapers, TV stations, and web pages. A documentary film, for example, produced by a French broadcasting organization was nominated at the “Third World Conference on Disaster Risk Reduction” held in March 2015 in Sendai, and the NHK special program “The Exposed Forest – Five Years after the Nuclear Accident” won the Outstanding Performance Award at the National Arts Festival in 2016, displaying the high interest in the research activities and outcomes of our project. Contents of interviews and material from our research was also presented at exhibition booths at the “Tohoku University Innovation Fair” and the “Third World Conference on Disaster Risk Reduction”.



Presentation of research achievements at the “Third World Conference on Disaster Risk Reduction”.

The 55th Annual Meeting of the Japan Radiation Research Society

One and a half year after the nuclear accident in Fukushima, we organized “The 55th Annual Meeting of the Japanese Radiation Research Society” at Tohoku University Kawauchi Campus in September 2012, where 519 participants attended our session on matters related to the accident. We had lively scientific discussions with other attendants and hosted a public lecture titled “Radiation and Mass Media” after the annual meeting, uploading the video of the lecture to inform a wider audience.



“The 55th Annual Meeting of the Japan Radiation Research Society” at Kawauchi Campus in Tohoku University.

Establishment of the “Research Support Fund for Recovery from Nuclear Disaster”

In order to correctly understand the effects of low-dose and low-dose-rate radiation exposure, which is a characteristic of the Fukushima Daiichi nuclear power plant accident, continuous research and accumulation of scientific knowledge over a long period of time (several decades) are essential. In addition, by building an archive of samples obtained through research, we can pass on valuable samples and knowledge to the next generation, and it is expected that changes which cannot be captured today will be clarified in the future with the progress of science and technology. Therefore, in April 2020, this project will established the “Research Support Fund for Recovery from Nuclear Disaster” to ensure the long-term continuation of our research with support from the community.



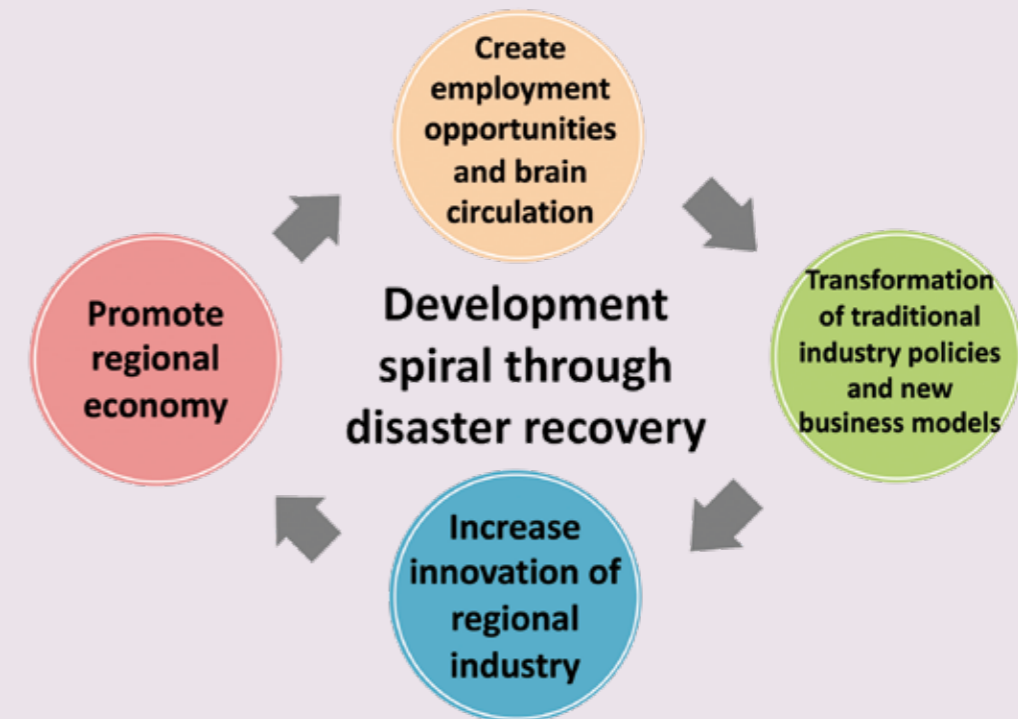
Pamphlet

Project 07

Regional Industries

Restoration Support Project

Regional Innovation Research Center



In order to recover from the Great East Japan Earthquake, we have to not only solve apparent issues such as hardware e.g. infrastructure support, but also continue to investigate local industry and communities, clarifying problems and recommending solutions, as well as educate revolutionary producers who will initiate innovations (create new values) and thus establish new opportunities for employment.

The Regional Innovation Research Center aspires in the following investigative research and human resource development projects to support mid to long term recovery of the industry and communities in the Tohoku region.

Investigative Research	Recovery of Regional Industry	Continuous investigative research for practical problem solving and policy making regarding disaster recovery and diversity of local communities/economy, especially fishery industry
Development of Human Resources	Regional Innovation Producer School (RIPS)	Project of human resource development to raise innovative producers who implement new businesses and innovations
	Regional Innovation Advisor School (RIAS)	Project of human resource development to raise supporters who have practical skills to aid and support innovative producers



Project Leader
Regional Innovation Research Center
Director Masahiko Fujimoto

Ten years have passed since the earthquake, and in the disaster-stricken areas along the Sanriku coast, the reconstruction of infrastructure such as seawalls and large-scale bulldozing works is coming to an end. On the other hand, many of the major industries in the fishery industry are still struggling to secure materials, not only due to the shortage of manpower, but also due to the continued poor catch of major marine products such as squid and saury. In addition, COVID-19 seriously impacted economic activities, especially in the accommodation and food service industries, and the local economy is becoming increasingly exhausted.

To revitalize these local economies, I believe that business innovation of new start-ups and existing local small and medium-sized enterprises is essential. Our university wants to make continuous efforts to support such enterprises.

Project Activities

Regional Industries Restoration Support Project
Regional Innovation Research Center

Investigative Research of Local Communities

- 2011 4 Establishing the Research Center for Disaster Recovery
Initiation of the Investigative Research Project for Regional Industry Regeneration
- 2013 3 Presentation related to the disaster recovery at international conferences (South Korea, France, Belgium, UK)
- 2015 3 Public forum "Recovery of Industry and Communities in the Tohoku Region" as part of the Third UN World Conference on Disaster Risk Reduction
- 2016 5 Initiation of the Tohoku Fishing Industry Innovation Project
- 2017 3 Interim conference of the Tohoku Fishing Industry Innovation Project
- 2019 7 "Innovation Seminar" for innovation in the fishery processing industry to secure human resources



HR Education in Local Communities

- 2012 9 "Kansai Entrepreneurship School" in cooperation with the Kansai Economic Federation (12 events)
- 2013 4 MoU regarding RIPS satellite schools in Hanamaki, Iwate, and Aizuwakamatsu, Fukushima
- 8 Opening of the Regional Innovation Producer School (RIPS)
- 2014 5 Alumni network of RIPS graduates leading innovations in Tohoku
- 5 Financial support of 100 Million JPY from the U.S. Prudential Foundation
- 8 Initiation of two study groups (EDS & BPS) for exchange of RIPS graduates and development of new businesses
- 2015 5 Opening of the Regional Innovation Producer School (RIPS)
- 6 Cooperation & collaboration agreement with the Miyagi Association of Small Business Entrepreneurs
- 8 Collaboration Platform "Consortium for the Promotion of Regional Innovation in Tohoku" for HR Education
- 2016 1 MoU regarding RIPS and RIAS satellite schools in Morioka, Iwate, and Koriyama, Fukushima
- 5 Cooperation & collaboration agreement with the Sendai Cooperative Merchants Center
- 7 Alumni association of RIAS graduates
- 2017 1 Cooperation & collaboration agreement Hanamaki Shinkin Bank
- 3 Cooperation & collaboration agreement with Tome, Miyagi
- 9 Opening of the "Right Arm" Executive Education Lectures
- 2018 3 Cooperation & collaboration agreement with the city of Sendai and the Sendai City Industrial Promotion Organization
- 2020 9 Online operations of RIPS/RIAS



Investigative Research Project for Regional Industry Regeneration

After the Great East Japan Earthquake, we established the Research Center for Disaster Recovery in April 2011 in which more than 100 researchers from Tohoku University and other institutes gathered on a nationwide scale, promoting the "Investigative Research Project for Regional Industry Regeneration". In the course of this project, we collaborated with various organizations and academic associations as well as the International Research Institute of Disaster Science of Tohoku University, aiming for the recovery of the severely damaged local industry, conducting investigative research to recommend necessary measures and policies, and communicating findings and information to the general public. We also implemented large scaled surveys of corporations damaged by the disaster and published the findings of our investigations and research in five volumes of "The Great East Japan Earthquake Research".

Publication of "The Great East Japan Earthquake Research"



- I Recommendations for Local Economy Regeneration after the Great East Japan Earthquake (2012.3)
- II Recommendations for the Regeneration and Recovery of Industry and Society in the Tohoku Region (2013.3)
- III Assessment of Recovery Policies after the Disaster and Recommendations for the Creation of New Industries (2014.3)



- IV Recommendations for the New Phase in Tohoku Regeneration (2015.3)
- V How the Disaster Recovery Changed Tohoku (2016.3)



Investigative Research Symposium for Regional Industry Regeneration

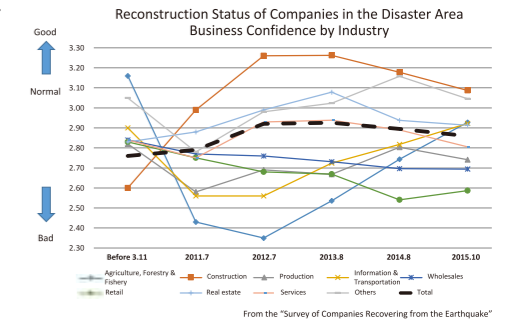
We organized seven symposia from 2011 to 2015, reporting on research projects related to regional industry regeneration and discussing relevant matters with other supporters of the regional recovery in panel sessions.

Symposium "How the Disaster Recovery Changed Tohoku"



Status Survey of Disaster Recovery in Companies

One of the main research topics for the Investigative Research Project for Regional Industry Regeneration is the correct assessment and evaluation of disaster affected company statuses. In order to keep a mid to long term record of the recovery process, we organized large scaled surveys titled "Status Survey of Disaster Recovery in Companies" over four years from 2012 to 2015. The large scale and continuity of the survey aimed at disaster affected companies provided valuable insight for further progress.



Case Study and Investigative Research Project of Regional Innovations

We researched innovations of companies from the Tohoku region and recorded the process. The case studies of our investigation were presented at the "Regional Innovation Café".



Regional Innovation Café "Challenging Ordinariness"

Publication of "Regional Innovations"



- I Challenges from Tohoku (2012.3)
- II Resources, Development & Evolution of Tohoku Businesses (2013.3)
- III Recovery from the Disaster, the Power of Tohoku (2014.2)



- IV Challenging Ordinariness (2015.2)
- V Challenges from Tohoku to the World (2016.1)

Tohoku Fishing Industry Innovation Project

This project is part of Tohoku University's "Research with Social Impact" and started 2016 with the aim to innovate the fishery industry (especially the processing industry) of Tohoku for five years. The innovation of fishing industry in Tohoku to find new ways after the damages of the Great East Japan Earthquake is an urgent matter. The characteristic of this project is the collaboration with local communities and government institutes to establish a concrete plan for the creation of innovations as well as the involvement in the assessment via action research to evaluate the process and implement appropriate corrections if necessary. As the first step in 2016, we organized interviews regarding business models with over 60 fishery processing manufacturers from Miyagi as well as other prefectures. In 2017 we are establishing an action plan to set the basic strategy for the future of the fishing industry in the Tohoku region as the second step. And as the third step after next year, we implemented tangible measures as well as action research to promote necessary activities as of 2019.



Project initiation meeting



Midterm debriefing conference.



Three step action plans for five years.

Communication at the UN World Conference on Disaster Risk Reduction

We communicated research results obtained in collaboration with university researchers and local communities not only in Japan but also in Korea, France, Belgium, and the UK, as well as reported outcomes at the public forum during the UN World Conference on Disaster Risk Reduction.



Public Forum at the UN World Conference on Disaster Risk Reduction.

Social Innovator HR Education School

With the support of the Japan Association of Corporate Executives, we organized the support and education of future "Social Innovators", who will manage innovative businesses to create concepts for the solution of social issues in the Tohoku region.



Obtaining necessary knowledge for Social Innovators.

"Kansai Entrepreneurship School" in cooperation with the Kansai Economic Federation

We organized joint lectures in collaboration with the Kansai Economic Federation, supporting the recovery after the Great East Japan Earthquake. Experienced managers from the Kansai area addressed young managers of Tohoku and students regarding business plans and innovations.



Discourses by experienced managers from Kansai.

HR Education Leading Regional Innovations

For economic development of the Tohoku region, it is necessary to not only have motivated innovators with challenging ideas and high potential for the creation of new businesses, but also to be able to find these innovators and support them. It is therefore necessary to educate as many supporters as possible who will support and guide new innovations in an effective manner.

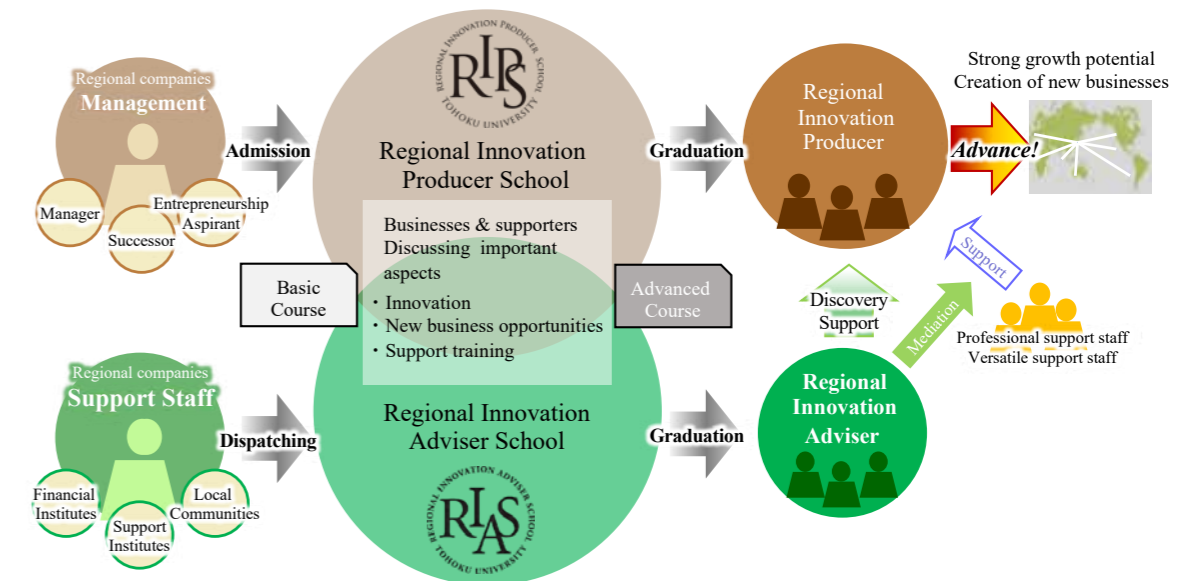
The Regional Innovation Producer School (RIPS)

RIPS aims to educate talent and future leaders and to raise innovative producers who implement new businesses and innovations, who will engage with the local communities to improve the local industry. In 2019, more than 200 students graduated RIPS and are currently actively involved in communities of Tohoku. RIPS is organized parallel to RIAS (educating professional staff specialized to support innovators), so future innovators are able to obtain necessary knowledge and skills together with future professional staff and supporters.

Regional Innovation Advisor School (RIAS)

RIAS aims to raise supporters who have practical skills to aid and support innovative supporters through finances and other professional expertise. Participants of RIPS and RIAS have the opportunity to learn new methods for business development together and obtain a new perspective. Through the support training, we aim to nurture a wide range of supportive skills so participants are able to effectively help other businesses after graduation.

Educate innovation producers Develop new businesses and advance support structure after graduation



Promote innovation of regional industry Nurture advanced understanding and support skills



The Future of RIPS and RIAS Graduates

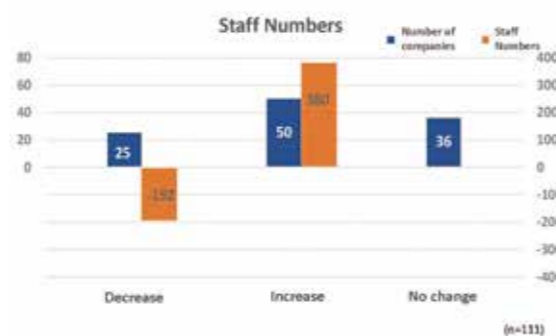
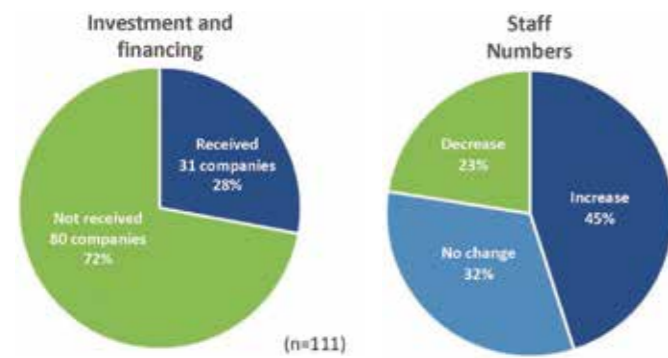
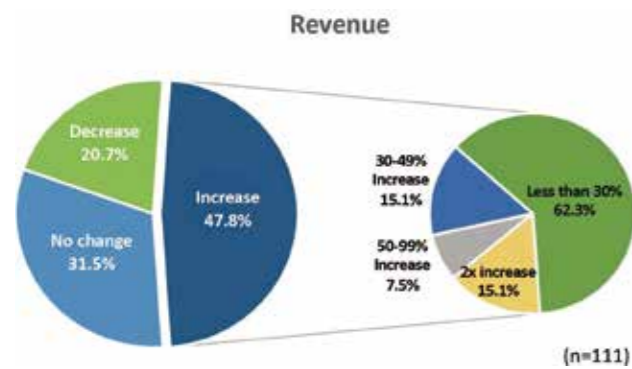
RIPS and RIAS alumni association functions as a place for continued learning and mutual study after graduation, and has grown into a network of innovation producers and supporters of local small and medium-sized companies that revitalize the Tohoku region. The activities of the two research groups, the Experience Design Study Group (EDS) and the Business Practice Study Group (BPS), lead to business collaboration among alumni and contribute to new innovations.

RIPS Graduates		RIAS Graduates	
FY 2012	11	FY 2015	25
FY 2013	35	FY 2016	32
FY 2014	29	FY 2017	28
FY 2015	26	FY 2018	27
FY 2016	41	FY 2019	22
FY 2017	33	FY 2020	22
FY 2018	30	156 graduates in the 6th year	
FY 2019	29		
FY 2020	21		
255 graduates in the 9th year			

Survey of RIPS Graduates

Every year, we organize a survey for graduates of the RIPS to assess the business situation after graduation. In 2018, we asked about the situation of 2012-2016 graduates 2-6 years later. (Survey results from

111 businesses, 79.8%, comparing the situation directly after graduation) According to the analysis, graduates saw an increase in sales and revenue and many businesses were able to employ more people, showing the positive effect of our programs.



Situation after RIPS graduation

Survey of RIPS Graduates (2018.7-9)
139 businesses graduating between 2012-2016 ⇒
Response rate 79.8%

Financial support of 100 Million JPY from the U.S. Prudential Foundation

In order to support disaster recovery, the Prudential Foundation had provided subsidies of 100 million JPY in total as startup capital for 13 graduates of the RIPS developing excellent business plans.



President Lata Reddy of the Prudential Foundation and the adopted graduates 2014.

“Right Arm” Executive Education Lectures

In order to educate and foster “right arm” executives, high-performance assistants of business executives, necessary for the effective realization of the strategic plans of RIPS graduates, we provide opportunities to increase planning and management capabilities as well as obtain basic knowledge regarding strategy and marketing.



“Right Arm” Executive Education Lectures

Establishing the Collaboration Platform “Consortium for the Promotion of Regional Innovation in Tohoku” for HR Education

In order to support the businesses of RIPS and RIAS in private-public collaboration, we established the “Consortium for the Promotion of Regional Innovation in Tohoku”.



Consortium supporting activities of RIPS and RIAS.

Collaboration with Local Communities

For the promotion of investigative research regarding HR education and development of industries in Tohoku, we establish multiple partnerships with local communities, research institutes, business organizations, and financial institutions.



Collaboration agreement with Hanamaki Shinkin Bank for the development of model businesses.

Project 07

Regional Industries

Restoration Support Project

Tohoku Agricultural Science Center for Reconstruction

Our Center was established in April 2014 in order to educate human resources leading recovery of agriculture and communities in disaster stricken areas as well as to prepare for issues and problems related to expected future mega disasters from an interdisciplinary point of view via education and research.

Graduates of our practice oriented lectures and exercises are conferred qualifications in Certificated Agricultural Reconstruction (CAR) or Certificated Agricultural Information Technology (CAIT). Tohoku University Students also have further opportunities to obtain higher qualifications related to their research in disaster recovery. Depending on the content of the graduation thesis, they are conferred the title of Junior Field Specialist (JFS) or Field Specialist (FS). Our characteristic curriculum received the "President's Education Award" 2016.

As of 2016 we initiated recovery support actions in Katsurao, Fukushima, and since 2017 we promote the Fukushima Innovation Coast Concept to support regional communities.

○ 復興農学マスター (CAR) コース CAR:certificated agricultural reconstruction

Participants will obtain deeper understanding of agriculture related to natural disasters as well as training in cutting-edge technology via "Agricultural Science for Reconstruction Lectures", "Agricultural Reconstruction Field Training (On-site Lectures at Disaster Stricken Areas)". Graduates will be ready to start working under real life conditions in disaster stricken areas.

○ IT農業マスター (CAIT) コース CAIT:certificated agricultural information technology

Participants will obtain deeper understanding of agriculture related to information technology as well as training in cutting-edge technology via "Agricultural Science for Reconstruction Lectures", "Agricultural Information Technology Training (On-site Lectures at Disaster Stricken Areas)". Graduates will be ready to start working under real life conditions.

4 Certificates available CAR, CAIT, FS/JFS



Undergraduate and graduate students

The Graduate School of Agricultural Science will confer certificates after completion of required conditions.
※Please refer to the web page for details (<http://www.tascr.agri.tohoku.ac.jp/>)



FY 2016
President's Education Award



Project Leader
Graduate School of Agricultural Science
Professor Shinichiro Ogura

We believe that "without the recovery of agriculture, forestry and fisheries, there will be no recovery of the Tohoku region", and we have been working for the prosperous development of the Tohoku region through the reconstruction of the food and agriculture sector. In the educational program, "Agricultural Reconstruction" we discussed and worked together with many people from students to adults, which gave us many innovative ideas and the joy of cooperation. I would also like to express my gratitude for the help and advice I received not only from researchers but also from many people in the government and business sectors in the reconstruction of the disaster stricken areas. It has been a great source of support for me to have formed bonds with many people with different positions and specialties through reconstruction activities. In order to overcome the aftermath of the disaster and restore a diverse and rich agricultural, mountainous and fishing community, we continue to collaborate with agricultural science and various other fields to build a new food and agricultural system.

Project Activities

Regional Industries Restoration Support Project
Tohoku Agricultural Science Center for Reconstruction

- 2014
 - 4 Establishment of the Tohoku Agricultural Science Center for Reconstruction (TASCR)
 - 4 Kick-off symposium of TASCR
 - 5 Starting lectures of the center with 103 students
 - 7 Publication of "Rapeseed Science ~ the Regeneration of Saltwater Damaged Farmland" presenting achievements of the rapeseed project
 - 9 On-site experience workshop of the rapeseed project
 - 11 Excellence Award in the R&D and New Technology category of the Food Action Nippon Awards 2014 for the rapeseed project
 - 12 Organic rice "Tohokudai ni Hitomebore" from Kawatabi Seminar Center sold in stores at cooperative shops in the Graduate School of Agricultural Science and School of Engineering
- 2015
 - 3 Students presenting at the public forum "Let's build a Model Village - New Agriculture & Safe, Peaceful, and Fruitful Communities" at the Third UN World Conference on Disaster Risk Reduction
 - 4 Publication of the Second edition of "Rapeseed Science ~ the Regeneration of Saltwater Damaged Farmland"
 - 10 Public seminar "'The 21st Century as Environmental Epoch' Let's talk about recycling! - Livestock manure as important resource" at Tohoku University's Project of Integrated Compost Science at Kawatabi Seminar Center
 - 12 "Tohokudai ni Hitomebore" rice sold in all stores of cooperative shops in Tohoku University by course participants
- 2016
 - 2 Memorial Lecture "Utilizing Agricultural Knowledge for Environmental Maintenance of Livestock" by Prof. Nakai on his Japan Agricultural Award at the cutting edge agriculture symposium
 - 5 Visit of two professors from Nizhny Novgorod State Agricultural Academy
 - 6 Selection of the topic "Development of a new ICT "high value-added farming model in harmony with nature" for the promotion of agriculture in mountainous regions" as a subsidy for the project to promote practical development for regional reconstruction
 - 10 Katsurao monitoring tours by volunteers to increase rural population
 - 10 Cooperation & collaboration agreement between the Graduate School of Agricultural Science and Katsurao, Fukushima
 - 10 "Tohokudai ni Hitomebore" sold at the Homecoming Day
- 2017
 - 3 "Tohoku University President's Education Award 2016"
 - 6 Volunteers joining "Tour de Katsurao"
- 2018
 - 5 Publication of Rapeseed Science results in "Utilizing Agricultural Knowledge for Reconstruction - The Rapeseed Science Project"
 - 6 Approval of the regional reconstruction and development project "Development of High Functional and Stable Food Supply Technology and an Efficient Sales Structure of Regional Specialties"
 - 6 Approval of the Fukushima Innovation Coast Concept "Utilizing Recovery Knowledge for the Creative Reconstruction of Katsurao"
 - 11 Completed two plant factories (plastic greenhouses) in the Katsurao Tohoku University field
- 2019
 - 3 Presentation by 2 graduate students at MAFF's "Special Exhibition regarding the Great East Japan Earthquake"
 - 9 Tasting of the first harvest of mangoes in Katsurao
 - 12 New plant factory building (third building) completed in Katsurao
- 2020
 - 9 Publication of the Agricultural Reconstruction monograph
 - 11 Tasting of organic tomatoes in Katsurao
 - 11 Rice harvested in Katsurao "Satoyama no Tsubu" was distributed to new students as COVID support.
 - 12 Tohoku Agricultural Science Center for Reconstruction Symposium "Achievements and Objectives of Agricultural Reconstruction"



Certificates and Degrees conferred by the Tohoku Agricultural Science Center for Reconstruction

Our center currently confers four different certificates (Japan's first) in order to nurture human resources with necessary skills regarding both specialized scientific literacy and on-site communication to lead the swift recovery of villages and agriculture in disaster stricken areas. In the six years from 2014 to 2019, we conferred 257 Certificated



Award ceremony for the "President's Education Award".

資格 Certificate	第1期 (2014年) 1st Term (2014)	第2期 (2015年) 2nd Term (2015)	第3期 (2016年) 3rd Term (2016)	第4期 (2017年) 4th Term (2017)	第5期 (2018年) 5th Term (2018)	第6期 (2019年) 6th Term (2019)	計 Total
復興農業マスター (CAR) Certificated Agricultural Reconstruction (CAR)	50名 50	32名 32	45名 45	43名 43	51名 51	36名 36	257名 257
IT農業マスター (CAIT) Certificated Agricultural Information Technology (CAIT)	44名 44	29名 29	38名 38	39名 39	31名 31	25名 25	206名 206
復興農業ジュニアフィールドスペシャリスト (JFS) Junior Field Specialist (JFS)	8名 8	9名 9	9名 9	7名 7	1名 1	0名 0	34名 34
復興農業フィールドスペシャリスト (FS) Field Specialist (FS)	2名 2	1名 1	5名 5	2名 2	2名 2	2名 2	14名 14

資格認定者数
Certificates conferred
Number of conferred certificates.

*7th term (2020) lectures were cancelled due to the COVID-19 pandemic.
**4 prospected certifications of Junior Field Specialists in 2020.



Agricultural Science for Reconstruction Lectures (Common Lectures for each Certificate)

We conduct omnibus type lectures regarding the interdisciplinary education about the primary industry. After each lecture, working adults and students discuss and present their findings in randomized mixed groups. The discussion and findings will be supported and evaluated by the lecturer as well as supporting teaching staff.



Discussion groups at lectures.



Agricultural Reconstruction Field Training (Certificated Agricultural Reconstruction Course)

In this course students have the opportunity to learn about cutting-edge agricultural technology as well as get firsthand experience of production systems at the Kawatabi Seminar Center, create reconstruction plans of villages and agricultural production in group discussions, and actually debate and recommend the results. In particular, a multitude of excursions are organized, investigating tide-water control forests in the coastal region of Iwanuma, Miyagi, analyzing the biodiversity in paddy fields, examining resource circulation systems utilizing the heat from hot springs, and observing the behavior of cows in pasturelands.



Field training at Millennium Hope Hills.



On-site Lectures at Disaster Stricken Areas (Common Lectures for each Certificate)

We provide necessary knowledge as well as experience for the future recovery of individual areas struck by the disaster. The on-site lectures of the first term were organized in eastern Sendai and East Matsushima, for the second term in Onagawa, and from the third to the sixth term in Katsurao, Fukushima.



On-site lectures at disaster stricken areas in Katsurao, Fukushima.



Agricultural Information Technology Training (Certificated Agricultural IT Course)

This course provides practical applications of "Agricultural Information Technology", educating most recent examples utilizing IT equipment, and discussing issues and agricultural problems as well as introduction plans. There are opportunities for students to get firsthand experience with cutting edge technology such as weather, temperature and humidity sensors, remote monitoring systems, or drones for utilization in the field.



Agricultural information technology training using drones.

◆◆◆◆◆ “Tohokudai ni Hitomebore” Project

This project was initiated by volunteers of our courses in order to bring word of the profundity of agriculture and the excellent taste of the rice grown with the “Winter Watered Paddy Field Farming Method” they experienced at the investigations and inspections during “Agricultural Reconstruction Field Training” to as many members of Tohoku University as possible. With the “Winter Watered Paddy Field Farming Method”, paddy fields are continuously filled with water even during the winter, protecting birds of passage and other smaller animals and vitalizing the soil with their presence. This is an organic farming method, not relying on chemicals and is currently adopted in the Tajiri-Kabukurinuma area of Miyagi.

During the activities, promotional material was created, necessary steps for commercialization were taken, and information was distributed through social media. Furthermore, study groups or tasting events were organized, communicating the various activities of the Kawatabi Seminar Center with cooperation of other members. In 2014, the volunteers named the organic rice grown at the Kawatabi Seminar Center “Tohokudai ni Hitomebore” (“Hitomebore” being the brand of the rice, but also meaning “Love at first sight with Tohoku University”), and sold the products at cooperative stores of the Graduate School of Agricultural Science and the School of Engineering in order to raise the interest in agricultural regeneration. In collaboration with graduates of the course in 2018 we sold a record amount of 240kg (300g x 800 packages).”



Tasting event at the Homecoming Day.



Sales of “Tohokudai ni Hitomebore”

◆◆◆◆◆ The Appeal of Agriculture – Farming is Cool!

In October 2014, volunteers from our courses participated in public lectures at the Kawatabi Seminar Center, presented the knowledge and experience obtained at the Agricultural Science Center for Reconstruction, and promoted the appeal and importance of agriculture to the general public. Many children were also engaged, experiencing our motto “Farming is Cool!” at first hand.



Rice harvesting at the Kawatabi Seminar Center.

◆◆◆◆◆ Acting toward Reconstruction One by One – Activities of Working Adults

There are many working adults participating in the courses who also are involved in reconstruction support and related activities at their places of employment. For example, employees of financial institutes in Miyagi visit communities of disaster stricken coastal areas to support the reconstruction of towns and villages, and specialists from IT firms cooperate with their suppliers to provide second hand personal computers to communities.



Explanation of the recovery process in disaster stricken Onagawa by working adults.

◆◆◆◆◆ Rapeseed Project for Regeneration of Saltwater Damaged Farmland

We utilize salt resistant rapeseeds for the regeneration of farmland damaged by saltwater from the tsunami after the Great East Japan Earthquake and aim for the full recovery of disaster stricken agriculture. We selected the only salt resistant species from the gene bank of the Plant Genetics and Breeding research field and conducted experimental seeding in saltwater damaged area farmlands of Miyagi and Fukushima. Furthermore, we 1) established a stable production method for rapeseeds for improvement of soil quality, 2) developed a marketing strategy for rapeseed oil, and 3) created an autonomous energy provision system utilizing biodiesel obtained from rapeseed oil.

The research results of our project were chosen as a highlight paper at the Japan Geoscience Union Conference in April 2014 from more than 4000 presentations, recognized as highly newsworthy and having academic as well as social impact. In July 2014 we published “Rapeseed Science ~ the Regeneration of Saltwater Damaged Farmland” (first edition sold out, second edition on sales) and in May 2018 we published the second book “Agricultural Knowledge for Reconstruction - The Experience of Tohoku University’s Rapeseed Project”. Also in November 2014, we received the Award of Excellence in the “Research and New Technology” category at MAFF’s “Japan Award for Food Action 2014”.



Weed and sludge removal at farmlands.



Explication of rapeseeds in full bloom at tsunami stricken farmlands.



Rapeseed oil obtained from tsunami stricken farmlands.

◆◆◆◆◆ Public Seminar at the UN World Conference on Disaster Risk Reduction

In March 2015, a public seminar was organized at the North Kawauchi Campus in Tohoku University within the course of the forum of the UN World Conference on Disaster Risk Reduction, titled “Let’s build a Model Village – New Agriculture & Safe, Peaceful, and Fruitful Communities”. 13 graduates of the Tohoku Agricultural Science Center for Reconstruction recommended measures for disaster prevention, disaster mitigation, and resilient communities on four topics regarding the autonomous supply of energy and resources at “Model Villages”. After the presentation, the ca. 60 participants were involved in the discussion, some of which expressing interest to enter the curriculum of the center the following year. It was a very meaningful event, communicating future measures for reconstruction and regeneration as well as issues, giving both the participants and presenters an opportunity to think about the current situation in Tohoku and attract new members to our curriculum.



Group discussion after the presentations.

◆◆◆◆◆ Weed Removal and Sheep Grazing for the Recovery of the Soul

In disaster stricken areas of Iwanuma, Miyagi, destroyed by the tsunami, a lot of weed is currently growing wildly, impairing the scenery and interfering with reconstruction works. Asso. Prof. Yu Yoshihara’s research suggests meaningful results from experimental weed removal utilizing grazing of sheep. Furthermore, by looking after the sheep in cooperation with local residents also presents an opportunity for animal therapy, leading to the recovery of the soul as well as teaching children a valuable lesson about the importance of life.

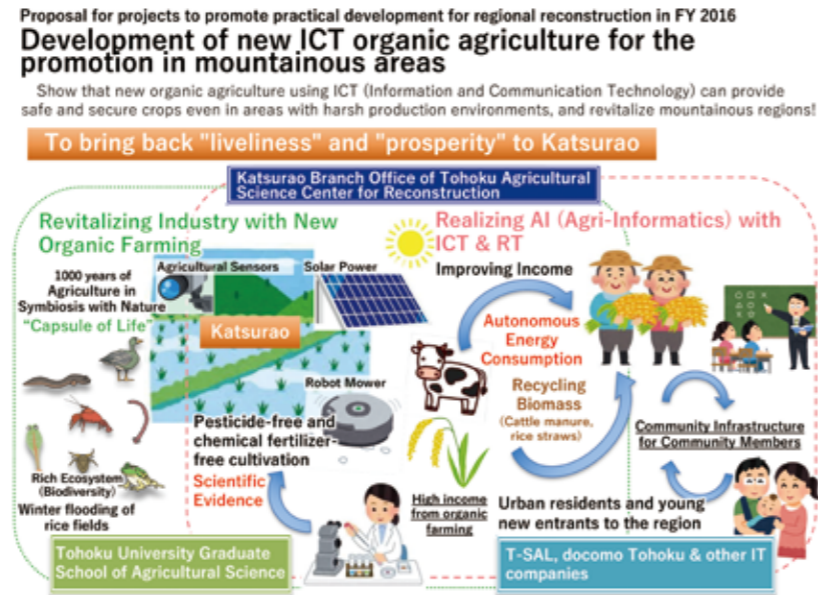


Animal therapy with Suffolk sheep.

Activities with the Community of Katsurao, Fukushima

The community of Katsurao in Fukushima is a small village with a population of 1500 before the Great East Japan Earthquake. Due to the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant, the entire community was forced to evacuate, and although the evacuation order was partially revoked in June 2016, there are only 326 residents back in the village as of November 1, 2020. The community as well as the local industry is currently facing extinction due to the decline of the population and is in urgent need of necessary resources and new ideas to counteract the problems.

Tohoku University's Graduate School of Agricultural Science initiated the "Tohoku University Rapeseed Project" in 2014, provided the know-how regarding methane fermentation systems, and recommended appropriate measures for reconstruction and creation of a new town. This was considered an opportunity to also introduce student excursions of the center to disaster-stricken areas, establish collaboration agreements, and strengthen the relation overcoming a distance of ca. 160km. As of 2016 we conduct the restoration support projects collaboration with the community of Katsurao, practicing new methods not only in education but also in research toward the recovery of local communities.



Overview of the reconstruction support project at Katsurao.

Collaboration Agreement with the Community of Katsurao and Installment of Satellite Facilities

The community of Katsurao in Futaba, Fukushima, concluded a collaboration and cooperation agreement with the Graduate School of Agricultural Science in October 2016 in order to promote research and education as well as develop new technologies regarding farming, stock breeding, and related productions for the recovery of the area on the one side and to solve the problems of the community and revitalize the region on the other. Furthermore, a satellite facility of the center was established within the community to conduct education and research activities.



Inauguration ceremony of the satellite facility in Katsurao.

Searching for Regional Revitalization Ideas through Monitor Tours

In autumn 2016, volunteers from our courses organized destination management and marketing activities in Katsurao, obtaining necessary ideas to increase the population and regenerate the region through several monitor tours visiting various sites. The results were summarized in a pamphlet and recommended to the local communities. These activities were selected as part of Regional Economy and Industry Vitalization Support Projects 2016.



Investigation of the historic "Magai Buddha" site in Katsurao.



Meeting with members of the community.

Construction of a Pilot Plant Factory at Katsurao

With the approval of the regional reconstruction and development project "Development of High Functional and Stable Food Supply Technology and an Efficient Sales Structure of Regional Specialties" in 2018, we started the construction of a pilot plant factory in Katsurao, Fukushima. By applying the agricultural IT, we are experimentally growing mangoes, a tropical plant that has never been cultivated in the northern region, and organic tomatoes in a plant factory. In 2019 we attracted much attention from the media with a mango tasting event,

even with participants from outside the community. Currently, we are testing various cultivation methods to achieve an even higher quality, increasing fruit size and sugar content.



Mango tree (left) and tomatoes (right) at the plant factory

Promoting Exchange with Visits to Disaster Stricken Communities

As part of the Fukushima Innovation Coast Concept "Utilizing Recovery Knowledge for the Creative Reconstruction of Katsurao", we invited Tohoku University members, affiliates from other universities and IT professionals to Katsurao and showed the current status of recovery after the disaster. The tours are very meaningful as people see the impact of the evacuation caused by the nuclear accident at the time of the disaster firsthand. They can also observe the current state of reconstruction and issues, and have the opportunity to talk to people from the community. So far the project attracted 324 participants. Furthermore, in FY 2019, an IT programming class for elementary school students was held in Katsurao as educational exchange aimed at promoting IT technology. We will continue to promote mutual exchange through repeated visits to the affected areas.



International students visiting Katsurao



Field visit (At an elementary school in Namie, which was hit by the tsunami)

Interacting with community members of Katsurao through paddy rice cultivation

Since 2016, we rented a paddy field in Katsurao and have been growing paddy rice every year with the help of local farmers. In 2019 and 2020, we also held rice planting and harvesting events. Together with the general public, students from Tohoku University and Koriyama Women's University, who have signed a cooperation agreement with Katsurao, experienced rice cultivation while interacting with the villagers through these events. Additionally, Tohoku University exhibited a booth at the 2019 Katsurao Thanksgiving Festival and deepened exchanges with visitors by offering specialty coffee. We will continue our interactions with community members of Katsurao and further seek activities that contribute to the community.



Rice planting event (2019)



Experiencing threshing without machinery during rice harvesting (2020)

Releasing and publishing the Agricultural Reconstruction Lectures as Digital Archive

Since the establishment of the Tohoku Agricultural Science Center for Reconstruction, there have been six courses in "Agricultural Reconstruction". In total 51 teachers were involved, supporting 463 Meister graduates. Although the lectures were cancelled in 2020 due to COVID-19, we published a digital version of the lectures to preserve the content so far and have begun to make them available to the public on a limited basis.



Agricultural Reconstruction Lectures

Donation of rice produced in Katsurao to new students and a children's cafeteria during COVID-19

In the midst of the spread of COVID-19 in 2020, we distributed rice grown and harvested at Tohoku University's paddy fields in Katsurao (Fukushima-bred variety "Satoyama-no-Tsuzumi") to children's cafeterias in Sendai City (30 kg each to two locations) and to students of Tohoku University's Faculty of Agriculture. The initiative was made possible with the cooperation of the Meisters of Agricultural Reconstruction and the community members of Katsurao.

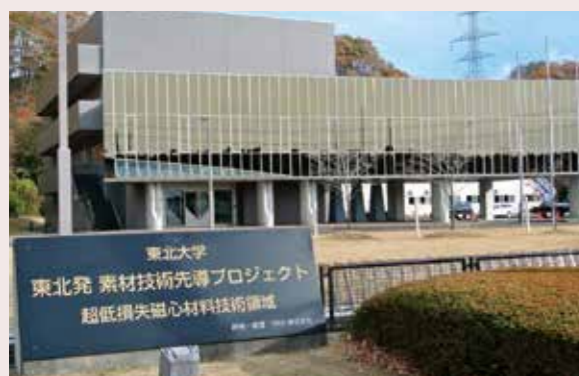


Distribution of rice to new students.

Project 08

Industry-Academia Collaboration Development Project for Reconstruction

In this project we collaborate with local communities and affiliate organizations and utilize policies and programs of the government, MEXT, or METI to support enterprises in disaster stricken areas of Tohoku in various ways. We aspire to practically implement and commercialize the seeds and research outcomes of Tohoku University in industry-academia collaboration in order to promote the recovery of the industry of heavily damaged regions.



東北発 素材技術先導プロジェクト

Tohoku Innovative Materials Technology

Tohoku University has already world leading capabilities in research areas such as material science and acts as center for various research related to important technology fields. We aspire to create revolutionary technology seeds and practically implement them for commercialization in the following three areas by collaborating with local universities and enterprises.

- Ultra Low Friction Technology
Drastic improvement of energy efficiency via development of ultra-lubricant nano-interface optimization technology
- Ultra-Low Core Loss Magnetic Material Technology
Drastic reduction and mitigation of power loss via development of new nano-crystalline magnetic materials
- High Efficiency Rare Elements Extraction Technology
Realization of element recycling via advanced collection and reutilization of rare elements from urban mines



地域イノベーション戦略支援プログラム

Program for Strategic Regional Innovations

In order to support excellent initiatives for the creation of innovations, we established a system promoting a continuous support from research at universities to the realization and commercialization, aspiring a vital, attractive, and autonomous region.

- Next-Generation Automobiles in Miyagi
Utilizing global cutting-edge seeds and technology, we promote the recovery after the earthquake via establishment of next-generation automobile research centers and reinforcing the technology standards of local enterprises in order to create a large and lively accumulation area of automobile industry affiliates for continuous development
- Knowledge Based Medical Device Cluster in Miyagi
Based on the "Miyagi Recovery Plan", we create medical equipment and devices utilizing diverse seeds of Tohoku University in strong private-public collaboration in order to establish a medical equipment industry area in Tohoku.



Project Activities

Industry-Academia Collaboration Development Project for Reconstruction

Tohoku Innovative Materials Technology

2012 10 Tohoku Innovative Materials Technology Symposium (annual, ~2017.1.)

■ Ultra Low Friction Technology Area

2012 10 International tribology symposium collaborating with the Green Tribology Innovation Network (GRENE)

2013 4 Course for sharing equipment and facilities
4 First regional collaboration exchange, meeting for technology consultations

2014 4 Collaborative research with the Miyagi Industrial Technology Institute and 5 regional enterprises (~2017)

2015 4 Tohoku Economic Federation's "Project for the Development of New Enterprises and Support of Alliances"
7 METI's "Projects to support the advancement of strategic core technologies"

2016 10 Private-public symposium on "Tohoku Innovative Materials Technology - Ultra-Low Friction Technology"

2017 3 Research workshop on "Tohoku Innovative Materials Technology - Ultra-Low Friction Technology"

■ Ultra-Low Core Loss Magnetic Material Technology Area

2014 6 Successful development of nano-crystalline soft-magnetic material drastically reducing energy loss
9 Opening ceremony of the Material Solutions Center (MaSC)
12 Verifying the world leading energy efficiency of high efficient motors

2015 11 Successful production of FeNi magnets completely free of rare earth elements
11 Establishment of the "Tohoku Magnet Institute (TMI)"

2016 2 Successful pilot production of a compressor motor utilizing the revolutionary nano-crystalline alloy NANOMET®

■ High Efficiency Rare Elements Extraction Technology Area

2013 11 International workshop on rare materials recycling technology

2015 2 Pilot production of the LIBS sorter
8 Technology seminar on automobile recycling for new developments in the recycling industry

2016 2 Seminar on the new E-Scrap recycling system
6 Tohoku Forum on Precious Metals Recycling
6 Workshop on extraction and separation of precious metals

Program for Strategic Regional Innovations

■ Next-Generation Automobiles in Miyagi Area

2012 9 Initiation Conference for Next-Generation Automobiles in Miyagi
12 Opening of the Miyagi Reconstruction Park

2014 4 Symposium for the promotion of private-public collaborations for establishment of a regional automobile industry

2015 2 Excursion of disaster stricken areas in Ishinomaki using EV cars

2017 2 Concluding symposium

■ Knowledge Based Medical Device Creation in Miyagi Area

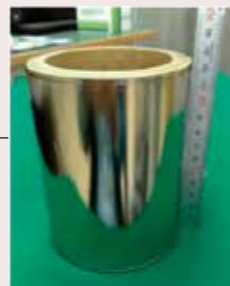
2012 7 Investigations of enterprises and health care professionals for the creation of medical devices (24 times total)
11 Kick-off meeting

2013 3 Inspection of medical equipment manufacturing (15 times total)
5 Miyagi School for Creation of Medical Devices (10 "Introduction Courses", 5 "Elementary Part 1", 4 "Elementary Part 2", 5 "Elementary Part 3")

2014 7 Miyagi private-public collaboration fair for creation of medical devices (annual, ~2016.7)

2015 11 "Innovation Skills Necessary for the Medical Welfare Equipment Industry" Lectures

2017 3 Summarizing Session



Tohoku Innovative Materials Technology

Ultra Low Friction Technology



Industry Collaboration in Ultra Low Friction Research Utilizing Cutting-Edge Science and Technology

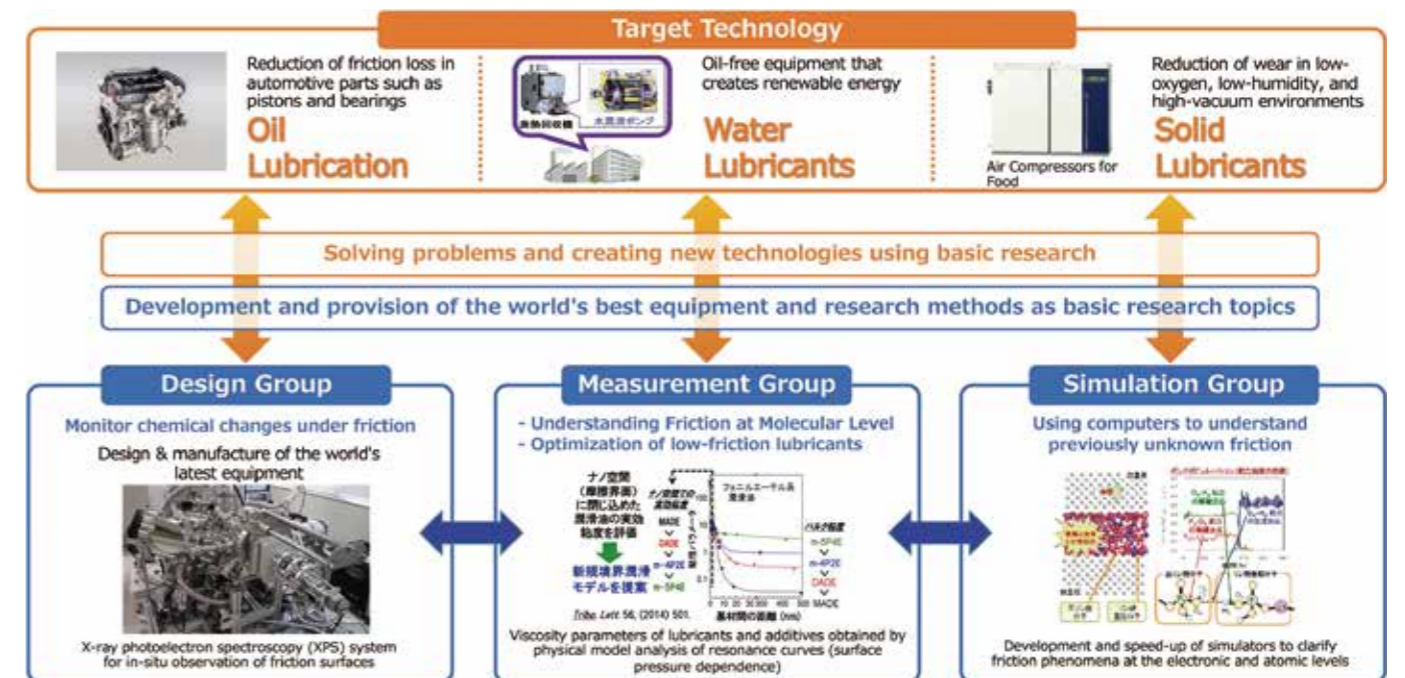
Friction reduction technology is applied in many industry areas, e.g. automobile industry, as well as everyday life, contributing to effective energy utilization, and is key to safety and security, being also very important for the realization of a low-carbon society. We promoted development of ultra-low friction technology based on the nano level analysis of friction, focusing on ultra-low lubricated friction surfaces from a scientific point of view, in industry-academia collaboration of researchers and technicians.



Interdisciplinary Development of Low-Friction Materials and Surface Design Technology

Utilizing best practices and methods in research, e.g. "design", "measurement", and "simulation", we succeeded in developing new lubricant materials currently considered for commercialization by the

participating companies. The development in "Oil Lubrication" was conducted by developing materials which facilitate synthesis of MoS₂ from the lubricant additive MoDTC, for "Water Lubricants" we utilized DLC displaying low wear and low friction, and for "Solid Lubricants" we created low friction composite resins based on the analysis of tribochemical reactions by simulation.



Development of the Snow Repelling Coating "Riku Oh"

We analyzed the mechanism of the snow repellent coating "Yuki Oh" preventing snow accretion in joint research with KF ATTAIN Co., Ltd., and succeeded in reducing the drying time from 48 hours to 40 minutes retaining the same performance. Furthermore, developed and commercialized the roof paint "Riku Oh" based on modifications to "Yuki Oh".



Snow repelling coating "Yuki Oh"



Roof paint "Riku Oh"

Development of SiC Polishing Techniques

Collaborating with TDC Corporation, we contributed to the low-cost production of semiconductors and developed a technique for ultra-rapid advanced polishing of large silicon carbide (SiC) substrates as well as necessary equipment related to the process.



Polishing techniques for various materials with nano-level quality assurance

Development of Automatic Screw Feeder

We supported the friction research of rail material in the screw feeder developed by Ohtake Root Kogyo Co., Ltd., advancing the design of the apparatus for the stable feed of micro screws, and developed a micro screw feeder capable of handling screws with diameter smaller than 1mm.



Automatic micro screw feeder



Rails used in the automatic screw feeder

Ultra-Low Friction Technology Seminar and Private-Public Collaboration Symposia

In order to help the regional industry to solve the problems relating to friction, surfaces and interfaces of their products, we cooperated with the Industry Technology Institute of the Miyagi Prefecture Government, and held seminars titled "The World of Surface, Interface and Friction for Creating New Industry" several times a year to answer questions such as "What is a surface or interface?" or "How does friction technology work and how can we evaluate?" We also consulted engineers of regional companies to solve each of their own questions and problems to facilitate the development of their products. Furthermore, private-public collaboration symposia on ultra-low friction technology were held to promote friction technologies in the region as well as exchanges between participating companies, thus advancing the regional economy.



Discussions at the seminars



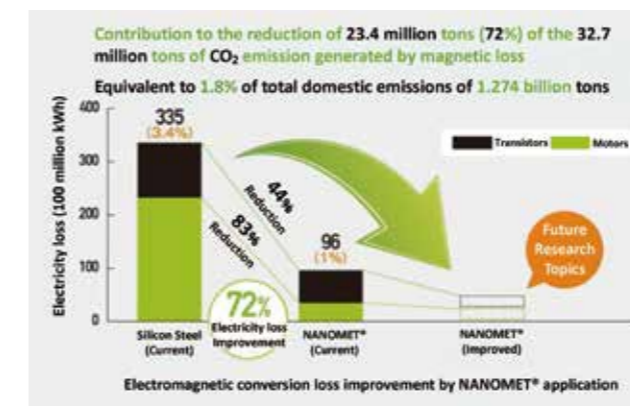
Posters and panels at the exhibition.

Tohoku Innovative Materials Technology

Ultra-Low Core Loss Magnetic Material Technology Area

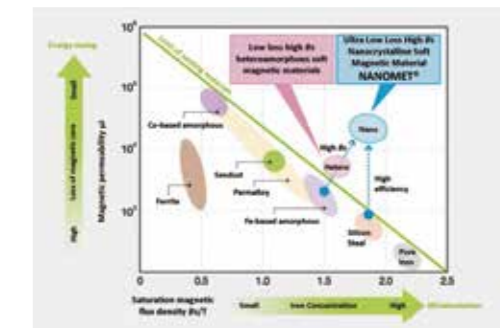
Research in Ultra-Low Core Loss Magnetic Material Technology

In order to reduce energy consumption on a global scale, it is necessary to improve the efficiency in all areas, power transfer as well as everyday utilities. Especially motors and transistors using electro-magnetic conversion are prone to energy loss, even reaching to 3.4% of the total consumption. Our technology area conducts research and development for the realization of revolutionary ultra-low core loss magnetic materials, solving the above mentioned issues and contributing to the vitalization of the industry in the Tohoku region.



Development of the Revolutionary Nano-Crystalline Soft-Magnetic Alloy "NANOMET"

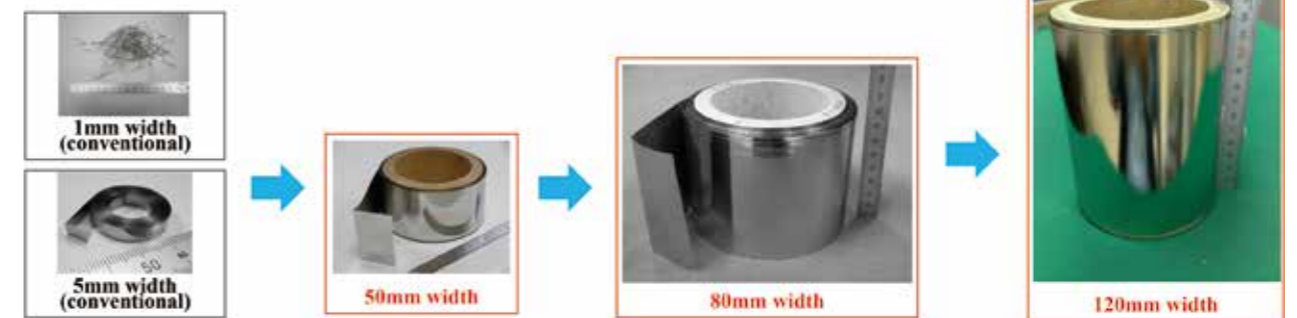
To develop extremely low core loss magnetic materials, we created the new nano-crystalline alloy "NANOMET" utilizing the nano-crystallization of special self-assembly nano-heterogeneous amorphous structures. NANOMET* provides applications for areas demanding strong magnetic fields, expected to be highly beneficial to large current transformers for power grids and motors. Adopting the nano-crystalline materials to transformers or motors will contribute to saving energy due to the reduced core loss. Cooperating with Panasonic Corporation, we were able to build a prototype of a motor using NANOMET* and we further modified the process to develop a prototype of compressors with similar capabilities as mass produced devices, verifying the energy efficiency of our products. Compared to motors or compressors using ordinary magnetic steel (silicon steel), we achieved a ca. 3% higher efficiency, displaying one of the highest levels in the world.



Development of Nano-Crystalline Soft-Magnetic Materials for Significant Energy Loss Reduction

We were able to develop new nano-crystalline soft-magnetic alloys with widths of 50mm, 80mm, and finally 120mm, superior to the

existing materials regarding high saturation magnetic flux density and loss of magnetic hysteresis. Magnetic cores (for transformers or motors) made with these nano-crystalline soft-magnetic alloys have ultra-low core loss properties, contributing to more efficient power transfers and home appliances with less energy consumption.



Development process of 120mm wide alloys

A Tohoku University Venture "Tohoku Magnet Institute"

On November 5, 2015, we established the "Tohoku Magnet Institute Corporation" (TMI). The corporation was founded by a fund managed by Tohoku University Venture Partners Co., Ltd., via the Private-Public Innovation Program (MEXT & METI) based on the Industrial Competitiveness Enhancement Act as well as funding participation (600 million JPY funding capital) of five private companies (Alps Electric, TOKIN, JFE Steel, Panasonic, and Murata Manufacturing). Based on the research achievements regarding the revolutionary soft-magnetic alloy "NANOMET", we further improved the functionality and performance, and continue to develop and commercialize nano-crystalline soft-magnetic alloys with increased productivity.



Announcement press conference of TMI

"MEXT's Minister Award" at the 14th Commendation of Contributions to Private-Public Collaborations (2016)

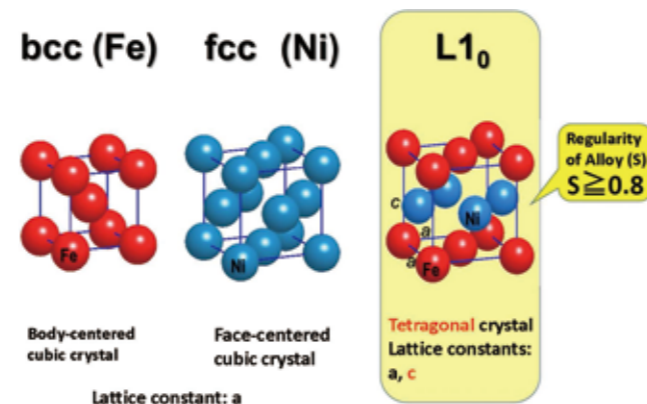
As result of activities in industry-academia collaborations with leading national companies of various fields based on university seeds and the research and development project "Leading Materials Technology from Tohoku" by MEXT and the Reconstruction Agency, we received the MEXT's Minister Award at the 14th Commendation of Contributions to Private-Public Collaborations.

14th Commendation of Contributions to Private-Public Collaborations "MEXT's Minister Award" for "Development and Commercialization of Revolutionary Ultra-High Efficient Soft-Magnetic Materials (NANOMET) in Private-Public Collaboration" Prof. Akihiro Makino (Institute for Materials Research) Prof. Junichi Umehara (Institute for Materials Research, visiting) Prof. Tsuyoshi Nomura (New Industry Creation Hatchery Center, visiting)



Production of FeNi Magnets Completely Free of Rare Earth Elements

In order to produce high functional magnets, rare earth elements such as samarium (Sm), neodymium (Nd), or dysprosium (Dy) were considered necessary. However, we succeeded in developing an easy and fast production method for high quality FeNi magnets completely free of rare earth elements. To secure the predominance of the Japanese industry based on next-generation energy efficient technology, the development of new high functional magnets is of utmost importance, and we are proud to say that our research achievements have contributed to a future solution of this issue. FeNi Magnets formed in space and contained in very small amounts in natural meteorites have been known since the 1960s. However, this formation was done by ultra-slow cooling (in an extreme state of equilibrium) and took several billion years and was thought to be impossible in a short period of time. Our technology utilizes the ultra-high speed atom transfer of the nano-crystallization process in amorphous metals, creating an effect similar to a time tunnel, and thus reducing the production time of high quality materials from several billion years to 300 hours. The research achievements of our group were published in the international academic journal "Scientific Reports".



Fe, Ni and L10FeNi crystal structures.

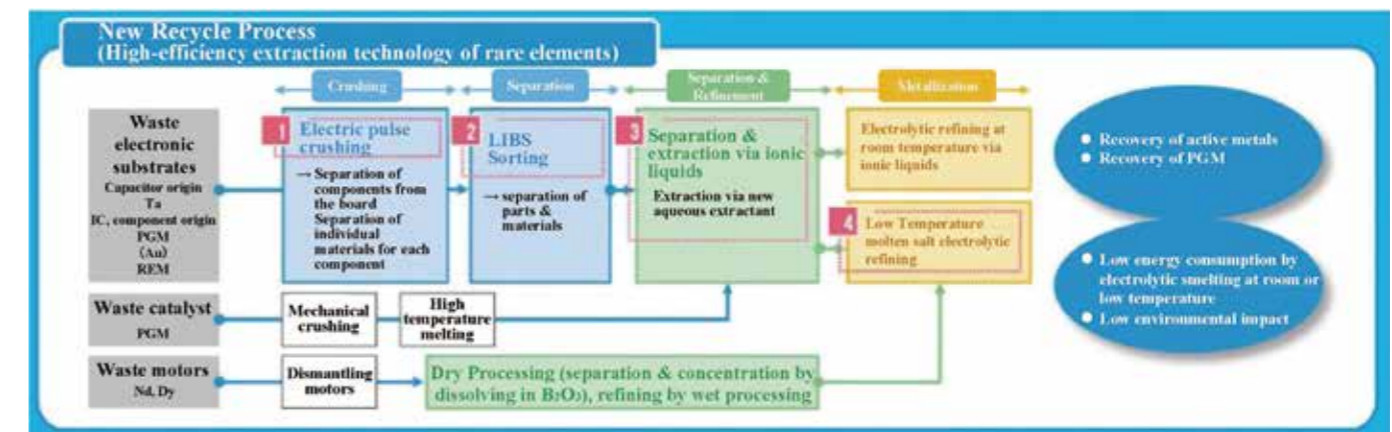
Tohoku Innovative Materials Technology

High Efficiency Rare Elements Extraction Technology Area

Resource Issues Regarding Rare Metals and Recycling Technology

Rare metals are fantastic materials adding special properties even when used in small amounts for high-tech devices such as hybrid cars or electric home appliances. These rare metals are essential resources, but the production is limited only to some countries. Considering the global demand of those rare elements with respect to the supply by the

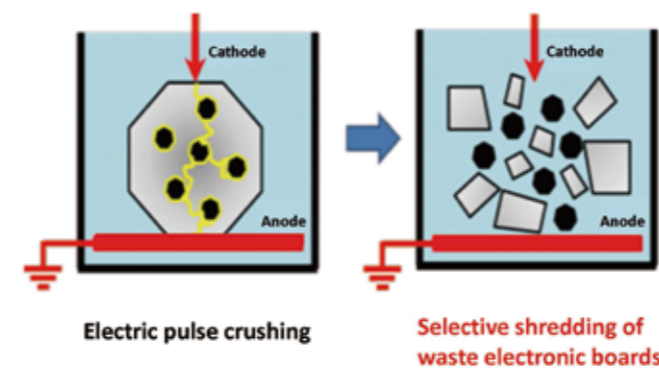
small number of countries possessing these materials as resources, there exists an issue of insufficient supply and high costs. In order to solve this problem, "Element Recycling" technology is an important method in procuring necessary amounts of rare elements. By efficiently extracting the rare elements from disposed electronic equipment in "urban mines" of waste, we were able to develop an effective recovery technology for the valuable materials.



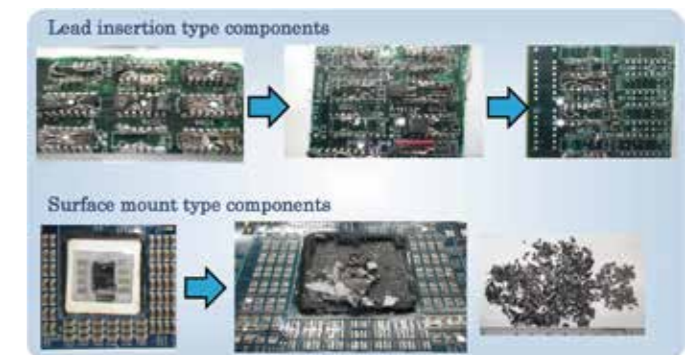
Development of "Electrical Pulse Crushing" Technology

In order to effectively recycle discarded materials, the waste has first to be crushed into small parts, which are sorted and "compressed" by objective and type. Electronic circuit cards for example differ from other waste, since the electrical components are printed on the board, meaning the materials would also be crushed if put through a normal

process. Our project developed technology to separate the electrical components from such boards utilizing shock waves from an electrical pulse under water. We also developed a method to visualize and observe shock waves utilizing this "electrical pulse crushing" under water and experimenting on a model of the crushing phenomenon. The method led to a more efficient research of pulse crushing, providing an outlook for a commercialization schedule.



Selective crushing utilizing electrical pulses.

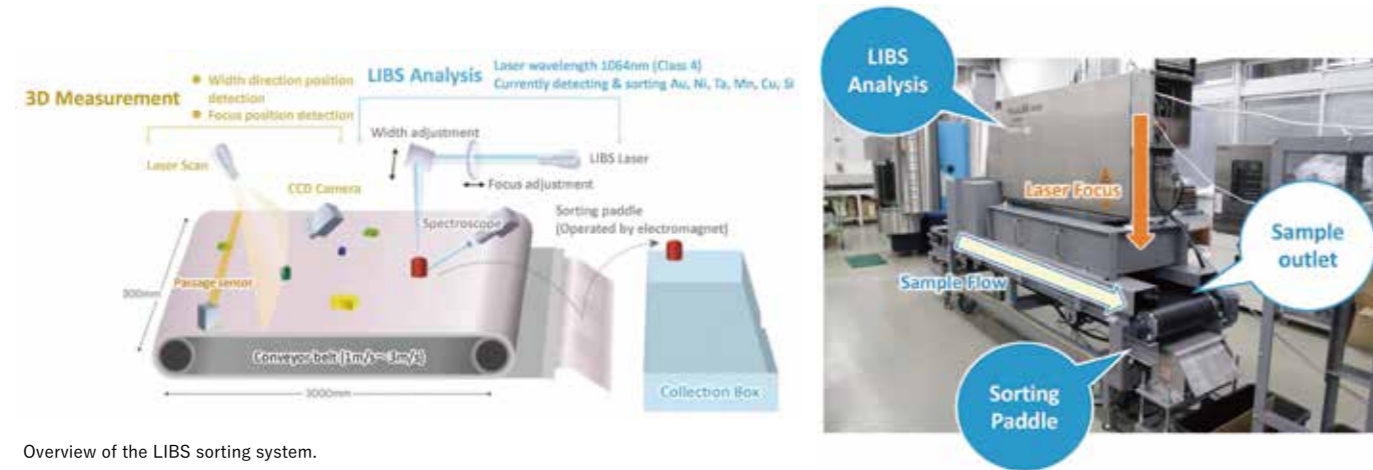


Examples of crushed electrical circuits by the electrical pulse crushing.

Development of LIBS Sorting Technology

Since contained rare elements differ with each part, we needed technology to sort the separated components. We utilized the Laser Induced Breakdown Spectroscopy (LIBS) analysis method to analyze

the spectrum of each small parts and organize the sorting process by determining the necessary elements. The developed LIBS sorting system technology provides a swift selection and separation process for practical use.



Overview of the LIBS sorting system.

Development of a New Extraction Process Utilizing Ionic Solutions

In order to refine the desired elements contained in the separated electrical components, we conducted research on chemical extraction methods and developed several ionic solutions for the targeted separation and extraction of elements of the platinum group and rare earth elements and tested the efficiency and characteristics of the process.



Efficient separation and extraction via ionic solutions.

Contributions to the E-scrap Recycling Industry

In order to contribute to fundamental experiments as well as practical processes of the E-scrap industry, we organized various tech-seminars to support companies and provide necessary methods. We also conducted joint research on increased recovery rates of rare and precious metals with disaster stricken companies. Furthermore, we held seminars on topics such as E-scrap recycling from discarded automobiles or small electric house appliances, presenting parts of our developed technology during excursions. We also started projects to establish a recycling system of rare and valuable metals in Miyagi, in order to create a collection system for the future.



The Tohoku precious metals recycling forum



Excursion during the ELV recycling forum.

Program for Strategic Regional Innovations

Next-Generation Automobiles in Miyagi

"Development of New Products and Systems at Universities Private-Public Collaboration for Next-Generation Automobiles"

As key for the recovery and regeneration after the Great East Japan Earthquake, there are high expectations for next-generation automobiles. Strategic innovations in this field utilize cutting-edge seeds and technology. In order to continuously evolve the automobile industry in

the Tohoku region centered at Miyagi as one accumulation zone, we are aspiring to create a research and development center for next-generation automobiles by collaboration of ca. 40 research laboratories of Tohoku University. Cooperating also with local communities, financial institutions, and companies we will conduct education of human resources and share necessary equipment for further developments. We will continue to promote the recovery after the Great East Japan Earthquake and reinforce the technological capabilities of the region in collaboration with related companies.

Fostering Human Resources to Support the Future Automobile Industry

This human resource education program has a "basic phase" with many participants and an "advanced phase" with only a small number of participants. During the basic phase, experts from e.g. companies

gave lectures, providing a platform for private-public exchange related to the automobile industry. In the advanced phase, we organized practical training tailored to the knowledge, experience, and skills of the individual participants. Furthermore, we included various activities e.g. laboratory tours or excursions to local companies.



Laboratory tour presenting research

In order to raise interest and awareness via direct exchange with university researchers, we organized laboratory tours for affiliates of regional companies involved in automobile development.



Excursion to regional companies

We organized 12 excursions (with a total participation of 22 companies) visiting regional companies, asking employers about their current status and obtaining an overview of the present situation.

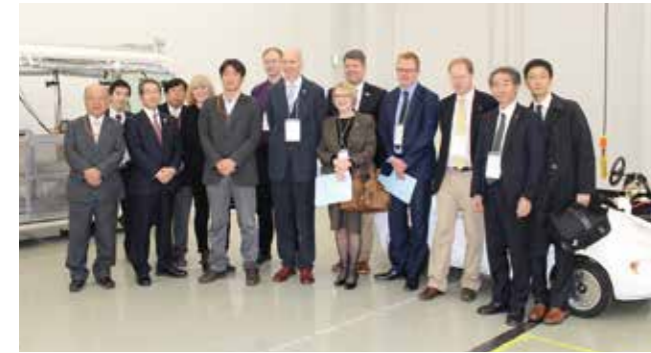
Summer school

In order for students to participate more proactively we held summer schools as part of the human resource education program. Presentations and group discussions on topics such as matching university seeds with regional needs led to a deeper understanding of current projects related to next generation automobile technology.



Opening of the Miyagi Reconstruction Park

The "Miyagi Reconstruction Park" established as research center for facility visits and tours is an innovation creation center accommodating not only disaster stricken medium and small sized businesses such as manufacturers, welfare facilities, or service industries, but also entrepreneurs or university research institutions aspiring to create new regional industries. We conduct presentations of research outcomes such



Visit by British community executives



Electric Vehicle

Excursion to Disaster Stricken Areas by EV Cars

In order to create resilient communities in disaster stricken areas we conducted on-site visits and investigations regarding the introduction of electric vehicles (EV) and examples of charging systems introduced at guesthouses and factories. Observing the current status and practical utilization of EVs, helping local communities, we were able to assess the situation and clarify issues as well as objectives for future research.

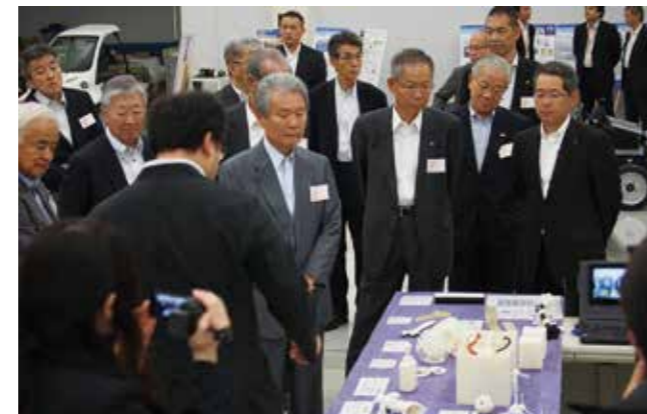


Electric vehicles utilized at temporary housings in Mangokuura, Miyagi.

as small electric cars and share research equipment of the university with the local communities with many visitors from both local and global interested parties. (23 related companies)



Visit by Prime Minister Abe



Visit by the President of Keidanren

Development of Reverse Trike Mobility Vehicles

Reverse Trike Mobility Vehicles are three-wheeled electric bicycles, having two front and one back wheels, and can be operated in three different ways 1) by pedal, 2) with electric assistance, and 3) using electricity only. Considering the advanced aging in provincial towns and rural areas, this provides new ways for mobility of local residents, also improving safety by e.g. preventing turnovers in bends or locking (braking) mechanisms when getting off.



Electric Reverse Trike Mobility Vehicle

Utilizing Driving Simulators to Prevent Driving the Wrong Direction on Expressways

We conducted joint research utilizing driving simulators (DS) in collaboration with MILT's Sendai Office of Rivers and National

Highways of the Tohoku Regional Development Bureau. The outcomes have been introduced to the Kahoku interchange of the Sanriku Expressway as colored pavements and are attracting attention for the efficiency to prevent driving the wrong way on expressways.



Before the installation.



Testing on driving simulators.



After the installation

International Next Generation Automobile Symposium

Since 2013, we have held an international symposium once a year, inviting many speakers from Japan and abroad who are involved in next-generation automobiles. The speakers came from Europe, the U.S., and Asia, and covered a wide range of topics, including fuel cells, electric vehicles, legal issues, the use of big data, MEMS, and robot technology.



Concluding Symposium

The concluding symposium was held at the Westin Sendai in February 2017, and was attended by many people from industry, academia, government, and academia who have participated and contributed in various ways. Lectures were given on Tohoku University's efforts in the research of next-generation automobiles, and the results over the past five years were reported.



Participants

Program for Strategic Regional Innovations

Knowledge Based Medical Device Creation in Miyagi

Creation of an Internationally Competitive Industry for Medical Devices

In order to establish a center for the creation of medical equipment, continuously developing and commercializing advanced technology as well as accumulate knowledge and expertise, we aspire to found the necessary basis as fundament for our activities. We conduct research and

development in five areas and already succeeded in the commercialization of eight products in total (4 devices, 1 Printed-Array Strip (PAS) for gene searching, 1 imaging phantom for equipment development, 1 research reagent, and 1 analysis technology) as well as two venture businesses. Furthermore, we participate in the establishment of a parts cluster by medium and small sized manufacturers of the region.



Five research and development topics.

Various Human Resource Development Programs in Private-Public Collaboration

We are organizing the “Miyagi School for Creation of Medical Devices” on a regular basis, promoting the understanding of medical devices manufacturing and commercialization to management or technical staff of enterprises which aspire to participate in the market and had 1005 participants so far. In order to provide necessary know-how, we have to accurately comprehend the needs of enterprises, why we conducted surveys after each event and constantly modify the program.

Furthermore, we record the seminars and study sessions and make them accessible to a broader audience online. Additionally, we held medical engineering seminars to nurture and educate human resources who will lead national progress with abilities to realize innovations in clinical practices or medical equipment industries, as well as conducted periodic excursions and inspections of university medical equipment for affiliates. We also organized the “Innovation Skills Necessary for the Medical Welfare Equipment Industry” lectures and discussed the possibilities and results of “coaching” in advancing medical engineering, having talks and sessions with experienced managers and affiliates.



Private-Public Collaboration Fair of the Knowledge Based Medical Devices in Miyagi



Visiting the manufacturing of steel surgical equipment



Practical training utilizing high functional patient simulators.

Development of the “STH-PAS” Gene Search Tool

Although genetic tools for the investigation of various bacteria are constantly developed, easy and comprehensive examination technology for practical use has yet to be established. Particularly, developing countries often have severe issues with infections, but the needs are not always satisfied due to the high cost of examination infrastructure. In order to comply, we developed and commercialized the simple and inexpensive gene search tool “STH-PAS” for the swift examination of infections.



STH-PAS

Development of Automatic Preparation Device “AccuDisp” for Anti-Cancer Agents

Currently it is recommended that injectable anti-cancer agents are prepared by pharmacists in a sterile environment. However, there are also many medical institutes where the preparation is conducted by doctors or nurses in the open space of facilities, risking the chemical exposure of the drugs. In order to solve the issue, we developed the high functional automatic preparation device “AccuDisp” for Anti-Cancer Agents which fits in existing safety cabinets. The commercialization of the device does not only prevent chemical exposure but also increases the precision of the preparation due to automatization, thus increasing the level of provided medical care.



AccuDisp

Development of the High-Efficient Magnetic Stimulation Device “PathleaderTM”

By conducting magnetic stimulation of peripheral nerves in muscles paralyzed by injuries or illnesses with high-frequent pulses, it is possible to induce movement, and thus supporting the rehabilitation of limbs. However, existing rehabilitation methods used electrodes in direct contact with the skin, inducing pain to the paralyzed patients. We developed the Magnetic Stimulation Device “PathleaderTM”, utilizing magnetic stimulation without pain, reaching deeper muscles in the body without direct contact.

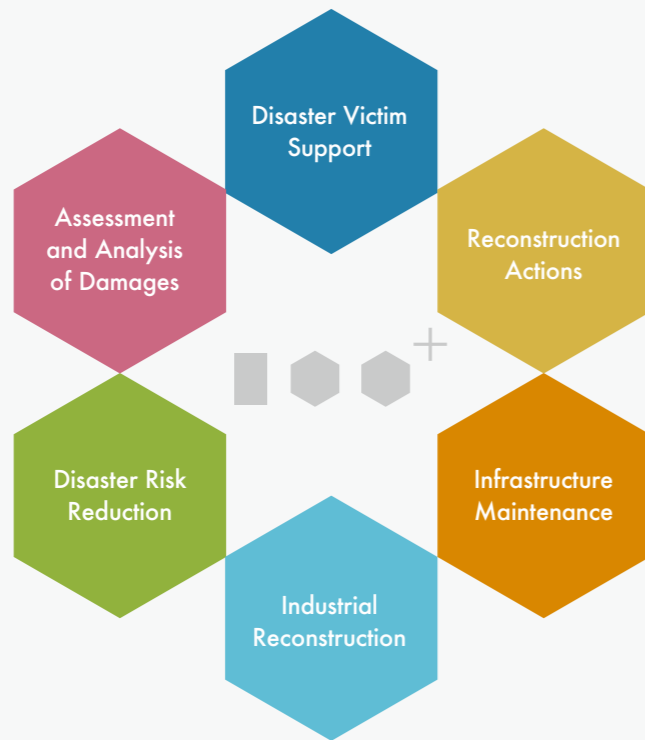


PathleaderTM



Tohoku University Member's Projects Reconstruction Action 100+ - Overview

The "Reconstruction Action 100+ (Plus)" is a general term describing more than 100 projects emerging from the voluntary efforts of Tohoku University's members to contribute to the regeneration of the region. It is based on the sole feeling of each and every one at Tohoku University: "What can we do to help?" We will continue our endeavors as comprehensive university in the center of the disaster stricken area through our strengths in individual professions to support the reconstruction of the community.



Disaster Victim Support

- Preventing Panic and False Rumors
~ Searching for the suppressive behavior of disaster Victims [Graduate School of Arts and Letters] Finalized
- "Disaster Volunteers" Internship Project [Graduate School of Arts and Letters] Finalized
- Project: "Hello" from the Porch [Graduate School of Arts and Letters] Finalized
- Criminal Psychology at Times of Catastrophes [Graduate School of Arts and Letters] Finalized
- Consultation Room for the Soul [Graduate School of Arts and Letters] Finalized
- Education of "Interfaith Chaplains" and Social Implementation [Graduate School of Arts and Letters]
- Reconstruction Support through Art [Graduate School of Arts and Letters]
- Psychological Aid for Members of the Disaster Stricken Region [Graduate School of Education] Finalized
- Support Room for Disaster Affected Children [Graduate School of Education]
- Clinical Psychology Consultation [Graduate School of Education] Finalized
- Legal Counsel by Law Students [Graduate School of Law] Finalized
- Provision Disaster Law Consultation Q&A [Graduate School of Law]
- Practical Seminar on Radiation Measurement [Graduate School of Science] Finalized
- The Principle of Catastrophes: Public Lectures [Graduate School of Science] Finalized
- Lectures at Schools for Revival of Learning [Graduate School of Science] Finalized
- Health Survey and Guidance for Disaster Victims [Graduate School of Medicine]
- Advancing and Analyzing Oral Health in Disaster Stricken Areas [Graduate School of Dentistry]
- Education for Multi-Level Health Promotion of a New Generation in Disaster Stricken Areas [Graduate School of Dentistry]
- Mental Care of Radiation [Graduate School of Pharmaceutical Sciences] Finalized
- Encouragement Project for Children from the Contaminated Area - Distribution of Education for Practical Radiation Protection [Graduate School of Pharmaceutical Sciences] Finalized
- Study toward improved communication and engagement with publics after the Fukushima Dai-ichi Nuclear Power Plant Accident [Graduate School of Pharmaceutical Sciences]
- Support for Disaster Affected Foreigners [Graduate School of International Cultural Studies] Finalized
- Support Program for Students of Disaster Stricken Areas [Graduate School of Life Sciences] Finalized
- Learning Support for School Children [Graduate School of Environmental Studies] Finalized
- Education Program for the Reconstruction of the Kesenuma Area [Graduate School of Environmental Studies] Finalized
- Contribution to community medicine in Tohoku region [Graduate School of Biomedical Engineering]

- Connecting the Promotion of Social Capital to the Regeneration of the Region [Graduate School of Biomedical Engineering] Finalized
- Health Support for Senior Citizens at Shelters & Provisional Homes, Prospective Cohort Studies of Daily Life Functionalities at Provisional Homes in Kesenuma [Institute of Development, Aging and Cancer] Finalized
- Smart Aging On-site College [Institute of Development, Aging and Cancer] Finalized
- Prevention of Sudden Deaths at Shelters and Provisional Homes after the Disaster [Institute of Development, Aging and Cancer]
- Medical Consultation Support via Regeneration of Information Communication at Shelters and Provisional Homes after the Disaster [Institute of Development, Aging and Cancer]

Assessment and Analysis of Damages

- Recording Damages and Regeneration of the Great East Japan Earthquake [Graduate School of Arts and Letters] Finalized
- Let's See and Think! International Study Tour at Minami Sanriku to Remember the Disaster and the Region [Graduate School of Arts and Letters] Finalized
- Assessment and Analysis of Disaster Related Cultural Properties [Graduate School of Arts and Letters] Finalized
- Socioeconomic Analysis of the Damages and Reconstruction Process after the Great East Japan Earthquake [Graduate School of Economics and Management] Finalized
- Detailed Analysis, Evaluation and Estimates of Impacts on Statistical Analyses in Medical Fields from the Great East Japan Earthquake [Graduate School of Economics and Management] Finalized
- Exhibition of Visions for the Renewal of East Japan [Graduate School of Economics and Management] Finalized
- Active Distribution of the Current Recovery Status after the Disaster from the Education & Research Scene [Graduate School of Science] Finalized
- Regeneration and Minerals, Radioactive Contamination Removal and Minerals [Graduate School of Science] Finalized
- International Network for Disaster Status Communication [Graduate School of Science] Finalized
- Status Report on the Great East Japan Earthquake and International Communication of Geographical Analyses [Graduate School of Science] Finalized
- Long Term Monitoring of Environmental Radiation of Disaster Stricken Areas (Onagawa) [Graduate School of Science] Finalized
- Communication of Scientific Intelligence and Need for Information after the Catastrophe [Graduate School of Science] Finalized
- Grass-Root Radiation Monitoring: The Miharu Misho Project [Graduate School of Science] Finalized
- Long Term Monitoring of Environmental Radiation of Disaster Stricken Areas (Fukushima) [Graduate School of Science]
- Radioactivity Measurements of Wild Mushrooms [Graduate School of Science]
- Tome Project [Graduate School of Medicine] Finalized
- Exposure of Organochlorines and Evaluation of Health Risks for the Next Generation - Regional Regeneration Project Measuring the Development of Feti and Newborns as Indicators [Graduate School of Medicine] Finalized
- Support for the Regeneration of Health Administrative Functionalities in Disaster Stricken Areas-Based on the Video Records of the Regeneration Process [Graduate School of Medicine] Finalized

- Analysis of Internal Radiation Exposure through Teeth Examinations – Radiation Dose Evaluation via Lost Milk Teeth of Children in Fukushima & Miyagi [Graduate School of Dentistry] Finalized
- Evaluation of Radiation Effects on Animals [Graduate School of Dentistry] Finalized
- Comprehensive Radiation Dose Evaluation through the Analyses of Teeth [Graduate School of Dentistry] Finalized
- Radiation Dose Evaluation via the Analyses of Children's Teeth in Fukushima [Graduate School of Dentistry]
- Monitoring Radiation & Radioactivity in Atmosphere, Oceans, Soil and Plants [Graduate School of Pharmaceutical Sciences] Finalized
- Radiation Exposure Assessment of Children in Miyagi after the TEPCO Fukushima Daiichi Nuclear Disaster [Graduate School of Pharmaceutical Sciences] Finalized
- Recommendations for the Damage Assessment of Affected School Facilities and Reconstruction Support, Structural Design and Earthquake-Resistant Architectures [Graduate School of Engineering] Finalized
- Investigative Research Regarding the Storage of Remains after the Disaster in the Arahama Region of Wakabayashi [Graduate School of Engineering] Finalized
- Joint Investigation of the Fishing Ground Environment at the Miyagi Coast [Graduate School of Agricultural Science] Finalized
- Evaluation of the Risk Communication Regarding the Effects of Radiation [Graduate School of Agricultural Science] Finalized
- Investigation of the Dynamics of Radioactive Cesium Contamination in Grassland and Verification of the Effect of Tillage Decontamination at Tohoku University's Kawatabi Field Center [Graduate School of Agricultural Science]
- Conditions of Animal Damage in Disaster Areas and Countermeasures [Graduate School of Agricultural Science]
- Researching Swift Agreements in Reconstruction Plans: Changes of Disaster Victim's Views [Graduate School of International Cultural Studies] Finalized
- Clarifying Conflict Sources of Reconstruction Plans [Graduate School of International Cultural Studies] Finalized
- Investigation Regarding Disaster Prevention Function of Ecosystems [Graduate School of International Cultural Studies] Finalized
- Fukushima-Chernobyl Project [Graduate School of International Cultural Studies]
- Creation of tsunami resilience index in areas affected by the Great East Japan Earthquake [Graduate School of International Cultural Studies]
- Application of Robots to the Great East Japan Earthquake and Research into Disaster Response Technologies [Graduate School of Information Sciences]
- Green Regeneration Project from the Sea and Fields: "Monitoring Organism Diversity in Disaster Stricken Fields and the Coastal Ecosystems with Public Participation" [Graduate School of Life Sciences]
- Monitoring Environmental Radiation in Soil [Graduate School of Environmental Studies] Finalized
- Risk Evaluation and Technology as Counter Measures of Heavy Metal Tsunami Debris [Graduate School of Environmental Studies] Finalized
- Investigating New Soil & Ground Water Contamination after the Earthquake & Tsunami [Graduate School of Environmental Studies] Finalized

- Measuring Radioactivity of Primary Sector Products, Soil, and Waste [Graduate School of Environmental Studies] Finalized
- Support for Measuring Radiation [Institute for Materials Research]
- Evaluation of Radiation Effects on Animals [Institute of Development, Aging and Cancer] Finalized
- Promoting the Observation of Submarine Earthquakes and Tectonic Movements [International Research Institute of Disaster Science] Finalized
- Mental Health Support for the Disaster Stricken Area [International Research Institute of Disaster Science] Finalized
- Promotion of Health in Shichigahama [International Research Institute of Disaster Science]
- Resilience of the Urban Recovery System after the Great East Japan Earthquake and Regional Vulnerability Assessment to Tsunamis [International Research Institute of Disaster Science] Finalized
- Evaluation of Initial Disaster Response by Minamisanriku Town Officials after the Great East Japan Earthquake [International Research Institute of Disaster Science] Finalized
- Comprehensive Examination of Recovery from the 2011 Great East Japan Earthquake and Tsunami, and Urban Safety Induction Strategies Considering Natural Disaster Risk in the 21 Century [International Research Institute of Disaster Science]
- Archiving the Experience of the Great East Japan Earthquake [Center for Northeast Asian Studies] Finalized
- Support for the Local Government Regarding the Regeneration of Folklore and Traditional Culture in Disaster Stricken Areas and the Investigation of Methodology [Center for Northeast Asian Studies] Finalized
- Comparing Local Communities Regarding the Regeneration Process and Applying Ethnographic Information [Center for Northeast Asian Studies] Finalized

Reconstruction Actions

- Natural Disasters and Religion [Graduate School of Arts and Letters]
- Support of the Dialect Life at Disaster Stricken Areas [Graduate School of Arts and Letters]
- "City Building Concept" in Catastrophically Damaged Regions [Graduate School of Law] Finalized
- Volunteer Support [Graduate School of Law] Finalized
- Food Production and Supply Systems to Overcome Misinformation [Graduate School of Economics and Management] Finalized
- Regeneration Support for the Fish Market [Graduate School of Economics and Management] Finalized
- Miyagi Voices 2016 Publication [Graduate School of Economics and Management] Finalized
- Dispatching Supporters for the Regeneration of Local Communities [Graduate School of Economics and Management]
- Recovering Earthquake and Tectonic Activity Observation [Graduate School of Science] Finalized
- Support of Damaged Laboratory Equipment [Graduate School of Science] Finalized
- Data Management Support Promoting Data Utilization in Disaster Stricken Communities [Graduate School of Medicine] Finalized

- Support of Pharmaceutical Services in Disaster Stricken Areas [Graduate School of Pharmaceutical Sciences] Finalized
- Support for Damaged (Non-Wooden) Building Reconstruction, Evaluation Method for Damage Degree and Recoverability [Graduate School of Engineering] Finalized
- Sendai School of Design Workshop Series "Redesign Toward Regeneration" [Graduate School of Engineering] Finalized
- Investigation of New Local Management Methods in the Arahama Area (Wakabayashi Ward) [Graduate School of Engineering] Finalized
- Fundamental Research and Core HR Education for Decommission of Nuclear Reactors, Maintenance of Structural Building Integrity, and Disposal of Nuclear Waste [Graduate School of Engineering] Finalized
- Sendai 3/11 Memorial Community Center [Graduate School of Engineering] Finalized
- Technology for Decontaminating the Environment [Graduate School of Engineering]
- Regeneration Support for Food, Agriculture, and Communities [Graduate School of Agricultural Science] Finalized
- Preparations for the Tohoku Agricultural Science Center for Reconstruction [Graduate School of Agricultural Science] Finalized
- Rapeseed Project [Graduate School of Agricultural Science] Finalized
- Regeneration of the Region & Planning Cities [Graduate School of Agricultural Science] Finalized
- Reconstruction of the Primary Sector [Graduate School of Agricultural Science] Finalized
- Support of Food and Environmental Education [Graduate School of Agricultural Science]
- Rapeseed Project for Regeneration of Saltwater Damaged Farmland [Graduate School of Agricultural Science] Finalized
- Decontamination of Living Organisms [Graduate School of Agricultural Science] Finalized
- Recommendation and Guidelines for the Disposal and Recycling of Disaster Debris [Graduate School of International Cultural Studies] Finalized
- Conditions for Connectible Regional Projects Seen in the Regeneration Plan: Comparing Unlikely and Likely Continuable Projects [Graduate School of International Cultural Studies] Finalized
- Recommendation and Investigation for the Disposal and Recycling of Disaster Debris – Toward an International Collaborative Model – [Graduate School of International Cultural Studies] Finalized
- Dust my broom Project [Graduate School of International Cultural Studies]
- Reconstruction Education Support (SDGs Education Support) [Graduate School of International Cultural Studies]
- Education of Global HR via ICT Projects Contributing to the Disaster Region (Tohoku University ASIST) [Graduate School of Information Sciences] Finalized
- Providing Research & Laboratory Space, Production Facilities, and Laboratory Equipment for Free [Graduate School of Life Sciences] Finalized
- Active Analysis and Decontamination of Radioactive Material in Soil [Graduate School of Environmental Studies] Finalized
- Development of Earthquake Resistant Materials via Recycling Tsunami Debris and Creative Regeneration via Artificial Grounds [Graduate School of Environmental Studies] Finalized

- Introducing Life Style Design Methods to the Disaster Stricken Area [Graduate School of Environmental Studies] Finalized
- Creation of New Technology Based on the Life Style in the Disaster Stricken Area [Graduate School of Environmental Studies] Finalized
- Decontamination of Tsunami Debris [Graduate School of Environmental Studies]
- REDEEM: Recurrent Education for the Development of Engineering Enhanced Medicine [Graduate School of Biomedical Engineering] Finalized
- Joint Usage of Cutting Edge Facilities [Institute for Materials Research] Finalized
- Analysis of the Current Status of the Fukushima Nuclear Reactor and Recommending Mid- to Long-Term Measures [Institute of Fluid Science] Finalized
- Development of Water Treatment Technology via High Functional Micro Bubbles and Dielectric Barrier Discharge [Institute of Fluid Science] Finalized
- Assessment for Industry Regeneration and Measurement Equipment Support Utilizing Network Type Joint Research Centers [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- Rebirth of the Coastal Countryside Utilizing Steel Slags [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- Radioactive Decontamination Utilizing Polymer Separation Membranes [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- Technical Support Regarding the Accident at the Nuclear Power Plant [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- Promoting the Miyagi Geopark [International Research Institute of Disaster Science] Finalized
- International Innovation Workshop on Off Shore Tsunami Energy Dissipation and Peak Height Alleviation [New Industry Creation Hatchery Center (NICHe)] Finalized
- Evaluation for Dynamics of Radioactive Cesium in Environment [Cyclotron and Radioisotope Center]
- Excavation Projects for Disaster Regeneration [Center for Northeast Asian Studies]
- Center for Northeast Asian Studies Disaster Humanities Unit [Center for Northeast Asian Studies]
- Joint Study on Community Revitalization and Creation Process and Sustainability after the Great East Japan Earthquake [Center for Northeast Asian Studies] Finalized
- Tsunami-Struck Museum Rescue Activities [The Center for Academic Resources and Archives]
- Developing Algorithms for Environmental Radiation Measurement [Research Center for Electron Photon Science (ELPH)]

Disaster Risk Reduction

- Designing Chemistry Laboratories to Withstand Earthquakes [Graduate School of Science] Finalized
- Sharing Research Findings Regarding the Generation Mechanism of the 2011 Great East Japan Earthquake with Society [Graduate School of Science]
- Study on the Practical Implementation of a Social Fundament Equipped with Multiple Fail Safe Systems [Graduate School of Engineering] Finalized

- **Building a Sensor Communication Society for Disaster Prevention and Mitigation** [Graduate School of Engineering] Finalized
- **Analysis of Demolition Criteria of Damaged Architecture and Establishment of Highly Reliable, Resilient Design Guidelines** [Graduate School of Engineering] Finalized
- **Mitigating Health Issues in Disaster Affected Homes** [Graduate School of Engineering] Finalized
- **Securing Energy in Emergency Situations Without Power Supply** [Graduate School of Engineering] Finalized
- **Evaluation and Maintenance of Spent Nuclear Fuel Pools at Fukushima Daiichi** [Graduate School of Engineering] Finalized
- **Earthquake Resistance of Inappropriate Steel Frame Constructions Based on Damage Assessments after the Great East Japan Earthquake** [Graduate School of Engineering] Finalized
- **Development of Reliable Distributed Energy Supply and Preventive Tectonic Utilization Systems** [Graduate School of Engineering] Finalized
- **Ruins of the Great East Japan Earthquake: Sendai Arahama Elementary School** [Graduate School of Engineering] Finalized
- **Ruins of the Great East Japan Earthquake: Yamamoto Old Nakahama Elementary School** [Graduate School of Engineering] Finalized
- **Exhibition Support and Planning at the Yamashita Community Center for Disaster Prevention** [Graduate School of Engineering] Finalized
- **Exhibition Preparations at the Yamashita Community Center on Disaster Prevention** [Graduate School of Engineering] Finalized
- **Verification of Disaster Information and Support for Digitally Divided People** [Graduate School of Information Sciences] Finalized
- **Catastrophe and Regeneration Monitoring Based on Video Records of Disaster Stricken Areas** [Graduate School of Information Sciences] Finalized
- **Recommendations for Plans to Build Resilient Communities** [Graduate School of Life Sciences] Finalized
- **Disaster Debris Disposal, Recycle Management, Technology Recommendations** [Graduate School of Environmental Studies] Finalized
- **Development of Disaster Prevention Technology** [Institute of Fluid Science] Finalized
- **Development of Submarine Geologic Stress Measurement Methods Related to the Occurrence of Earthquakes** [Institute of Fluid Science] Finalized
- **Determining Total Damages in Tsunami Stricken Areas via Remote Sensing and Geo-Processing, Monitoring Regeneration, and Developing Next Generation Tsunami Prediction Technology** [International Research Institute of Disaster Science] Finalized
- **Tutorials from Disaster Episodes: A Cognitive Psychological Approach** [International Research Institute of Disaster Science] Finalized
- **“Pocket Notebook and Handbook for Family’s Disaster Resilience (MINNA-NO-BOSAI TECO)”** [International Research Institute of Disaster Science] Finalized
- **Architecture and Urban Design for Disaster Risk Reduction and Resilience Initiative (Arc-DR3 Initiative)** [International Research Institute of Disaster Science] Finalized
- **Landslide monitoring by radar in Kumamoto** [Center for Northeast Asian Studies] Finalized

Infrastructure Maintenance

- **Project A, Workshop I, School of Public Policy** [Graduate School of Law] Finalized
- **Reexamination of Disaster Prevention Legislations** [Graduate School of Law] Finalized
- **Mathematical Models for a Safe and Secure Society** [Graduate School of Science] Finalized
- **Fundamental Research for the Creation of a Sustainable Tohoku Region** [Graduate School of Science] Finalized
- **International Networks for the Investigation of Megathrust Earthquake and Tidal Wave Mechanisms of 1000 Year Periods** [Graduate School of Science] Finalized
- **Regeneration of Medical Care Functionality and Experience Distribution in Disaster Stricken Regions** [Graduate School of Medicine] Finalized
- **Regenerative Medical Care Utilizing Muse Cells** [Graduate School of Medicine] Finalized
- **Maternal and Child Health Activities after the Great East Japan Earthquake – Activity Reports of Health Nurses and Future Prospects** [Graduate School of Medicine] Finalized
- **Epilepsy Hotline Project** [Graduate School of Medicine] Finalized
- **Tohoku Center Project: Cause of Death Investigation Center** [Graduate School of Medicine] Finalized
- **Capacity Expansion of the School of Medicine** [Graduate School of Medicine] Finalized
- **Special Outpatient Services for Epilepsy via TV Conferences with Hospitals in Disaster Stricken Areas** [Graduate School of Medicine] Finalized
- **Regeneration of Dental Treatment in Disaster Stricken Areas via Network Establishment** [Graduate School of Dentistry] Finalized
- **Survey and Supply for Oral Care Needs of Disaster Stricken Communities** [Graduate School of Dentistry] Finalized
- **Dental Supply and Emergency Dental Care for Disaster Recovery** [Graduate School of Dentistry] Finalized
- **Oral Care for Senior Citizens Requiring Primary Nursing Care and People with Disabilities** [Graduate School of Dentistry] Finalized
- **Large Scaled (Forensic) Identification Methods after Catastrophes** [Graduate School of Dentistry] Finalized
- **Regional Self-Medication Support** [Graduate School of Pharmaceutical Sciences] Finalized
- **Development of Multilayered Wireless Networks** [Graduate School of Engineering] Finalized
- **Investigating Necessary Elements for Regeneration and Reconstruction Plans after Wide Devastating Disasters** [Graduate School of Engineering] Finalized
- **Environmental Energy Project for Tohoku Reconstruction** [Graduate School of Engineering] Finalized
- **Recovery Support for Regeneration and Rebirth of Ishinomaki** [Graduate School of Engineering] Finalized
- **Integrated Design and Analysis of a Sustainable Energy System** [Graduate School of Engineering] Finalized

- **Integrated design and analysis for sustainable municipalities** [Graduate School of Engineering] Finalized
- **Design for resilient energy system with renewable resources toward decarbonized society** [Graduate School of Engineering] Finalized
- **Cross border design and analysis for municipalities toward decarbonized society** [Graduate School of Engineering] Finalized
- **Regionally Autonomous Energy Supply Systems** [Graduate School of Agricultural Science] Finalized
- **Highly Reliable, Resilient Information System for Regeneration** [Graduate School of Information Sciences] Finalized
- **Inspection of Election Management Systems in Disaster Stricken Areas and Efficiency of Voting** [Graduate School of Information Sciences] Finalized
- **Promotion of Geothermal Energy and New Energy Visions** [Graduate School of Environmental Studies] Finalized
- **Resilient Zero Emission Communities** [Graduate School of Environmental Studies] Finalized
- **Oil-Free & Wireless Power Supply Systems Combined with Mega-Solar Power Plants** [Graduate School of Biomedical Engineering] Finalized
- **Concept for Advanced Prophylactic Health Community** [Graduate School of Biomedical Engineering] Finalized
- **The Miyagi Model for Regional Cancer Treatment Resilient to Aging and Disasters** [Institute of Development, Aging and Cancer] Finalized
- **Communication of Correct Information regarding Radiation Effects** [Institute of Development, Aging and Cancer] Finalized
- **Development of Spintronics Materials and Fundamental Device Technology for a Resilient Safe and Secure Society** [Research Institute of Electrical Communication] Finalized
- **Development of Fundamental Technology for Highly Functional Information Storage Devices** [Research Institute of Electrical Communication] Finalized
- **Platform Technology of Mesh-typed Regional Network** [Research Institute of Electrical Communication] Finalized
- **U-Type (urgent) Cooperative Research Projects** [Research Institute of Electrical Communication] Finalized
- **Self-Distributed Green Iron Manufacture Project Adequate to Regional Environments** [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- **Disaster Psychology Education and Distribution** [International Research Institute of Disaster Science] Finalized
- **Telemedicine Service using “Electronic Medical Doctor’s Bag” for Disaster Medical Care Support** [Cyberscience Center] Finalized
- **Development of Dependable Identity Management Systems for Disaster-tolerant Networks** [Cyberscience Center] Finalized
- **R&D on a Real Time Tsunami Inundation Forecast System utilizing Supercomputers** [Cyberscience Center] Finalized
- **Construction of Resilient Campus Information Infrastructure** [Cyberscience Center] Finalized

- **Suitable Safety Systems at Nuclear Power Facilities** [New Industry Creation Hatchery Center (NICHe)] Finalized
- **Program for Archives and Publication of 3D Pointcloud Data of the Great East Japan Earthquake for Tsunami Ruins** [The Center for Academic Resources and Archives] Finalized

Industrial Reconstruction

- **Case Study and Investigative Research Project of Regional Innovations** [Graduate School of Economics and Management] Finalized
- **Status of Constructions after the Disaster Regeneration** [Graduate School of Economics and Management] Finalized
- **Miyagi Sendai Vegetarian Project** [Graduate School of Economics and Management] Finalized
- **Social Innovator HR Education School** [Graduate School of Economics and Management] Finalized
- **New Development of Correct Radiation Measurement Technology for the Renewal of Japan** [Graduate School of Science] Finalized
- **Development of Reduction Technology for Radioactive Cesium Transfer to Cultivated Mushrooms** [Graduate School of Science] Finalized
- **Industry-Academia Cooperation Center for Molecular Imaging** [Graduate School of Medicine] Finalized
- **Development and Distribution of Disaster Response Type Dental Treatment Utilities** [Graduate School of Dentistry] Finalized
- **Development of Living Resources Utilization for Pharmaceuticals** [Graduate School of Pharmaceutical Sciences] Finalized
- **Private-Public Cooperative Manufacturing Support** [Graduate School of Engineering] Finalized
- **Development of Portable Power Generation Sheets for Emergencies** [Graduate School of Engineering] Finalized
- **Non-Invasive Diagnosis of Venous Thrombosis of Shelter Residents** [Graduate School of Engineering, Graduate School of Biomedical Engineering] Finalized
- **Education and Training for Nuclear Power Safety** [Graduate School of Engineering] Finalized
- **Autonomous High Technology Society Scheme** [Graduate School of Engineering] Finalized
- **Inspection and Measurement Supporting Safe and Secure Energy** [Graduate School of Engineering] Finalized
- **Development of Super Compact Power Units for Personal Information Terminals of the Next Generation** [Graduate School of Engineering] Finalized
- **Free Access to Microfabrication Facilities and R&D Support for Disaster Affected Institutes** [Graduate School of Engineering] Finalized
- **Resilient Power Supply System Utilizing Distributed Power and Power Load Equipment Clusters** [Graduate School of Engineering] Finalized
- **New Industry Creation Concept for Higher Order Industry (Production, IT) Regeneration** [Graduate School of Engineering] Finalized
- **Cooperative Agreement with Miyagi Organization for Industry Promotion regarding Industry-Academia Cooperation for Regional Regeneration Support** [Graduate School of Engineering] Finalized
- **Development of Green Power Integrated Devices with High Efficient Electric Energy Supply and Energy Saving Electric Systems** [Graduate School of Engineering] Finalized
- **Mitigation of Indoor Radiation** [Graduate School of Engineering] Finalized
- **Study on Depth Distribution of Radioactivity on Artificial Covering Surfaces and its Effect on Air Dose Rates** [Graduate School of Engineering] Finalized

- **Emergency Response Research: Development of Measurement Methods and Pharmacokinetic Analysis regarding Radioactive Cesium in Livestock** [Graduate School of Agricultural Science] Finalized
- **Development of New Technology for Utilization in Local Industries** [Graduate School of Agricultural Science] Finalized
- **Let's Light the Olympic Flame 2020 with Bio Methane!** [Graduate School of Agricultural Science]
- **Arahama Project** [Graduate School of Agricultural Science]
- **Hayashi Rice Project** [Graduate School of Agricultural Science] Finalized
- **Turbine Power Technology Development and Education** [Graduate School of Information Sciences] Finalized
- **AC/DC Hybrid Grid Homes and Residential Energy Share Model (Smart Village Project)** [Graduate School of Environmental Studies] Finalized
- **Smart Community Possibilities in Higher Ground Transfer of Disaster Stricken Residential Areas** [Graduate School of Environmental Studies] Finalized
- **Reutilization of Waste Wood and Sludge from the Great East Japan Earthquake for Earthquake-Proof Artificial Grounds** [Graduate School of Environmental Studies] Finalized
- **Fusion of Soil Separator-Multi Method and Bon Terrain Method for Tsunami Debris Recycle and Ground Materials Evaluation** [Graduate School of Environmental Studies] Finalized
- **Erosion Resistant Soil Covering Material and Safe Storage of Contaminated Soil Utilizing Tsunami Debris** [Graduate School of Environmental Studies] Finalized
- **Development of High Functional Soil Covering Materials for Concealing Contaminated Soil Utilizing Tsunami Debris** [Graduate School of Environmental Studies] Finalized
- **Creation of Sources for Future Life** [Graduate School of Environmental Studies] Finalized
- **Development of an Ultra Early Cancer Diagnosis and Treatment System** [Graduate School of Biomedical Engineering] Finalized
- **Development of Disaster and Energy Crisis Resilient Medical Equipment** [Graduate School of Biomedical Engineering] Finalized
- **Support for the Raise of Medical Equipment Production in Miyagi** [Graduate School of Biomedical Engineering] Finalized
- **Technological Seed Fostering for Practical Implementation and Commercialization of Medical Equipment** [Graduate School of Biomedical Engineering]
- **Development of a Practical Program for School Coaching Models in Disaster Stricken Areas** [Graduate School of Educational Informatics Research Division] Finalized
- **Development of Successor Support Methods for Traditional Culture in Disaster Stricken Areas Facing Extinction** [Graduate School of Educational Informatics Research Division] Finalized
- **Development of High Functional Equipment and Radioactive Samples as Response to the Nuclear Accident** [Institute for Materials Research] Finalized
- **Development of Safe and Secure High-Temperature Steam Oxidation Resistant Materials for Nuclear Reactors** [Institute for Materials Research] Finalized
- **Control and Analysis of Elements in Advanced Steel** [Institute for Materials Research] Finalized

- **Maintaining Functionality at Local Regeneration Centers** [Institute for Materials Research] Finalized
- **Development of Organization Control Technology for High Mechanical Vesting of High-Value-Added Iwate Produced Cobalt Alloy Robots** [Institute for Materials Research] Finalized
- **Innovation Creation in Tohoku via Industry-Academia Cooperation Centered at New Nano Cristal Soft Magnetic Materials** [Institute for Materials Research] Finalized
- **"Iwate Produced Cobalt Alloy Production Support for Medical Use"** [Institute for Materials Research] Finalized
- **Development of Decontamination Methods for Sr and Cs in Environmental Water as Response to the Nuclear Accident** [Institute for Materials Research] Finalized
- **Element Strategy in Design of Advanced Steel** [Institute for Materials Research] Finalized
- **Development of Emergency Response Medical Care Technology** [Institute of Fluid Science]
- **Development of Alternative Energy Resources** [Institute of Fluid Science] Finalized
- **Super Computation of Flotsam Mixed Tsunamis** [Institute of Fluid Science]
- **Technology Development for the Practical Implementation of Real Time Image Processing Synthetic Aperture Radar** [Research Institute of Electrical Communication] Finalized
- **Fundamental Research Support Program for Renewable Energy Materials** [Research Institute of Electrical Communication] Finalized
- **Decontamination Planning and Monitoring Project of the Ministry of Environment** [Institute of Multidisciplinary Research for Advanced Materials] Finalized
- **Continuous Workshops on the Great East Japan Earthquake** [International Research Institute of Disaster Science]
- **R&D of Green Materials for Energy Harvesting and Energy Saving** [Advanced Institute for Materials Research] Finalized
- **Development and Design of Earthquake-Resistant Materials Meeting International Standards** [Advanced Institute for Materials Research] Finalized
- **Optimized and Efficient Creation of New Energy via Advanced Fusion of Research Areas** [The Frontier Research Institute for Interdisciplinary Sciences] Finalized
- **Creation of New Disciplines via Cross-Sectoral, Interdisciplinary Research for Disaster Regeneration and New Industry Developments** [The Frontier Research Institute for Interdisciplinary Sciences] Finalized
- **Advanced Interdisciplinary Research via Cross-Sectoral, Interdisciplinary Research for Disaster Regeneration and New Industry Developments** [The Frontier Research Institute for Interdisciplinary Sciences] Finalized
- **"Mg-Soleil Saving the World" (Key for Abandoning Nuclear Power) (New Industry Creation Hatchery Center)** [New Industry Creation Hatchery Center (NICHe)] Finalized
- **Development of Collection System for Contaminated Waste Materials at Nuclear Power Plants** [New Industry Creation Hatchery Center (NICHe)]
- **Establishment of an "International Center for the Creation and Implementation of Mobility Innovation"** [New Industry Creation Hatchery Center (NICHe)]

Disaster Victim Support

[Graduate School of Arts and Letters]

Project: "Hello" from the Porch

After the Great East Japan Earthquake, many "provisional" communities emerged, disregarding previous local community structures or relationships. This new environment often led to a disconnect to the surroundings with less communication and even lonely deaths of senior citizens at provisional homes. We had the desire to provide a place – a porch – for residents to be able to share their thoughts, communicate and start conversations with others, in order to prevent further tragedies and visited provisional homes in several new communities on a regular basis.



Special summer holiday event "Cooking Dumplings with Mum and Dad"



Flower arrangement class at provisional homes

Disaster Victim Support

[Graduate School of Arts and Letters]

Education of "Interfaith Chaplains" and Social Implementation

Due to the Great East Japan Earthquake, many people lost their loved ones or experienced similar forms of loss. In this program, we aimed for the spiritual care of disaster victims by collaborating with local priests, medical personnel and researchers involved in the "Counsel Room for the Heart" project. We established special endowed course for Practical Religious Studies within the Graduate School of Arts and Letters to educate "chaplains" who would not be involved in missionary work but take care of the psychological state of families who lost their loved ones and be involved in memorial services. Until 2020 we helped more than 200 chaplains to graduate who are now active in hospitals and communities of the region. Many university institutes followed our model, establishing an association for chaplains and thus expanding the community to help people in need.



Group work at interfaith chaplain training



Memorial services organized during the training course for chaplains (Watanoha Matsubara seawall, Ishinomaki, Miyagi)

Disaster Victim Support

[Graduate School of Education]

Psychological Aid for Members of the Disaster Stricken Region

At the time of the Great East Japan Earthquake, many local officials and staff from the disaster stricken regions engaged in the

support of children and residents while losing family members and homes themselves. This project was aimed to support academic and administrative staff via mental health care and counseling services immediately after the disaster. Through the psychological support for university members, the environment of the children and people involved improved as well, leading to more enriched mental health care of the affected children. Several years after the disaster, the psychological aid was continued according to the needs at the old or respectively new homes of the disaster victims. Furthermore, issues regarding children or families were resolved by direct visits and the mid to long term recovery and regeneration of the region was approached from a psychological perspective via the mental support of the residents, also increasing awareness through workshops and symposia.



Symposium "Regeneration Support from Educational Aspects"



Support at provisional homes

Disaster Victim Support

[Graduate School of Education]

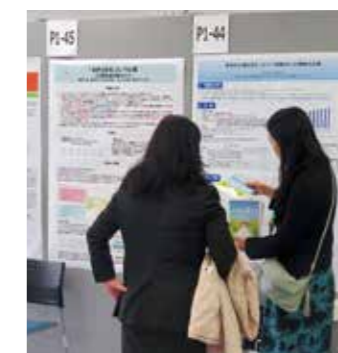
Support Room for Disaster Affected Children

In this project, we aim for long term mental health care and support of children who lost their parents due to the Great East Japan Earthquake. (Finalized March 31, 2021)

- Free phone counseling
- Individual counseling of children and guardians
- Family Salon
- Learning support for orphans (Tohoku University students as lecturers)
- Dispatching psychiatrists to disaster affected communities
- Supporting the recovery supporters
- Archiving and communicating all efforts and activities
- Establishing a mental health care support network with other communities
- Symposia and internships for people who interact with children
- Constructing a database regarding the mental state and support of disaster affected children
- Communication of necessary information regarding support activities
- Advice for disaster studies



Study group



Conference Presentation



Lectures

Disaster Victim Support [Graduate School of Law]

Legal Counsel by Law Students

As time goes by after the 3.11 Disaster, there is an increasing amount of legal troubles related to the earthquake. At Tohoku University's Free Legal Counseling Center run by students of the School of Law, law students specialized on legal problems related to the catastrophe visited disaster stricken areas and organized on-site legal counseling services.



On-site counseling (Hanamaki)



Counseling training (to prepare for on-site cases)

Disaster Victim Support [Graduate School of Science]

The Principle of Catastrophes: Public Lectures

After the public lecture "The 3.11 Earthquake and Dispersion of Radioactive Materials" organized by the Graduate School of Science, we got many inquiries to keep informing the public. We organized several symposia and Science Cafés, explaining the mechanism of earthquakes and tsunamis, analyzing the dispersion of radioactive materials from a specialist's point of view to the public. Our main aim was to help people understand the scientific reasoning of the situation and take away the fear of the unknown, thus helping citizens to gather correct information and knowledge as well as support the recovery and regeneration of the affected communities.



Science Café "The 3.11 Earthquake and Dispersion of Radioactive Materials"

Disaster Victim Support [Graduate School of Medicine]

Health Survey and Guidance for Disaster Victims

During the course of this project, we organized medical checkups and surveys of disaster victims in Miyagi and provided individual guidance based on the results. As necessary, we also collaborated with mental health care teams, provided guidance regarding exercises and nutrition, and consulted with communities to prevent nursing-care. Furthermore, we assessed the situation in disaster stricken communities and recommended necessary measurements for the recovery of hygiene and sanitation of the region, maternal and child health, and prevention of infectious diseases, as well as archived the recovery process of related health care systems.



Health assessment of disaster victims (Ajishima)



Exercise class (Oshika Area)

Disaster Victim Support [Graduate School of Dentistry]

Advancing and Analyzing Oral Health in Disaster Stricken Areas

The Graduate School of Dentistry applied the latest research results to community dental health and contributed to a world-leading community oral health promotion system, as well as develop human resources through research, education, and social contribution. After the Great East Japan Earthquake, we got several reports, that the health of children in the coastal regions was worsening and needed urgent attention as well as detailed analyses to prevent infections on a daily basis. Our Graduate School collaborated with communities of the coastal region (Watari) in Miyagi, organized on-site dental health checkups at elementary and middle schools to automate data collection, and established a database for the prevention of oral diseases. We also developed learning material for oral health care activities at schools and contributed to the prevention of oral diseases of children in the disaster stricken region.



On-site dental health class at an elementary school in Watari, Miyagi.

Disaster Victim Support [Graduate School of Pharmaceutical Sciences]

Encouragement Project for Children from the Contaminated Area – Distribution of Education for Practical Radiation Protection

In disaster stricken areas affected by the nuclear power plant accident, evacuated children were rumored to have "contracted radioactivity" and bullied due to the ignorance and misinformation of others. In this project, we aimed to correctly educate the public regarding practical radiation protective measures, decrease unnecessary exposure as well as encourage children and adults in their environment to act appropriately. We established a curriculum for the teaching and learning of correct knowledge and distributed it to appropriate personal at elementary and middle schools such as science teachers, organized workshops and science classes as well as on-site lectures for families.



Distribution of correct knowledge regarding protective measures against



Radiation measuring at homes and correct evaluation of values (Iidate)

Disaster Victim Support [Graduate School of Biomedical Engineering]

Connecting the Promotion of Social Capital to the Regeneration of the Region

A program to improve team medicine through coaching was implemented for 57 managers and 285 collaborators of the Tohoku University Hospital for three years starting in fall 2011 (funded by MEXT's "Establishment of a Human Resource Development System for University Hospital Staff to Promote Team Medicine"). This was conceived with the intention of promoting resilience, based on the results of a similar program conducted in the previous year (Journal of Healthcare Quality and Safety 2016; 11: 39-45), which showed that communication taken by leaders is related to organizational vitality and medical safety, as well as the participants' experience of using coaching to make their organizations function during the earthquake. This course was conceived with the intention of promoting resilience. The data revealed that organizations where participants could make suggestions and requests to improve had a better medical safety culture. (Jpn J Compr Rehabil Sci 2017; 8: 88-97) This initiative is a pioneering example of the full-scale introduction of such a system into a medical organization and its results.



This project's activities were featured in the Chunichi Shimbun in July 2012.

Disaster Victim Support [Institute of Development, Aging and Cancer]

Health Support for Senior Citizens at Shelters & Provisional Homes, Prospective Cohort Studies of Daily Life Functionalities at Provisional Homes in Kesennuma

In order to ensure the well-being of senior citizens as well as the reconstruction of a new environment, we have to 1) promote the independence of senior citizens so they do not consider themselves as burden to the recovery, and 2) not abandon and sacrifice them during the progress of regeneration. Therefore, support for senior citizens is a necessary requirement, though excessive support and services have the negative effect to take any opportunity of independence away from them. During the process of migration from evacuation shelters to provisional homes and finally public restoration housing, many senior citizens developed severe health issues, such as physical weakness (frail), malnutrition, pneumonia, dementia, alcohol dependence, and depression. To counteract these problem, we started the "Prospective Cohort Studies of Daily Life Functionalities" project in 2012.



Ruins in the coastal region of Kesennuma after the tsunami with the destroyed retirement home in the back.



Health counseling at public restoration housings.

Disaster Victim Support [Institute of Development, Aging and Cancer]

Smart Aging On-site College

We visited community centers in disaster affected areas of Ishinomaki, Kesennuma, and Watari, and introduced easy-to-understand familiar science such as "What healthy aging is" and "Know-how for enjoying your aging", i.e. Smart Aging, as a series of on-site lectures. Having tea and sweets, the audience enjoyed some outcomes of recent scientific investigations regarding aging. We believe that we were able to increase the audience's interest regarding their own health and raise the motivation for intellectual curiosity as well as promoting their health.



On-site College (Ohya, Kesennuma)



On-site College (Orose, Kesennuma)

Disaster Victim Support [Institute of Development, Aging and Cancer]

Medical Consultation Support via Regeneration of Information Communication at Shelters and Provisional Homes after the Disaster

The post-disaster venous thromboembolism (VTE) became noteworthy with the deaths due to pulmonary embolism (PE) related to sleeping in a car during the Niigata-Chuetsu Earthquake, and the high incidence of deep vein thrombosis (DVT) in evacuation centers has been reported in the subsequent Noto Peninsula Earthquake in 2007, the Niigata-Chuetsu-Oki Earthquake in 2007, and the Iwate-Miyagi Nairiku Earthquake in 2008. Since the Great East Japan Earthquake, we have been conducting DVT screening tests using a portable ultrasound device at evacuation centers and temporary housing facilities in Miyagi Prefecture as part of a campaign to prevent venous thrombosis, and have also been conducting research to provide information via the Internet. We have been analyzing how evacuees with DVT were followed during their evacuation, and released the results, which has been adopted as a joint guideline of the Japanese Circulation Society, the Japanese Society of Hypertension, and the Japanese Society of Cardiology.

Assessment and Analysis of Damages [Graduate School of Arts and Letters]

Let's See and Think! International Study Tour at Minami Sanriku to Remember the Disaster and the Region

In order to keep the memory and record experiences of the Great East Japan Earthquake, we organized investigative visits to the regions in Minami Sanriku, Miyagi, which were totally destroyed by the tsunami with the participation of students from the Kanto area. In particular, we photographed the scenery of the town after the tsunami, talked about the destruction at the time of the earthquake, and also organized volunteer services for provisional homes. More than half of the participants came from abroad, who would be able to report what they have seen with their own eyes once they returned to their country, thus communicating firsthand information on a global scale. This was also an important opportunity for young students to be involved in the recovery process and to think about their own role in the regeneration of the region, forming the shapes for the next generation. We hope that the participants of the investigative study tours will be the next "Storytellers", communicating their experience to their communities.



Lunch at a provisional store in Minami Sanriku.



Discussions in the bus.

Assessment and Analysis of Damages [Graduate School of Science]

Grass-Root Radiation Monitoring: The Miharu Mishi Project

The Miharu Mishi Project was initiated by volunteers from the town of Miharu and Tohoku University to monitor radiation levels of grass-roots. Since July 11th, 2011, we continued to provide radiation monitoring to elementary and middle schools. 2019 was the final year of the original goal of nine years (the period when new elementary school students who entered school immediately after the earthquake will complete their compulsory education), and our activities as a town have come to an end. In 2020, we are preparing to compile a record of our activities to date and the town's response immediately after the disaster for permanent display in the town's facilities.



Miharu Mishi Project

Assessment and Analysis of Damages [Graduate School of Dentistry]

Radiation Dose Evaluation by Analysis of Milk Teeth from Children in Fukushima

We have collected more than 7,000 milk teeth from children in the Fukushima and reference prefectures. We can estimate the internal exposure to radiation by measuring the radioactivity and radionuclides in these teeth. In addition, the electron spin resonance method can also estimate the external exposure to radiation by quantifying the carbonic radicals that are generated in the teeth after radiation exposure. Hence, this project represents a new approach to estimate individual exposure to radiation after the Fukushima Daiichi Nuclear Power Plant accident through tooth dosimetry, thereby expanding reconstruction research methodologies into disaster science and disaster risk reduction science.



Collection of milk teeth



Radiation dose evaluation by teeth analysis

Assessment and Analysis of Damages [Graduate School of Pharmaceutical Sciences]

Radiation Exposure Assessment of Children in Miyagi after the TEPCO Fukushima Daiichi Nuclear Disaster

After the nuclear power plant accident at TEPCO's Fukushima Daiichi Reactor, highly radioactive particles of the similar level to Fukushima settled in the southern parts of Miyagi. However, since contamination and radiation monitoring by the government was only limited to the prefecture of Fukushima and Miyagi was excepted, families with children in fear of contamination raised the demand for continuous monitoring of radiation exposure.

Upon requests from communities close to the prefecture of Fukushima which were affected most, we conducted individual radiation exposure monitoring via small size badges for children in Marumori, Kakuda, and Ohgawara in collaboration with local authorities. The measurement results were provided to the guardians of the children and also discussed with the community and other residents. A scientific overview and detailed report was given in the academic journal RADIOISOTOPES (2015, 2017).



Individual radiation exposure monitoring in the Kosugou area of Shiroishi, Miyagi.

Assessment and Analysis of Damages [Graduate School of Information Sciences]

Application of Robots to the Great East Japan Earthquake and Research into Disaster Response Technologies

Disaster robotics was developed to support emergency response, recovery and prevent disasters. The unmanned ground vehicle 'Quince' contributed to the cool shutdown of the Fukushima Daiichi Nuclear Power Plant by investigating the upper floor of nuclear buildings in 2011 as the first robot of its kind manufactured in Japan. The serpentine robot 'Active Scope Camera' was used for inspection of confined spaces of Fukushima Daiichi in 2016-17. We also developed an aerial vehicle with a rotating spherical shell for inspection of damaged infrastructure and buildings which is being tested at bridges nationwide by MLIT and CAO SIP Programs for the future procurement. CAO ImPACT Tough Robotics Challenge, which is organized by the research group, performs R&D of the 'Active Scope Camera' and 'Cyber Rescue Canine' in collaboration with the Japan Rescue Dog Association, providing information such as position and situation reports about the people in need of help to support search and rescue.



Disaster ground rescue robot "Quince"



Serpentine robot "Active Scope Camera"



Cyber rescue dog

Assessment and Analysis of Damages [Graduate School of Life Sciences]

Green Regeneration Project from the Sea and Fields: "Monitoring Organism Diversity in Disaster Stricken Fields and the Coastal Ecosystems with Public Participation"

By conducting biodiversity monitoring of coastal ecosystems along the tsunami-affected Tohoku coast, we aim to: (1) understand the magnitude of disturbance to these ecosystems caused by the Great East Japan Earthquake and Tsunami; (2) detect conditions that promote recovery of disturbed ecosystems and anthropogenic factors that inhibit recovery; (3) provide information on ecosystem functions and biodiversity needed to promote better land use and projects for recovery; and (4) create a pathway for local communities to take advantage of ecosystem functions and services. We also organized a 10 year commemoration symposium in collaboration with our partner associations in March 2021.

Tohoku University played a central role in the participation of



Guidance by community investigators

local residents, the regeneration and recovery of the natural habitat and functionality supporting the biodiversity, and the promotion of the environmental literacy of the residents, providing real-time scientific results to the communities.



Biological research with local children.



Investigation of the biodiversity in paddy fields of Sendai.

Assessment and Analysis of Damages [Graduate School of Environmental Studies]

Monitoring Environmental Radiation in Soil

After the Fukushima Daiichi Nuclear Power Plant accident, radioactive materials released in the environment also fell on farmland in Miyagi, causing concerns about contamination of crops. To alleviate this concern, we conducted quantitative analysis of radioactive cesium in agricultural products and soil in Miyagi, using a gamma counter, Wizard-2480, loaned to us free of charge by PerkinElmer Japan. The results were made publicly available on the websites of JA Sendai and Ai Coop Miyagi.



Radioactive Cesium Measurement with a gamma counter.

Assessment and Analysis of Damages [Graduate School of Environmental Studies]

Risk Evaluation and Technology as Counter Measures of Heavy Metal Tsunami Debris

This study aims to clarify how far historical tsunami deposits, especially muddy tsunami deposits, have been inundated on land, and to obtain more detailed information about tsunami inundation risks. As a result, it is possible to evaluate more quantitatively the inundation area of historical tsunami deposits in the Sendai Plain and East Matsushima. In the course of this research, we found outcrops preserving tsunami deposits from about 6,000 years ago in the overseas terraces of Noda Village, Iwate. By comparing the chemical composition of the tsunami sediments from the Great East Japan Earthquake in 2011 and the historical tsunami sediments in the Sendai Plain and applying machine learning, we discovered that the overseas terraces in Noda Village are almost exclusively composed of past tsunami sediments. This area was found to be an extremely valuable outcrop that can reveal the details of the tsunami-affected area caused by major earthquakes originating from both the Kuril Trench and the Japan Trench. Reconstruction research is being expanded into disaster science and disaster risk reduction science.



Coastal terraces in Noda Village, Iwate, consisting almost entirely of tsunami sediments. (The lower part is covered with sediments from the Jogan tsunami (869), and the surface is covered with tsunami sediments from the Great East Japan Earthquake in 2011.)

Assessment and Analysis of Damages

[Center for Northeast Asian Studies]

Support for the Local Government Regarding the Regeneration of Folklore and Traditional Culture in Disaster Stricken Areas and the Investigation of Methodology

In January 2021, Shinsensha published "Disaster Documentary: On Sharing Memories and Records of the Great East Japan Earthquake" (Sakura Koretsune and Hiroki Takakura, eds.) as a collection of study records by the Disaster Humanities Study Group of the Center for Northeast Asian Studies from 2018 to 2019. Since the Great East Japan Earthquake, Tohoku University's experts in humanities and sciences have been conducting practical research on disaster recovery and disaster risk reduction in a multitude of ways. Each time, a documentary film related to the Great East Japan Earthquake is screened, and a discussion between the film's director and other filmmakers and researchers in fields related to the content is held. It is a record of the memories and experiences to utilize findings from disaster risk reduction of local communities through film and video for both the communication of these memories and records as well as the prevention of disasters in the future.



"Disaster Documentary: On Sharing Memories and Records of the Great East Japan Earthquake"

Reconstruction Actions

[Graduate School of Arts and Letters]

Support of the Dialect Life at Disaster Stricken Areas

There are many people who lost their homes and had to move from their familiar surroundings to new communities due to the destruction of the earthquake. A local dialect is not only just a regional language but also a way of life and a statement to belong to a community, displaying regional identity, and thus a symbol for the "home of the soul". Since these rare dialects are more and more dissipating, we organized investigations to record and archive dialects of the disaster stricken areas, reported via pamphlets and workshops as well as actively communicated the dialect of the people from destroyed areas and related results to the next generation.



Conversation record of the dialect from disaster areas.



Introduction to the Kesennuma dialect for supporters.

Reconstruction Actions

[Graduate School of Economics and Management]

Food Production and Supply Systems to Overcome Misinformation

Immediately after the disaster, we have been conducting research on the relationship between the distribution of agricultural products and harmful rumors in Fukushima Prefecture in collaboration with the Graduate School of Science. In 2018, we organized the "Study Group on Recovery and Reconstruction Policies for Areas Affected by Nuclear Power Plants" with a grant from the Keiwakai Memorial Foundation, and at the end of the fiscal year, we held a symposium on "Recovery of Agriculture and Fisheries Industries after the Great East Japan Earthquake and Export Strategies. Results of our research will be released in 2021 to the general public.

The purpose of the workshop/symposium: In the areas affected by the Great East Japan Earthquake, there were concerns about the future of the agriculture, forestry, and fisheries industries, as well as the fish processing industry, even before the disaster struck, but solutions and



Reports and discussions at the symposium.

actions to address these issues were often postponed. Additionally, due to the nuclear accident at the Fukushima Daiichi Nuclear Power Plant, farmland and sea areas in Fukushima's Hamadori and other areas have been contaminated by radiation. Joint research was conducted on issues related to the recovery of agriculture and fisheries industries, focusing on the export of agricultural products and management innovation in the fisheries processing industry, and the symposium provided important information and discussions.



Flyer

Reconstruction Actions

[Graduate School of Engineering]

Sendai 3/11 Memorial Community Center

In 2016, Sendai City opened the Sendai 3.11 Memorial Exchange Center in Arai Station, the closest station to the sea on the Sendai Subway, as a memorial center for the coastal areas affected by the Great East Japan Earthquake. It is a place to learn about the Great East Japan Earthquake, and as a gateway to the coastal areas of eastern Sendai which were severely damaged by the tsunami, it is a center for communicating wisdom and lessons as well as connecting them to the future. In addition to permanent information displays such as three-dimensional maps and timelines, the center also has a variety of special exhibitions that delve into the damages caused by the earthquake and tsunami, the nature of reconstruction, and the lives of people in the affected areas in the past.



Life before the disaster, chaos immediately after and the current state of reconstruction.



Directly connected to the subway station concourse, it will be a gateway to visit the coastal areas.

Reconstruction Actions

[Graduate School of International Cultural Studies]

Recommendation and Investigation for the Disposal and Recycling of Disaster Debris – Toward an International Collaborative Model –

Immediately after the Great East Japan Earthquake, this project was implemented with the President's Budget, with the main objective of accurately assessing the situation of disaster waste disposal in each affected municipality and making policy recommendations for the proper disposal and recycling of waste. While ascertaining the status of disaster waste generation in affected municipalities, we conducted interviews with people in charge of disaster waste disposal

(all four areas of Miyagi, Fukushima, and Iwate) and conducted on-site surveys of disaster waste disposal sites (including the status of generation, ascertaining composition, measuring radiation levels, and taking photographs). It was revealed that complex factors hindered the rapid disposal of earthquake waste, such as confusion in the policy-making process due to extensive damages, the lack of smooth information communication and exchange of opinions between the national government and affected municipalities, and the necessity for decontamination. There were also discussions regarding the priorities and policies for accepting international assistance from abroad. These research results and policy recommendations were widely publicized at the 3rd UN World Conference on Disaster Risk Reduction (poster presentation), the 4th Asian Automotive Environment Forum (keynote speech), the Graduate School of International Cultural Studies public lectures, presentations at the Waste Planning Section of the Japan Society of Material Cycles and Waste Management, conference presentations at the Japan Macro-Engineers Society ("Outstanding Presentation Award"), and "The Journal of Japan Waste Management Association (Invited Paper)".



Reconstruction Actions

[Graduate School of International Cultural Studies]

Dust my broom Project

Although we can observe a steady progress of recovery and regeneration of the disaster stricken areas, there are also regions, in which the reconstruction is stagnating, where people leave the communities, or rapid aging of the community occurs, i.e. socially vulnerable people are not considered as they should be. In this project, we aimed to communicate correct information to the public via reports and exhibitions about appropriate measures for the disposal of earthquake and tsunami debris, organization of talk shows, and hosting of special lectures. Furthermore, we organized regular on-site inspections of disaster stricken areas in Fukushima, Miyagi, and Iwate to be able to report about the recovery progress on our web page. We also organized the soap bubble event "Memorial Reverse" in the severely damaged coastal region of Yamada in Iwate 2016 as well as distributed about 300 neck warmers made from recycled PET bottles at Nishikigaoka Elementary School in Sendai and Nakai Elementary School in Kesennuma 2017.



On-site classes.



Soap bubble event

Reconstruction Actions [Graduate School of International Cultural Studies]

Reconstruction Education Support (SDGs Education Support)

With MEXT's support, we organized on-site class lectures "Waste Disposal and Recycling" for fourth graders at elementary schools in Miyagi. Analyzing contents of textbooks, we discussed the information to be provided during the classes, compensating already provided knowledge and contributing to the "Education of Recovery" via the information in these classes. We also prepared learning material with three focuses "Reuse", "International Resources Recycling", and "Promotion of Environmental Education" and distributed it to the children and teaching staff at the schools. Furthermore, we recorded the classes on DVD and created a project report to distribute to related organizations and concerned parties both locally and globally. Finally, we published and distributed "Special Textbook" focusing on environmental issues and international relations for elementary schools in Miyagi in 2017.

Reconstruction Actions [Graduate School of Environmental Studies]

Decontamination of Tsunami Debris

The tsunami sediments generated by the Great East Japan Earthquake contained small amounts of toxic elements such as As and Cd, and in some of the affected areas exceeded soil environmental standards. In order to remove toxic elements from tsunami sediments, we collaborated with Tohoku Gakuin University and Fujita Corporation and studied methods to clean soil by planting plants that accumulate toxic elements in contaminated areas. In addition to basic tests, we conducted field-level purification tests in farmland in Kesenuma, Shichigahama, Sendai, and other areas, and published the results of our findings in academic papers.



Growth of arsenic hyperaccumulator plant (*Pteris vittata*) in Shichigahama (October 2012).

Reconstruction Actions [Institute of Multidisciplinary Research for Advanced Materials]

Rebirth of the Coastal Countryside Utilizing Steel Slags

The Pacific coastal region centered around Miyagi was heavily damaged by salt from the tsunami, flooding a wide area of more than 20000ha. However, we proposed steel "slags", which are byproducts resulting in large amounts from the production of industrial steel, as recycling material to improve the conditions of the region. In collaboration with the Graduate School of Agriculture, local authorities of Miyagi, and Yamgata University, we tested our proposed method with rice, soy beans, and cucumbers, and applied the procedure to disaster stricken regions after obtaining favorable results.



Steel slags after processing.



Slag application to paddy fields

Reconstruction Actions [New Industry Creation Hatchery Center (NICHe)]

International Innovation Workshop on Off Shore Tsunami Energy Dissipation and Peak Height Alleviation

In this project, we aim to find proactive means to dissipate the tsunami energy off shore, rather than just protect against it at the coastal line, and pioneer in the development of countermeasures to alleviate the peak height as well as tsunami energy. By these countermeasures, we can increase the efficiency of current dikes along the coastal line, eliminate tsunami disasters, and promote the safe everyday life of local communities as well as contribute to the safety and reinforcement thereof regarding the facilities of nuclear power plants. We also organize biannual international workshops, the first being held in Sendai, and France several times thereafter. Each workshop was set a main topic, we summarized the recommended suggestions and developed an action plan to clarify the tasks and structures to advance necessary research in the following five years as well as developed a concept for research promotion in private-public collaboration.



Second Tsunami Workshop.



Third Tsunami Workshop.

Reconstruction Actions [Center for Northeast Asian Studies]

Excavation Projects for Disaster Regeneration

We established new methods to visualize underground structures or other buried objects by utilizing Ground Penetrating Radar (GPR). In the process of relocating settlements to safer areas after the Great East Japan Earthquake, many archaeological surveys have been conducted. GPR is a non-destructive exploration method, that provides not only a fast verdict about an excavation site but also details about the state of the remains, enabling a very effective investigation. We aim to contribute to the recovery process by providing necessary technology and knowledge to local communities for effective investigations.



Inside Zuiganji, Matsushima, intruded by the tsunami.



Search for tsunami victims in Ishinomaki.

Reconstruction Actions [The Center for Academic Resources and Archives]

Tsunami-Struck Museum Rescue Activities

We organized multiple rescue missions to collect and recover important specimens and archaeological resources from several museums in Miyagi damaged by the tsunami. The damaged material is temporarily archived at the Tohoku University Museum and will be returned to the individual museums once reconstruction is completed. We started this rescue project about one month after the Great East Japan Earthquake and had the opportunity to report to Prince Akishino when he visited Tohoku University in July 2011 with his wife. Furthermore, we organized field trips for elementary schools and continuously support the recovery of natural monuments. The museum's collection does not only feature scientifically valuable specimens but are also a property and heritage of the history of local communities. We are determined to protect and pass this evidence to the next generation and support the recovery of as many museums as possible.



Rescue activities at damaged museums (fossil rescue).



Specimens from the Ichthyosaur Museum (Minami Sanriku, Miyagi)



Exhibition at Sendai City Science Museum

Disaster Risk Reduction [Graduate School of Science]

Designing Chemistry Laboratories to Withstand Earthquakes

The chemical research laboratories of Tohoku University were severely damaged due to the Great East Japan Earthquake. In order to prepare to similar catastrophes in the future, we organized a symposium to discuss the necessary measures and required design of a chemical research laboratory as well as the future of laboratories with local researchers and experts in disaster prevention to gain a common understanding and be able to take appropriate measures.



Symposium on Disaster Prevention and Recovery of Japan.

Disaster Risk Reduction [Graduate School of Engineering]

Ruins of the Great East Japan Earthquake: Yamamoto Old Nakahama Elementary School

The town of Yamamoto, located in the southernmost part of the coastal area of Miyagi, has preserved the Nakahama Elementary School as a legacy of the earthquake open to the public. With the tsunami approaching, 90 students and teachers evacuated to the roof of the building, as it was deemed impossible to move inland to the evacuation site. Fortunately, they narrowly escaped the tsunami, and after spending a freezing night in a storage room in the attic, they were all rescued the next morning.

By enacting special regulations and designating the site as an Earthquake Disaster Cultural Property, the school building was preserved with as almost all traces of the destruction caused by the tsunami remaining, allowing the public to see the interior spaces in their original state. Not only the exhibition plan, but also the introductory video, information booklet, and sundial monument were designed based on a consistent concept, using the school itself as a teaching ground to provide a place where each visitor can think about how to prepare for future disasters.



School ground and monument



Showing the power of a tsunami

Disaster Risk Reduction [Graduate School of Information Sciences]

Verification of Disaster Information and Support for Digitally Divided People

Despite the seemingly well-developed information and communication infrastructure such as the Internet and cell phones, the Great East Japan Earthquake exposed a variety of inadequacies, such as the inability to convey necessary information, the inability to use it in emergencies, the continuous transmission of false information, as well as false and harmful rumors. Additionally, there are many people who do not have or are deprived of the means to communicate, because they cannot use a PC even if they have one, are not familiar with the internet, or do not have an online environment. This project is an attempt to investigate the actual situation, including the way the media disseminates information, to examine the causes and reasons for inadequacies, and to build an effective system that will facilitate the rapid and smooth communication of necessary information. As part of these efforts, we also held ongoing workshops on the use of ICT equipment to support NPO activities in disaster stricken areas, information dissemination from temporary housing, and community buildings.



Blog from a participant at temporary housings.



PC learning seminar

Disaster Risk Reduction [Institute of Fluid Science]

Development of Submarine Geologic Stress Measurement Methods Related to the Occurrence of Earthquakes

The tsunami, that greatly damaged the region after the Great East Japan Earthquake, was caused by the uplift of the upper oceanic crust along a fault line against the lower oceanic plate. It is also known that the stress of rock mass was greatly relieved near the fault by the slip. Therefore, if we can measure the rock stress near submarine faults in advance, we can evaluate the criticality of fault slip and the resulting tsunami. Additionally, if we can determine the urgency of tsunami occurrence, it will greatly contribute to reducing the risk of future disasters. In collaboration with our partner companies, we are developing a new method to measure rock stress even at great depths. As a result, we have proposed a new concept to improve the process of drilling as we can obtain rock samples at depths which record the stress state on their shapes, and we are currently developing and testing a new drilling tool to realize the concept.



Field experiments in a mine for testing a developed tool



Infrastructure Maintenance [Graduate School of Science]

International Networks for the Investigation of Megathrust Earthquake and Tidal Wave Mechanisms of 1000 Year Periods

We have been organizing tours to disaster stricken areas when foreign researchers and students in the natural sciences visit Tohoku University. The tours were more like a "storytelling" excursion, where the threat of tsunami damage, the disaster situation, and the recovery process were passed on from the perspective of a natural scientist. For the past ten years, we have conducted "storytelling" tours for participants of the International Ocean Drilling Project Conference and the International Symposium on Water Dynamics, researchers from Pennsylvania State University, University of Copenhagen, graduate students from California Institute of Technology and Aachen University, as well as international students attending Tohoku University Summer Program, and communicated our experience and knowledge to the international community. In total about 200 international visitors participated in the tours.



Tour of disaster-stricken areas in Okumatsushima during the visit of 23 graduate students from Aachen University.



Tour of disaster-stricken areas in Minami Sanriku during the visit of researchers from Pennsylvania State University.

Infrastructure Maintenance [Graduate School of Dentistry]

Large Scaled (Forensic) Identification Methods after Catastrophes

After the Great East Japan Earthquake, we were asked by the Miyagi Police as well as the Miyagi Prefecture Dental Association to assist in the forensic identification of bodies based on dental records and dispatched about 40 dentists to morgues on an everyday basis. Utilizing dental matching software, we processed the identification of unknown bodies in several prefectures and were awarded a certificate of appreciation by the Miyagi Police as a sign of recognition. Furthermore, with MEXT's support we were able to establish the first Forensic Dental Information Science course of Japan in 2012. Additionally, we were interviewed by the International Red Cross and Red Crescent Museum of Geneva, Swiss, which is shown as part of the exhibition. We also are a leading member of the committee for global standardization of forensic dentistry at the International Organization for Standardization (ISO), and a new ISO standard, "Dentistry - Terminology for Forensic and Dental Information," was published in 2020. We continue to present our work through multiple invites to lectures as well as media coverage.



Award of a certificate of appreciation by the Miyagi Police.



Forensic Dentistry conference at ISO.

Infrastructure Maintenance [Graduate School of Pharmaceutical Sciences]

Regional Self-Medication Support

At the time of the earthquake, many of the main medical institutions and community pharmacies in the communities were damaged and could not function. Patient medical information such as the "medication handbook" for pharmaceutical management of many people was temporarily lost, making it difficult to keep track of necessary medications they were taking. It was important to raise awareness of health and hygiene and drug treatment among disaster victims even during normal times. We compiled a "Disaster Preparedness Manual for Pharmacists" and opened "Self-Medication Studies" as a human resource development program to support local residents' awareness of self-medication during normal times, providing opportunities to learn about self-medication support, health and hygiene, disaster risk reduction, and disaster medical care. Furthermore, we held workshops in disaster stricken communities where we visit the region with students who wish to learn about the local pharmaceutical supply and medical relief system. These activities led to the establishment of the Miyagi Prefecture Liaison Conference on Disaster Medicine, which in turn led to the development of the Disaster Medicine Supply and Pharmacist Dispatch Manual (tentative).



Learning about the mobile pharmacy in "Self-medication Studies"



Workshops at disaster stricken communities

Infrastructure Maintenance [Graduate School of Engineering]

Recovery Support for Regeneration and Rebirth of Ishinomaki

Based on the comprehensive cooperation agreement with Ishinomaki, we provided specialized support and recommendations to the recovery process. On the peninsula for example, we could contribute to the planning, design, and order of community bases to stop depopulation of the region due to slow progression of the reconstruction process. Upon this experience, the interim "Community Reconstruction Exchange Center" with four buildings ("Main", "Oshika", "Hokujo", and "Ogachi", completed March 2015, February and May 2016), where disaster victims and visitors could share and exchange information of their experience were constructed to show the potential of peninsulas suffering from depopulation.

Furthermore, we supported the planning, design, and business of core community facilities and stores as well as collaborated during the planning of public transportation and reconstruction, regenerating town centers along the riverside.



North building of the "Community Reconstruction Exchange Center" in Ishinomaki.

Infrastructure Maintenance [Research Institute of Electrical Communication]

U-Type (urgent) Nation-wide Cooperative Research Projects

From the experience of the Great East Japan Earthquake we established U-type (urgent) nation-wide cooperative research projects with the aim to conduct "Research for the Realization of a Disaster Resilient Telecommunication Environment". The purpose of this project is the reinforcement of the morbid telecommunication technology as well as the safe realization and support of an efficient telecommunication environment under unforeseen changes in the environment. In order to accomplish these goals, we promoted the following four projects: "Construction of planar measurement techniques of earthquake, tsunami, and tectonic deformation using optical fiber networks", "Development of advanced wide-area public address systems for the case of emergencies and disasters", "Feasibility Study on Short Message Satellite Communication via Quasi-Zenith Satellite", and "Development of highly reliable cloud storage technology without information loss".



Outdoor testing of the wide-area public address systems for the case of emergencies and disasters.

Infrastructure Maintenance [Cyberscience Center]

Telemedicine Service using "Electronic Medical Doctor's Bag" for Disaster Medical Care Support

The "Electronic Medical Doctor's Bag" is a remote medical system for providing face to face medical treatment utilizing IT. The system is able to provide medical care at evacuation centers, temporary housings, disaster-stricken nursing homes, and affected families where doctors are unable to visit directly. In addition, physicians who have lost their medical institutions by the damages of the disaster will be supported to provide medical treatment for evacuees who have relocated from their original communities. We performed experimental medical care using this system at special nursing homes and a temporary housing in Kesenuma, Miyagi.



Electronic Medical Doctor's Bag

Infrastructure Maintenance [Cyberscience Center]

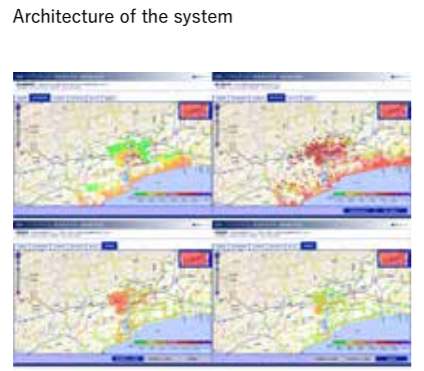
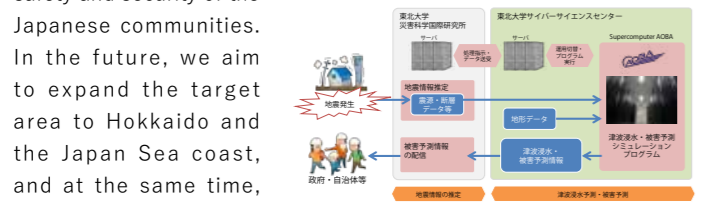
Development of Dependable Identity Management Systems for Disaster-tolerant Networks

We have developed a storage-based distribution technology for evacuation centers during disasters, which combines a reliable multicast method for efficient information distribution using a DTN (Delay/Disruption-Tolerant Network) mechanism, a packet collision avoidance method for improving throughput in overcrowded environments, and information distribution control and management technologies such as content transmission timeout control methods. As a result, in an environment with 500 terminals, computer simulations confirmed that using the reliable multicast method reduced the delivery time by more than 55% compared to existing delivery methods, and the packet collision avoidance method improved the throughput by about 40% on average. We also confirmed the effectiveness and feasibility of the system by successfully testing 100 units.

Infrastructure Maintenance [Cyberscience Center]

R&D on a Real Time Tsunami Inundation Forecast System utilizing Supercomputers

The objective of this project was the research and development of a real-time tsunami inundation forecast system that highly integrates measurement technology and simulation, aiming to create a supercomputing center that contributes to disaster risk reduction and mitigation. In particular, the supercomputer at Tohoku University's Cyberscience Center can estimate inundation damages within five minutes with a 30-mesh accuracy for the 8,000-km Pacific coast region from Kagoshima to Ibaraki, and provide GIS information on the damage status within 30 minutes to the government's disaster management office in the Cabinet Office. At present, the Cyber Science Center provides regular high-performance computing services to researchers and engineers in Japan, and operates the system 24/7, to enable real-time tsunami inundation damage forecast simulations in the event of a large-scale earthquake, thereby contributing to the safety and security of the Japanese communities.



Visualization of the inundation and damages forecast

Infrastructure Maintenance [The Center for Academic Resources and Archives]

Program for Archives and Publication of 3D Pointcloud Data of the Great East Japan Earthquake for Tsunami Ruins

We utilize 3D digital data (cloud data) to archive "Disaster Ruins". Currently we are collaborating with the International Research Institute of Disaster Science and employ a 3D Mixed Reality System to present the result to the general public. With the huge amount of digital data, we aim to realize a practical research and education system for mega catastrophe education. Furthermore, the information accumulated in the "Michinoku Shinrokuden" Disaster Archive will be mapped in a digital form to present the transformation of the region after the earthquake in 3D virtual reality. Additionally, collaborating with disaster stricken communities and the Smithsonian Institution, we will continue to communicate the experience of the Great East Japan Earthquake to global communities and raise awareness for possible future disasters.



Measuring the Kiyoto Sakuo Cave in Futaba.



Measuring the Disaster Management Office in Minami Sanriku



Demonstration of the 3D digital archive.

Industrial Reconstruction [Graduate School of Engineering]

Development of Portable Power Generation Sheets for Emergencies

After the Great East Japan Earthquake, we re-recognized the importance of minimum lighting as well as means for communication. From the perspective of energy supply, low power LED lighting and the development of emergency mobile charging units were prioritized issues, as well as the design of disaster resistant, light, and mobile power generators. In order to meet these requests, we developed portable power generation sheets, which produce electricity by stomping or hitting on it. These sheets are light and mobile, durable and have a large growth and deformation rate. These sheets can furthermore be utilized as cloths and power LEDs, using the generated power. The high versatility in emergency situations also increases the expectation in commercialization and creation of jobs for the local economy.

With the support of JST's Support Project for Strategic Development of Fundamental Technologies (FY2012 to FY2013) we developed high efficient electrical circuits for the effective utilization of the generated power and achieved a 3.7 times higher storage capacity compared to common rectifier circuits. This result was achieved by equipping car tires with the power generation sheet and driving at a speed of 16 to 20 km/h on flat ground for 100 seconds. By analyzing the instant wave forms of the generated voltage we also developed the technology for power generation under worse conditions such as uneven, wet or frozen ground to contribute to the road safety of residents after disasters.



Car tires equipped with the power generation sheet and high efficiency storage circuits.

Industrial Reconstruction [Graduate School of Engineering, Graduate School of Biomedical Engineering]

Non-Invasive Diagnosis of Venous Thrombosis of Shelter Residents

The diagnosis of venous thrombosis of disaster victims currently relies on mobile ultra-sonic diagnostic equipment, highly depending on the physician's or technician's skill to search for the thrombus in lower extremities and requiring previous blood samples and screening of the patients. We developed a new non-invasive diagnosis method for venous thrombosis of high-risk patients without blood sampling utilizing high-frequency ultra-sonic waves. (Graduate School of Engineering, Prof. Hiroshi Kanai)



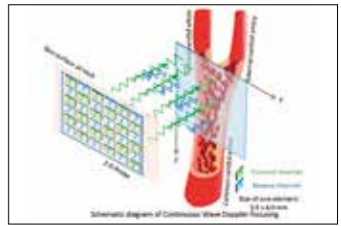
High-frequency ultrasound to estimate the size of red blood cell aggregates in dorsal hand veins

We have developed a novel medical device to visualize transmission image of blood vessel

and flow by continuous Doppler beamforming obtained with 2D matrix array ultrasound transducer for detection of flowing embolus. (Graduate School of Biomedical Engineering, Prof. Yoshifumi Saijo)



Prototype 2D array matrix probe.



Transmission image of a blood vessel

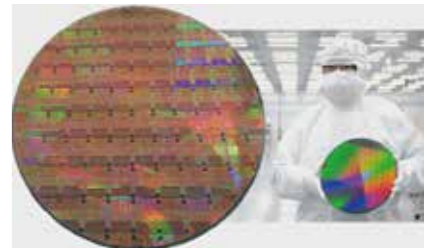
Industrial Reconstruction [Graduate School of Engineering]

Development of Green Power Integrated Devices with High Efficient Electric Energy Supply and Energy Saving Electric Systems

The massive power outages and rapid power consumption that occurred during the Great East Japan Earthquake made it impossible to ensure sufficient communication in times of disasters, such as safety confirmation and information gathering, which reminded us again of the limited energy and resources we have. In order to provide an adequate response as well as achieve carbon neutrality in the future, power electronics technology that supplies electrical energy with high efficiency and green electronics technology that reduces the wasteful use of supplied energy to the utmost limit are essential.

We are promoting the development of green power integrated devices that maximize energy efficiency and conservation. In green electronics technology development, we have succeeded in developing a 128Mb spin-transfer-torque magnetic random access memory (STT-MRAM), the world's smallest magnetic tunnel junction (MTJ) device, and spin-orbit torque (SOT)-MRAM chip using the world's only 300mm spintronics integrated circuit prototype and evaluation line at a public institution. We have also succeeded in demonstrating the world's highest performance AI associative processor and learning processor for automated transportation, making significant progress toward practical application. Additionally, we have confirmed the low-loss, high-frequency operation of ultra-small inverters using gallium nitride (GaN) on Si power devices, and the achievements will expand the range of applications from IoT/AI field, which requires ultra-low power consumption, to the automotive field.

We will continue to collaborate with world-leading and regional companies to create and commercialize innovative core technologies to reinforce Japan's international competitiveness, and to play a leading role in the reconstruction of the Tohoku region and the rebirth of Japan by contributing to regional revitalization.



300mm wafers fabricated on the world's only spintronics-compatible 300mm process prototyping line, compatible with cutting-edge companies operated by a university.

Industrial Reconstruction [Graduate School of Agricultural Science]

Let's Light the Olympic Flame 2020 with Bio Methane!

We aimed for the realization of an Olympic flame with renewable energy at the 2020 Tokyo Olympics. Bio methane gas obtained from fermentation of raw trash of households is currently attracting a great deal of public attention, since it would mean an Olympic flame created by local communities. We provide demonstrations and on-site lectures about the creation of bio methane gas to children at nationwide elementary schools, contributing also to environmental awareness and education. Furthermore, we organized a ceremony lighting a flame with bio methane at the old national stadium in Ishinomaki, Miyagi, and several other events at various places, showing our gratitude for the support in the regeneration process and bringing the light of recovery from disaster stricken areas of Tohoku.



Bio gas from raw waste.



On-site lectures at elementary schools.



Vegetable production meeting

Industrial Reconstruction [Graduate School of Agricultural Science]

Arahama Project

Agriculture and rural communities in the Arahama area of Wakabayashi, Sendai, suffered devastating damages from the tsunami caused by the Great East Japan Earthquake 3.11.

Since fall 2011 we have been working in close collaboration with local farmers in Arahama, the Sendai Agricultural Cooperative (JA Sendai), the Agriculture and Forestry Department of the Sendai City Economic Affairs Bureau, the Sendai Agricultural Improvement and Extension Center of the Miyagi Prefectural Government's Agriculture Policy Department, the Miyagi Federation of Land Improvement Organizations, the Management and Business Support Department of the Tohoku Agricultural Administration Bureau, and the Tohoku Agricultural Research Center of the National Agricultural Research Organization to support the reconstruction of the disaster stricken area. As



Conferences



Vegetable production meeting

one of the results of these discussions, the Sendai Ararahama Agricultural Cooperative was established in January 2015. Since then, in order to enhance the sustainability of the Sendai Ararahama, we have been providing technical guidance on direct sowing of rice and soybean cultivation using smart agriculture technology, support for the introduction and establishment of mini-tomatoes as a highly profitable crop, and human resource development for employees.



Reconstruction Festival Flyer

Industrial Reconstruction [Graduate School of Environmental Studies]

Reutilization of Waste Wood and Sludge from the Great East Japan Earthquake for Earthquake-Proof Artificial Grounds

In order to utilize the fiber-cement-stabilized soil method to reutilize tsunami debris and waste wood as construction material for the regeneration process, we organized relevant tests in Sendai, Kesenuma (both Miyagi) as well as Ohfunato (Iwate). As a result, we determined, that – although the properties of tsunami debris might vary depending on the region – the fiber-cement-stabilized soil method can be used to reutilize sludge and debris as artificial grounds and soil fundamental materials. Furthermore, we sampled the debris of different disaster areas and created new ground fundamental materials by mixing waste wood chips and tsunami debris, which was already tested regarding stability and earthquake resistance. We determined, that the fiber-cement-stabilized soil with mixed wood waste chips has a liquefaction resistance force eight times more than unprocessed tsunami debris and is highly usable as earthquake resistant ground material.



Reutilization of tsunami debris via fiber-cement-stabilized soil method.



Dike constructed with fiber-cement-stabilized soil.

Industrial Reconstruction [Graduate School of Environmental Studies]

Fusion of Soil Separator-Multi Method and Bon Terrain Method for Tsunami Debris Recycle and Ground Materials Evaluation

Although there are many projects for the reconstruction and regeneration after the Great East Japan Earthquake, tsunami debris is very hard to recycle or reutilize and is often just piled up in dumping grounds. We thought of developing recycling facilities to sort this debris, filter the sediment, and reutilize it for artificial soil. While testing, we first put the tsunami debris with all the mixed rubble

and waste in a water tank, dredged only the sediment, separated the sediment in sand and floc by the soil separator multi method, and finally applied the fiber-cement-stabilized soil method to modify the planting soil. This planting soil was used in Natori, Miyagi, to construct and plant trees in embankments.



Separation of tsunami debris by the soil separator-multi method.



Construction of embankments utilizing the planting soil obtained by from parts of the tsunami debris.

Industrial Reconstruction [Graduate School of Education (Former Graduate School of Educational Informatics Research Division)]

Development of Successor Support Methods for Traditional Culture in Disaster Stricken Areas Facing Extinction

The Great East Japan Earthquake did not only destroy whole communities but also continues to threaten local traditional folk art of various regions. After the earthquake, tangible property and cultural treasures were reconstructed very soon, but the intangible art, folklore, and tradition is still not supported sufficiently and has often trouble to find suitable successors. In this project, we aimed to preserve these traditional folk art utilizing information and communication technology and properly support successors of local tradition. By creating "CG Animated Educational Material", measuring and archiving the movement and actions via motion capture, we aim to establish valuable methods to support the local tradition of communities and to pass the individual knowledge on to the next generation.

Local folk art and culture reflects the environment as well as history of the region, and is considered to be a treasure of communities which has to be succeeded. Our project has so far digitally archived traditions of communities in Tohoku, such as the Kagura (Shinto theatrical dance) in collectives, and supports the succession of these invaluable treasures.



Motion capture of the Horyo Kagura.



Process from motion capturing to the creation of CG animations.



Motion capture of the Urahama Nenbutsu Kenbu.

Industrial Reconstruction [Institute for Materials Research]

Development of Decontamination Methods for Sr and Cs in Environmental Water as Response to the Nuclear Accident

The removal of radioactive cesium and strontium from the environment after the accident at the nuclear power plant was mainly conducted by utilizing solid extraction agents (column chromatography). However, the used columns not only became incompressible solid waste, but also degraded due to the high radioactivity, becoming secondary radioactive waste continuing to pose a threat to the environment. We developed a method to vitrify radioactive particles in a compact manner, recycling the solvent and applicable on site, by utilizing solvent extraction methods and related technology developed prior to the accident. In particular, we established a technique where solvent extraction was possible in a non-acidic, neutral water environment by adding co-extraction agents, were conventional methods required high acidic solutions.

Industrial Reconstruction [Institute of Fluid Science]

Development of Emergency Response Medical Care Technology

We are developing medical equipment utilized in emergency response medical care technology, such as plasma sterilization, medical bio sensors, health monitoring systems, or high functional cloths. The plasma sterilization equipment utilizing the atmosphere for example assumes its utilization for disinfection of hands or sterilization of instruments at e.g. hospitals in emergency situations where medical resources might be insufficient. Currently, we are developing a small sterilizer that operates with water, air and electricity. Furthermore, in the course of JST's Cutting-Edge Research Center Project 2011-2016, we developed medical bio sensor technology at Tohoku University. The design of vibration-proof material aims for preventing medical instruments, e.g. scalpels, from scattering during earthquakes, and we also developed heat dissipating materials for rugs to have effective measures against heat at summer and to save energy at evacuation shelters. Furthermore, in order to be able to respond to sudden health condition changes of injured or senior citizens, we aim to establish an easy system to continuously monitor the blood pressure and hemodynamics of several people.



Plasma sterilization light

Industrial Reconstruction

[Institute of Fluid Science]

Development of Alternative Energy Resources

To counteract the power shortage due to the problems at the nuclear power plant, we develop new efficient ways for solar power conversion, hydrogen fuel cells, and other natural energy utilization techniques, as well as the fusion of nano-energy (e.g. solar cells, hydrogen fuel cells) and mega-energy (e.g. fossil fuel, wind power, geothermal power) systems to realize a smart energy network with optimized design. As part of JST's Strategic Basic Research Programs 2009-2015 and in collaboration with the universities Tokyo, Hokkaido, Keio, and Nara Institute of Science and Technology, we developed the research for high efficient quantum dot solar cells exceeding the theoretical limit of a 30% conversion rate. With the support of METI's "Support Project for the Promotion of Industry-Academia Innovation" we established an industry-academia consortium for advanced energy devices in 2012, promoting the realization of optimized systems for solar, rechargeable, and fuel batteries as well as autonomous energy systems utilizing regenerative energy sources. Furthermore, we inaugurated the Innovative Energy Research Center in April 2013, advancing and leading research in all energy related fields of Tohoku University.



Meeting of Tohoku University's Core Technology Consortium for Advanced Energy Devices and AIST's Fukushima Renewable Energy Institute.

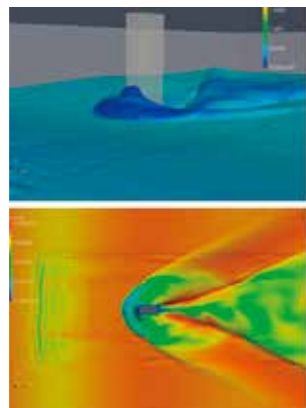


Industrial Reconstruction

[Institute of Fluid Science]

Super Computation of Flotsam Mixed Tsunamis

For the flow and impact forces of flotsam mixed tsunamis or floods, earthquake disaster debris, we have been developing a high-precision multiphase hydrodynamic approach without using the long-wave approximation, and have been predicting the multiphase tsunami flow characteristics and evaluating the damage to structures by supercomputing. In order to improve the quantitative prediction accuracy of the tsunami impact force evaluation by this simulation, we will conduct a basic experiment using the concept of coastal ocean modeling and tsunami scale modeling, and compare the results with the simulation results. The objective of this study is to develop a simulation method that can simultaneously analyze the interfacial deformation behavior of collision tsunamis. Also to clarify



Massively Parallel Supercomputing on Flood Flow Impacting Bridge Piers

the deformation and destruction behavior of debris and structures by considering the interaction between tsunami and structures in a relatively small area such as industrial and power plants. In addition, we are also developing a simulation method to optimize the configuration and shape of onshore structures to mitigate tsunami impact, and to predict the shape and configuration of tsunami buffer structures to be built offshore.

Industrial Reconstruction

[Advanced Institute for Materials Research]

R&D of Green Materials for Energy Harvesting and Energy Saving

The Advanced Institute for Materials Research (AIMR) has promoted world-leading research on materials science. In particular, we have focused on creating green materials for energy harvesting, energy saving, and environmental clean-up. Based on our results and achievements, we aim to dramatically improve the efficiency of solar energy usage (energy harvesting) as an aid to the reconstruction from the Great East Japan Earthquake. Aiming at highly efficient conversion of solar energy to electric power, we develop new materials and design new devices to achieve energy harvesting. In addition, we will promote the discovery of new superconducting substances as well as elucidation of superconducting mechanism for electric resistance reduction (energy saving), and contribute to the recovery from the disaster through materials research.

Industrial Reconstruction

[New Industry Creation Hatchery Center (NICHe)]

Establishment of an "International Center for the Creation and Implementation of Mobility Innovation"

Since the Great East Japan Earthquake, we have proposed a new regional transportation system using advanced technologies and knowledge in the Miyagi Reconstruction Park, and have created specific new industries such as the mass production of lithium-ion batteries that are safe, reliable, and can be produced and consumed locally. We are working to contribute to the reconstruction of Fukushima by using the results of our research solve social issues in the region, and by creating new industries through further R&D demonstrations and promotion of practical implementation.

As of September 2019, we established a center at the Fukushima Robot Test Field (RTF) and utilize the nationwide university network to promote the demonstration and implementation of next-generation mobility such as CASE and MaaS through co-creation between industry and academia. For example, we are holding seminars to raise awareness and develop human resources related to next-generation mobility, and have introduced small EVs for 3D environmental measurement, conversion to lithium-ion batteries, and demonstration of non-contact power supply.



Small EVs



Monthly Seminar

Looking at future facing challenges of the region



Photography cleaning volunteer work immediately after the disaster. Taking care of the albums of the victims and carefully removing mud from each photo.



Halloween Event at Yamamoto in recent years. Students started the event 5 years ago. Community support by creating a place for exchange and interaction.



Tohoku University's student volunteer group 'HARU' supports the reconstruction of the disaster area. It was formed by student volunteers immediately after the earthquake and has been engaged in many activities to support communities. We interviewed four members who are currently active in HARU about their recent activities and thoughts.

- Please tell us about your current activities.

Yoshida The main areas of HARU's activities are Ishinomaki and Yamamoto in Miyagi. In Ishinomaki, we engage with community members through tea ceremonies at public housing for reconstruction, and in Yamamoto, we assist in the management of product events.

Suzuki In Yamamoto, there are not enough people to organize events, so we are helping them out.

Hashimoto That's true. I recently heard someone in Yamamoto say "10, 20 years ago, there was a lot of laughter with many children. You don't hear that anymore nowadays." I think the depopulation and the aging community is a real issue for the region.

Higashiizumi I have the feeling, the disaster worsened the already bad situation regarding depopulation in these communities. When we visit, people often say "Students bring new life to the community", so I hope we can bring back some of the laughter with our volunteer work.

- 10 Years after the Disaster

Higashiizumi We recently started the

project 'Students thinking about 10 Years after the Disaster'. I think it is a good opportunity to reflect on our volunteer work with HARU and build a place to address not only issues of the disaster stricken communities but also societal issues through student workshops and meetings.

Suzuki It has also been 10 years since HARU started and there is a lot of history. Immediately after the disaster, members had no time to rest and really wanted to help regional communities. I think it is important to remember the spirit of our predecessors.

Yoshida Directly after the disaster, there was a lot of practical support and in-person work such as removing debris and cleaning. With the reconstruction of the communities, there is now a lot more soft interaction with mental support of people.

Hashimoto That's true. The 'hardware' side of reconstruction very much progressed, but there is still a need for long term support of the 'software' side of things.

Suzuki Management of HARU will be handed over to juniors, so we want to support them and pass on our knowledge.

Tohoku University Regional Reconstruction Project

HARU



Masayuki Yoshida, Representative, Faculty of Science, Mathematics, 3rd Year
Yuka Suzuki, Deputy Representative, Faculty of Science, Mathematics, 3rd Year
Kojiro Hashimoto, Manager for the Yamamoto Area, Faculty of Arts and Letters, 3rd Year
Naohiro Higashiizumi, Next Manager for the Ishinomaki Area, 'Students thinking about 10 Years after the Disaster' Project Leader, Faculty of Law, 2nd Year

Contributing to Regeneration Planning at Conferences and Meetings

After the Great East Japan Earthquake, members of Tohoku University actively participated in councils of central ministries and provided recommendations as well as contributed policy suggestions for the support of the regeneration and reconstruction of the region (reconstruction of cities and villages, decontamination, recovery from salt damage, counseling, verification of remains, etc.).

※ The following is a list of past activities, including those that have already been completed or pursued by retired members.

National	
[Cabinet Office]	
防災基本計画の在り方に関する検討会	法学研究科 島田 明夫教授
被災者の住まいの確保策検討ワーキンググループ	法学研究科 島田 明夫教授
火山防災エキスパート等合同会議	法学研究科 島田 明夫教授
第24期・社会学委員会東日本大震災後の社会的モニタリングと復興の課題検討分科会	経済学研究科 増田 聡教授
次世代インフラ・復興再生戦略協議会 ICTワーキンググループ	電気通信研究所 羽生 貴弘教授
東日本大震災復興構想会議検討部会	災害科学国際研究所 今村 文彦教授
東北地方太平洋沖地震を教訓とした地震・津波対策に関する専門調査会	災害科学国際研究所 今村 文彦教授
中央防災会議南海トラフの巨大地震モデル検討会	災害科学国際研究所 今村 文彦教授
中央防災会議南海トラフ巨大地震対策検討委員会	災害科学国際研究所 今村 文彦教授
総合科学技術会議 科学技術イノベーション政策推進専門調査会 復興・再生戦略協議会	災害科学国際研究所 今村 文彦教授
大規模災害情報の収集・保存・活用方策に関する検討会	災害科学国際研究所 今村 文彦教授
防災関連調査研究の戦略的推進ワーキンググループ	災害科学国際研究所 越村 俊一教授
防災教育チャレンジプラン実行委員会	災害科学国際研究所 佐藤 健教授
日本海溝・千島海溝沿いの巨大地震モデル検討会	理学研究科 松澤 暢教授 <p>災害科学国際研究所 今村 文彦教授</p>
地震・津波関連指針等検討小委員会	理学研究科地震・噴火予知研究観測センター 海野 徳仁教授 <p>工学研究科 京谷 孝史教授</p> <p>災害科学国際研究所 越村 俊一教授</p>
[Reconstruction Agency]	
「平成30年度被災地における先行事例収集業務」監修委員	経済学研究科 福嶋 路教授
専門家派遣集中支援事業	経済学研究科 福嶋 路教授
復興推進委員会	工学研究科 中田 俊彦教授
「新しい東北」先導モデル事業	工学研究科 中田 俊彦教授
災害危険区域内の土地利用のあり方勉強会	工学研究科 姥浦 道生教授
被災市街地における土地活用促進支援調査 有識者委員会	工学研究科 姥浦 道生教授
東日本大震災からの復興の総括に係るWG	工学研究科 姥浦 道生教授
「新しい東北」の創造に向けた一次産業分野における有識者懇談会	農学研究科 伊藤 房雄教授
有識者（社会基盤分野）事業評価者	災害科学国際研究所 今村 文彦教授
岩手県震災津波関連資料に係る収集・デジタル化並びにデジタルアーカイブ構築及び運用保守業務に関する技術的審査委員会	災害科学国際研究所 柴山 明寛准教授
[Ministry of Internal Affairs and Communications]	
地域防災計画における地震・津波対策の充実・強化に関する検討会	災害科学国際研究所 今村 文彦教授
東日本大震災を踏まえた危険物施設等の地震・津波対策のあり方に係る検討委員会	災害科学国際研究所 今村 文彦教授
避難支援アプリの機能に関する検討会	災害科学国際研究所 今村 文彦教授
東日本大震災アーカイブ利活用会合	災害科学国際研究所 佐藤 健教授
福島県原発事故避難区域に帰還される方々への地デジ支援事業の委託先の評価会	サイバーサイエンスセンター 曾根 秀昭教授
[Ministry of Education, Culture, Sports, Science and Technology]	
科学技術・学術審議会 研究計画・評価分科会 防災科学技術委員会	理学研究科 松澤 暢教授
東日本大震災を受けた防災教育・防災管理等に関する有識者会議	災害科学国際研究所 今村 文彦教授
地震調査研究推進本部地震調査委員会津波評価部会	災害科学国際研究所 今村 文彦教授 <p>災害科学国際研究所 越村 俊一教授</p>
国立研究開発法人防災科学技術研究所部会	災害科学国際研究所 越村 俊一教授
地震調査研究推進本部	災害科学国際研究所 源栄 正人教授 <p>災害科学国際研究所 遠田 晋次教授</p> <p>災害科学国際研究所 後藤 和久准教授</p>
災害に強い学校施設づくり検討部会	災害科学国際研究所 佐藤 健教授
中央教育審議会スポーツ・青少年分科会	災害科学国際研究所 佐藤 健教授
[Ministry of Agriculture, Forestry and Fisheries]	
食糧・農業分野における震災復興のための専門家会議	法学研究科 米村 滋人准教授
被災地の復興のための先端技術展開事業運営委員会	農学研究科 伊藤 房雄教授
東日本大震災に係る海岸防災林の再生に関する検討会	災害科学国際研究所 今村 文彦教授
[Ministry of Agriculture, Forestry and Fisheries / Ministry of Land, Infrastructure, Transport and Tourism]	
海岸における津波対策検討委員会	災害科学国際研究所 今村 文彦教授
[Ministry of Economy, Trade and Industry]	
再生可能エネルギーアドバイザーボード	工学研究科 中田 俊彦教授
再生可能エネルギー導入による産業復興の可能性調査検討委員会	工学研究科 中田 俊彦教授
持続可能なバイオマス発電のあり方に係る研究会	工学研究科 中田 俊彦教授
[Ministry of Land, Infrastructure, Transport and Tourism]	
東北港湾の復旧・復興基本方針検討委員会	経済学研究科 林山 泰久教授
東北ブロックにおける社会資本整備重点計画に関する有識者懇談会	経済学研究科 増田 聡教授
地産地消型自然エネルギーの有効活用方策の構築に関する検討会	工学研究科 中田 俊彦教授
井土浦海岸堤防構造検討会	工学研究科 田中 仁教授
東日本大震災による津波被害からの復興まちづくり検証委員会	工学研究科 姥浦 道生教授
東日本大震災における津波被害からの市街地復興事業検証委員会	工学研究科 姥浦 道生教授
交通政策審議会港湾分科会防災部会	災害科学国際研究所 今村 文彦教授
東北地方太平洋沖地震による津波被害を踏まえた津波警報改善に向けた勉強会	災害科学国際研究所 今村 文彦教授
防災国土づくり委員会	災害科学国際研究所 今村 文彦教授
空港の津波対策検討委員会	災害科学国際研究所 越村 俊一教授
緑地やオープンスペースの活用による津波被害の軽減方策等検討調査及び迅速な復旧・復興に向けたがれきの活用方策等に関する検討業務合同有識者委員会	災害科学国際研究所 越村 俊一教授
津波警報の発表基準等と情報文のあり方に関する検討会	災害科学国際研究所 越村 俊一教授
河川分科会（社会資本整備審議会）	災害科学国際研究所 今村 文彦教授
津波予測技術勉強会	災害科学国際研究所 越村 俊一教授
海岸委員会	災害科学国際研究所 越村 俊一教授
高田松原津波復興祈念公園 空間デザイン検討委員会	災害科学国際研究所 平野 勝也准教授
旧北上川かわまちづくり検討会 市民部会	災害科学国際研究所 平野 勝也准教授
高田松原津波復興祈念公園 景観検討調整会議	災害科学国際研究所 平野 勝也准教授
名取川水系河川整備学識者懇談会	災害科学国際研究所 今村 文彦教授
津波予測技術に関する勉強会	災害科学国際研究所 今村 文彦教授
震災伝承検討会	災害科学国際研究所 今村 文彦教授
仙台湾南部海岸地区環境等検討懇談会	災害科学国際研究所 越村 俊一教授 <p>災害科学国際研究所 有働 恵子 准教授</p>
震災遺構等サインに関する検討委員会	災害科学国際研究所 平野 勝也准教授
「大規模災害等に備えた外国人観光客への情報収集・提供方法に関する実証事業」検討会	災害科学国際研究所 佐藤 翔輔 准教授
仙台空港復旧・復興のあり方検討委員会	災害科学国際研究所 奥村 誠教授 <p>災害科学国際研究所 越村 俊一教授</p>
北上川等堤防復旧技術検討委員会	真野 明名誉教授

水辺を活かしたまちづくり検討

工学研究科 田中 仁教授

工学研究科 本江 正茂准教授

災害科学国際研究所 平野 勝也准教授

旧北上川かわまちづくり検討会

工学研究科 田中 仁教授

災害科学国際研究所 平野 勝也准教授

宮城県沿岸域河口部・海岸施設復旧における環境等検討委員会

工学研究科 田中 仁教授

災害科学国際研究所 平野 勝也准教授

災害科学国際研究所 真野 明名誉教授

澤本 正樹名誉教授

下水道地震・津波対策技術検討委員会

工学研究科 大村 達夫教授

災害科学国際研究所 今村 文彦教授

東北港湾における津波・震災対策技術検討委員会

工学研究科 風間 基樹教授

災害科学国際研究所 今村 文彦教授

[Ministry of the Environment]

再生可能エネルギー等導入推進基金事業審査委員会

工学研究科 中田 俊彦教授

防災拠点等への再生可能エネルギー等導入推進事業審査委員会

工学研究科 中田 俊彦教授

2050年再生可能エネルギー等分散型エネルギー普及可能性検証検討会

工学研究科 中田 俊彦教授

再生可能エネルギー熱を活用したゼロ・エネルギー化の検討ワーキンググループ

工学研究科 中田 俊彦教授

地域貢献型再生可能エネルギー導入方策検討ワーキンググループ

工学研究科 中田 俊彦教授

巨大地震に伴う災害廃棄物対応検討委員会

環境科学研究所 吉岡 敏明教授

平成25年度災害廃棄物対策指針の策定業務検討委員会

環境科学研究所 吉岡 敏明教授

川内村対策地域内廃棄物処理業務（減容化処理等）技術提案書審査委員会

環境科学研究所 吉岡 敏明教授

平成25年度飯館村小宮地区対策地域内廃棄物処理業務（減容化）アドバイザリー委員会

環境科学研究所 吉岡 敏明教授

葛尾村対策地域内廃棄物処理業務（減容化処理）技術提案書審査委員会

環境科学研究所 吉岡 敏明教授

東北地方災害廃棄物連絡会

環境科学研究所 吉岡 敏明教授

対策地域内廃棄物処理業務等（減容化処理）に係るアドバイザー委員会

環境科学研究所 吉岡 敏明教授

大規模災害発生時における災害廃棄物対策検討委員会

環境科学研究所 吉岡 敏明教授

災害廃棄物対策推進検討会

環境科学研究所 吉岡 敏明教授

災害廃棄物対策東北ブロック協議会

環境科学研究所 吉岡 敏明教授

中間貯蔵施設における可燃性除染廃棄物等の減容化施設検討会

環境科学研究所 吉岡 敏明教授

中間貯蔵施設における廃棄物等処理業務事業者選定に係る審査基準等検討会

環境科学研究所 吉岡 敏明教授

生成物の性状確認等に係る技術検討委員会

環境科学研究所 吉岡 敏明教授

放射線審議会

災害科学国際研究所 千田 浩一教授

[House of Councillors]

東日本大震災と統治機構についての審査会

法学研究科 牧原 出教授

[Japan International Cooperation Agency]
プロジェクト研究「防災の主流化」委員会
 災害科学国際研究所 今村 文彦教授
エクアドル「津波を伴う地震のモニタリング能力強化プロジェクト」
 災害科学国際研究所 越村 俊一教授
[Japan Aerospace Explorlation Agency]
観測衛星を利用した防災利用実証活動水害ワーキンググループ
 災害科学国際研究所 越村 俊一教授
大規模災害衛星画像解析支援チーム
 災害科学国際研究所 越村 俊一教授
水害ワーキンググループ
 災害科学国際研究所 越村 俊一教授
[Japan Atomic Energy Agency / Cabinet Office]
放射線防護対策評価検討会
 薬学研究科 吉田 浩子准教授
[National Institute for Environmental Studies]
災害廃棄物の迅速・円滑な処理を目指した処理技術・システムの研究アドバイザー委員会
 環境科学研究科 吉岡 敏明教授
[National Institute for Environmental Studies / Fukushima]
福島県環境創造センター環境創造部門
 工学研究科 中田 俊彦教授

Regional

[Miyagi]
宮城県NPO等の絆力を活かした震災復興支援事業審査委員会
 教育学研究科 石井山 竜平准教授
復興まちづくり検討会
 経済学研究科 大滝 精一教授
宮城県被災者復興支援会議
 経済学研究科 大滝 精一教授
新・みやぎ建設産業振興懇談会
 経済学研究科 増田 聡教授
宮城県防災会議（地震対策等専門部会）
 経済学研究科 増田 聡教授
宮城県国土利用調査審議会
 経済学研究科 増田 聡教授
宮城県議会再生可能エネルギー等調査特別委員会
 工学研究科 中田 俊彦教授
再生可能エネルギー等導入地方公共団体支援基金事業外部有識者評価会
 工学研究科 中田 俊彦教授
蒲生干潟自然再生事業等に関する意見交換会
 工学研究科 田中 仁教授

東部管内農地災害復旧等施工技術検討委員会
 農学研究科 伊藤 房雄教授
東日本大震災に係る災害廃棄物処理業務総括検討委員会
 環境科学研究科 吉岡 敏明教授
宮城県行政評価委員会 政策評価部会
 環境科学研究科 井上 千弘教授
宮城県災害廃棄物処理計画 有識者検討会
 環境科学研究科 吉岡 敏明教授
宮城県環境審議会環境基本計画策定専門委員会
 環境科学研究科 吉岡 敏明教授
宮城県震災復興会議
 災害科学国際研究所 今村 文彦教授
防災会議（東日本大震災検証・記録専門部会）
 災害科学国際研究所 今村 文彦教授
みやぎ防災教育推進ネットワーク会議
 災害科学国際研究所 今村 文彦教授
宮城県津波浸水想定の設定に関する検討会
 災害科学国際研究所 越村 俊一教授

防災教育を中心とした学校安全フォーラム実行委員
 災害科学国際研究所 桜井 愛子准教授
女川原子力発電所2号機の安全性に関する検討会
 災害科学国際研究所 今村 文彦教授
宮城県津波対策連絡協議会
 災害科学国際研究所 今村 文彦教授
宮城県国土強靱化地域計画アドバイザー
 災害科学国際研究所 今村 文彦教授
 災害科学国際研究所 佐藤 健教授
「宮城県復興10年総括検証」基礎データ資料作成業務に関する公募型プロポーザル方式選定委員
 災害科学国際研究所 佐藤 翔輔准教授
広域防災拠点整備検討会議
 災害科学国際研究所 佐藤 健教授
実践的防災教育総合支援事業推進委員会
 災害科学国際研究所 佐藤 健教授
松島自然の家再建に係る懇話会
 災害科学国際研究所 佐藤 健教授

防災教育を中心とした実践的安全教育総合支援事業
 災害科学国際研究所 佐藤 健教授

防災教育を中心とした学校安全フォーラム実行委員会
 災害科学国際研究所 佐藤 健教授

宮城県行政評価委員会政策評価部会
 災害科学国際研究所 佐藤 健教授

宮城県行政評価委員会
 災害科学国際研究所 佐藤 健教授

学校安全総合支援事業推進委員会
 災害科学国際研究所 佐藤 健教授

宮城県行政評価委員会政策評価部会第三分科会
 災害科学国際研究所 佐藤 健教授

未来へつなぐ学校と地域の安全フォーラム実行委員会
 災害科学国際研究所 佐藤 健教授

宮城県震災復興検証アドバイザー
 災害科学国際研究所 今村 文彦教授

宮城県総合計画審議会
 環境科学研究科 吉岡 敏明教授
 災害科学国際研究所 今村 文彦教授

公共土木施設構造検討会
 工学研究科 大村 達夫教授
 工学研究科 鈴木 基行教授
 工学研究科 田中 仁教授
 災害科学国際研究所 越村 俊一教授
 災害科学国際研究所 真野 明教授

地震対策等専門部会
 経済学研究科 増田 聡教授
 理学研究科 海野 徳仁教授
 災害科学国際研究所 今村 文彦教授

宮城県防災専門教育アドバイザー
 工学研究科 小野田 泰明教授
 災害科学国際研究所 佐藤 健教授
 災害科学国際研究所 平川 新名誉教授
 災害科学国際研究所 今村 文彦教授
 病院 石井 正教授

[Sendai]
仙台市震災復興検討会議、東部地域検討ワーキング
 経済学研究科 増田 聡教授

仙台市復興まちづくり連絡調整会議
 経済学研究科 増田 聡教授

仙台市震災復興メモリアル等検討委員会
 経済学研究科 増田 聡教授

仙台市復興記録誌編さんアドバイザー
 経済学研究科 増田 聡教授

津波避難施設の整備に関する検討委員会
 経済学研究科 増田 聡教授

仙台市議会 エネルギー政策調査特別委員会
 工学研究科 中田 俊彦教授

仙台市環境監査委員会
 工学研究科 中田 俊彦教授

仙台市集団移転跡地地活用検討委員会
 工学研究科 姥浦 道生教授

仙台市集団移転跡地地活用事業者選定委員会
 工学研究科 姥浦 道生教授

沿岸部メモリアル施設アドバイザー
 災害科学国際研究所 佐藤 翔輔准教授

中心部震災メモリアル拠点検討委員会
 災害科学国際研究所 佐藤 翔輔准教授
 災害科学国際研究所 マリ エリザベス准教授

仙台市津波避難施設の整備に関する検討委員会
 災害科学国際研究所 佐藤 健教授

新たな学校防災教育推進協議会
 災害科学国際研究所 佐藤 健教授

新防災教育副読本編集アドバイザー
 災害科学国際研究所 佐藤 健教授

災害に強いコミュニティのための市民フォーラム実行委員会
 災害科学国際研究所 佐藤 健教授

仙台市地域防災リーダー養成事業次期計画作成に向けた研究会
 災害科学国際研究所 佐藤 健教授

仙台市防災会議原子力防災部会
 サイバーサイエンスセンター 曾根 秀昭教授

仙台市情報化推進会議
 サイバーサイエンスセンター 曾根 秀昭教授

仙台市防災会議
 経済学研究科 増田 聡教授
 災害科学国際研究所 千田 浩一教授

仙台市復興推進協議会
 経済学研究科 福嶋 路教授
 農学研究科 伊藤 房雄教授

仙台市震災復興検討会議
 法学研究科 牧原 出教授
 経済学研究科 増田 聡教授
 医学系研究科 辻 一郎教授
 工学研究科 風間 基樹教授
 工学研究科 堀切川 一男教授
 農学研究科 中井 裕教授
 災害科学国際研究所 今村 文彦教授

仙台市震災復興推進本部会議（震災復興アドバイザー）
 経済学研究科 大滝 精一教授
 経済学研究科 増田 聡教授
 経済学研究科 西出 優子准教授
 工学研究科 小野田 泰明教授
 農学研究科 中井 裕教授
 災害科学国際研究所 今村 文彦教授

[Ishinomaki]
石巻市震災復興基本計画市民検討委員会
 工学研究科 小野田 泰明教授

復興まちづくり推進会議
 工学研究科 姥浦 道生教授

石巻市あけぼの北地区被災市街地復興土地区画整理審議会
 工学研究科 姥浦 道生教授

石巻市中心市街地活性化検討市民会議
 工学研究科 姥浦 道生教授

石巻市観光交流施設整備実務者検討委員会
 工学研究科 姥浦 道生教授

石巻市湊西地区被災市街地復興土地区画整理審議会
 工学研究科 姥浦 道生教授

上釜南部地区被災市街地復興土地区画整理審議会
 工学研究科 姥浦 道生教授

中央二丁目地区被災市街地復興土地区画整理審議会
 工学研究科 姥浦 道生教授

石巻市新蛇田地区被災市街地復興土地区画整理審議会
 災害科学国際研究所 平野 勝也准教授

学校防災推進会議
 災害科学国際研究所 桜井 愛子准教授
 災害科学国際研究所 佐藤 健教授

石巻市復興まちづくり推進会議
 災害科学国際研究所 平野 勝也准教授

駅前拠点地区検討会
 災害科学国際研究所 平野 勝也准教授

中瀬公園検討会
 災害科学国際研究所 平野 勝也准教授

河北（二子）地区復興まちづくり協議会
 災害科学国際研究所 平野 勝也准教授

新蛇田南第二地区被災市街地復興土地区画整理審議会
 災害科学国際研究所 平野 勝也准教授

石巻市震災伝承検討会議
 災害科学国際研究所 佐藤 翔輔助教

石巻市震災遺構検討会議（旧門脇小学校校舎）
 災害科学国際研究所 佐藤 翔輔助教

石巻市震災伝承事業に関するアドバイザー及びファシリテーター
 災害科学国際研究所 佐藤 翔輔准教授

かわまちづくり交流拠点検討会
 災害科学国際研究所 平野 勝也准教授

半島拠点部実務者会議
 災害科学国際研究所 平野 勝也准教授

石巻市市街地復興工事調整業務に関するプロポーザル選定委員
 災害科学国際研究所 平野 勝也准教授

震災伝承検討会議及び震災遺構検討会議（旧門脇小学校校舎、旧大川小学校校舎）
 災害科学国際研究所 佐藤 翔輔准教授

プロポーザル選定委員会（旧門脇小学校震災遺構調査・基本設計等業務、大川小学校旧校舎震災遺構調査・基本設計等業務）
 災害科学国際研究所 佐藤 翔輔准教授

石巻市学校防災推進会議
 災害科学国際研究所 佐藤 健教授

石巻市防災教育副読本編集委員会
 災害科学国際研究所 佐藤 健教授

石巻市震災復興推進本部復興ビジョン有識者懇談会
 工学研究科 小野田 泰明教授
 災害科学国際研究所 今村 文彦教授

[Iwanuma]
仙塩広域都市計画事業岩沼市矢野目西地区土地区画整理審議会
 工学研究科 姥浦 道生教授

岩沼市農業復興検討委員会
 農学研究科 伊藤 房雄教授

みやぎ防災教育推進協力校事業大崎市防災教育アドバイザー
災害科学国際研究所 佐藤 健教授

防災教育を中心とした実践の安全教育総合支援事業大崎市防災（安全）教育アドバイザー
災害科学国際研究所 佐藤 健教授

[Kesenuma]
岩井崎プロムナードセンター整備検討会議
災害科学国際研究所 佐藤 翔輔准教授

気仙沼市防災会議
災害科学国際研究所 今村 文彦教授

気仙沼市新庁舎建設基本構想策定有識者会議
災害科学国際研究所 丸谷 浩明教授

気仙沼市震災復興会議
経済学研究科 大滝 精一教授
災害科学国際研究所 今村 文彦教授

[Shiogama]
北浜地区被災市街地復興土地区画整理審議会
工学研究科 姥浦 道生教授

藤倉二丁目地区被災市街地復興土地区画整理審議会
工学研究科 姥浦 道生教授

塩釜市防災教育推進協議会
災害科学国際研究所 佐藤 健教授

防災教育推進協議会
災害科学国際研究所 佐藤 健教授

塩竈市震災復興計画検討委員会
工学研究科 姥浦 道生准教授
医工学研究科 小玉 哲也教授
首藤 伸夫名誉教授

[Tagajo]
多賀城市立小・中学校防災主任会アドバイザー
災害科学国際研究所 佐藤 翔輔准教授

多賀城市被災者現況調査アドバイザー
災害科学国際研究所 佐藤 翔輔准教授

多賀城市立東豊中学校区防災教育推進委員会アドバイザー
災害科学国際研究所 佐藤 翔輔准教授

[Natori]
名取市防災会議
災害科学国際研究所 佐藤 翔輔准教授

閑上地区まちなか再生協議会
災害科学国際研究所 平野 勝也准教授

名取市新たな未来会議
経済学研究科 増田 聡教授
経済学研究科 福嶋 踏准教授
工学研究科 風間 基樹教授
工学研究科 姥浦 道生准教授
災害科学国際研究所 越村 俊一教授
災害科学国際研究所 村尾 修教授

東日本大震災第三者検証委員会
電気通信研究所 鈴木 陽一教授
災害科学国際研究所 越村 俊一教授
沢谷 邦男名誉教授

[Higashimatsushima]
東松島市防災会議
災害科学国際研究所 佐藤 翔輔准教授

東松島市震災伝承館事業アドバイザー
災害科学国際研究所 佐藤 翔輔准教授

東松島市震災復興モニュメント検討委員会
災害科学国際研究所 佐藤 翔輔准教授

東松島市復興まちづくり計画有識者委員会
経済学研究科 増田 聡教授
農学研究科 大村 道明助教

[Onagawa]
復興まちづくりデザイン会議
災害科学国際研究所 平野 勝也准教授

女川町発展計画審議会
災害科学国際研究所 平野 勝也准教授

女川町復興計画策定委員会
農学研究科 木島 明博教授
首藤 伸夫名誉教授

[Kami]
加美町防災会議
法学研究科 島田 明夫教授

[Shichigahama]
七ヶ浜町震災復興計画震災復興アドバイザー
工学研究科 小野田 泰明教授

[Minamisanriku]
道の駅整備推進協議会
災害科学国際研究所 平野 勝也准教授

(仮)南三陸町震災伝承館施設展示基本計画策定業務プロポーザル審査委員会
災害科学国際研究所 平野 勝也准教授

南三陸町震災復興計画策定会議
災害科学国際研究所 越村 俊一教授
災害科学国際研究所 平野 勝也准教授
大橋 英寿名誉教授

[Yamamoto]
山元町コンパクトシティ型スマートコミュニティ事業アドバイザーーボード
工学研究科 中田 俊彦教授

山元町震災復興有識者会議
災害科学国際研究所 今村 文彦教授

[Watari]
亘理町震災復興会議
災害科学国際研究所 今村 文彦教授

亘理町防災会議
災害科学国際研究所 佐藤 翔輔准教授

亘理町防災主任者会（防災教育推進研修会）アドバイザー
災害科学国際研究所 佐藤 翔輔准教授

[Hokkaido]
防災アドバイザー
災害科学国際研究所 定池 祐季助教

厚真町心のサポート・防災学習推進協議会
災害科学国際研究所 定池 祐季助教

[Aomori]
スマートシティアカデミー
工学研究科 中田 俊彦教授

弘前型スマートシティ構想策定委員会
工学研究科 中田 俊彦教授

青森県エネルギー産業振興戦略推進会議
工学研究科 中田 俊彦教授

弘前市分散型エネルギーインフラプロジェクト事業化アドバイザーー会議
工学研究科 中田 俊彦教授

弘前型スマートシティ懇談会
工学研究科 中田 俊彦教授

青森県原子力安全対策検証委員会（津波関係）
災害科学国際研究所 今村 文彦教授

学校と地域が一体になった防災教育推進事業アドバイザー

災害科学国際研究所 今村 文彦教授
災害科学国際研究所 佐藤 翔輔准教授

防災対策強化検討委員会
災害科学国際研究所 佐藤 健教授

[Akita]
津波浸水想定調査委員会
災害科学国際研究所 越村 俊一教授

[Iwate]
スマートコミュニティ推進協議会
工学研究科 中田 俊彦教授

海と山と人をつなぐ地域再生可能エネルギーシステム・大船渡プロジェクト推進協議会
工学研究科 中田 俊彦教授

高田地区海岸養浜技術検討委員会
工学研究科 田中 仁教授

宮古市スマートコミュニティ推進協議会
工学研究科 中田 俊彦教授

大船渡地区津波復興拠点整備事業専門員会
工学研究科 姥浦 道生教授

岩手県河川・海岸構造物の復旧等における環境・景観検討委員会
災害科学国際研究所 平野 勝也准教授

岩手県津波防災技術専門委員会
災害科学国際研究所 今村 文彦教授

陸前高田市景観審議会
災害科学国際研究所 平野 勝也准教授

高田松原津波復興祈念公園震災津波伝承施設検討委員会
災害科学国際研究所 柴山 明寛准教授

自主防災組織活性化検討会議
災害科学国際研究所 佐藤 健教授

岩手県津波防災技術専門委員会（津波関係）
災害科学国際研究所 今村 文彦教授
首藤 伸夫名誉教授

釜石市復興プロジェクト会議
工学研究科 小野田 泰明教授
災害科学国際研究所 越村 俊一教授

[Yamagata]
スマートコミュニティ推進委員会
工学研究科 中田 俊彦教授

山形県廃棄物処理施設審査会
工学研究科 中田 俊彦教授

[Fukushima]
伊達市総合計画審議会
法学研究科 穴戸 邦久教授

双葉町津波被災地域復興小委員会
経済学研究科 増田 聡教授

檜葉町復興まちづくり計画検討委員会
経済学研究科 増田 聡教授

大熊町除染検証委員会
薬学研究科 吉田 浩子准教授

福島県再生可能エネルギー次世代技術開発事業
工学研究科 中田 俊彦教授

地域復興実用化開発等促進事業費補助金審査会（エネルギー分野）
工学研究科 中田 俊彦教授

福島市環境審議会
工学研究科 中田 俊彦教授

イノベーション・コースト構想将来展開検討会
工学研究科 中田 俊彦教授

大熊町ゼロカーボンビジョン策定有識者会議
工学研究科 中田 俊彦教授

福島県復興計画検討委員会
農学研究科 伊藤 房雄教授

福島県復興ビジョン検討委員会
農学研究科 伊藤 房雄教授

葛尾村産業再生事業化計画アドバイザー
農学研究科 伊藤 房雄教授

中間所蔵施設に関する専門家会議
環境科学研究科 吉岡 敏明教授

ふくしま環境・リサイクル関連産業研究会
環境科学研究科 吉岡 敏明教授

福島県海岸における津波対策等検討会
災害科学国際研究所 越村 俊一教授

福島県沿岸津波浸水想定策定に向けた技術検討会
災害科学国際研究所 越村 俊一教授

[Ibaraki]
茨城県原子力安全対策委員会
災害科学国際研究所 越村 俊一教授

[Shizuoka]
防災・原子力学会会議津波対策分科会
災害科学国際研究所 今村 文彦教授
災害科学国際研究所 後藤 和久准教授

[Shimane]
地震津波防災対策検討委員会
災害科学国際研究所 遠田 晋次教授

[Tokushima]
徳島県復興指針検討委員会
災害科学国際研究所 定池 祐季助教

[Kochi]
高知県南海トラフ地震対策推進本部
災害科学国際研究所 今村 文彦教授

石油基地等地震・津波対策検討会
災害科学国際研究所 越村 俊一教授

Others

[Hyogo Earthquake Memorial 21st Century Research Institute]

東日本大震災生活復興研究会
経済学研究科 増田 聡教授

[Tohoku Regional Development Association]
東北地域づくり協会
国際文化研究科 青木 俊明准教授

[Japan Environmental Storage & Safety Corporation]
中間貯蔵事業技術検討会
環境科学研究科 吉岡 敏明教授

除染・中間貯蔵関連技術探索サイト技術評価委員会
環境科学研究科 吉岡 敏明教授

[Radioactive Waste Management Funding and Research Center]
巨大地震・津波等の対策技術検討委員会
災害科学国際研究所 越村 俊一教授

[Tohoku Electric Power Co., Inc.]
津波評価に関する技術検討会
災害科学国際研究所 越村 俊一教授

[Research Organization for Catastrophic Disaster Reduction]
大規模災害対策研究機構
災害科学国際研究所 越村 俊一教授

[The Japanese Institute of Fisheries Infrastructure and Communities]
津波漂流物対策の技術調査検討委員会
災害科学国際研究所 越村 俊一教授



震災10年の知と 未来事業

Lessons from 3.11 - Toward the Future

10 Years after the Great East Japan Earthquake

Thank you to everybody for your support.

Join us in creating a new future.

“Lessons from 3.11 - Toward the Future”

Immediately after the Great East Japan Earthquake Tohoku University established the Institute for Disaster Reconstruction and Regeneration Research in April 2011. Since then, over 10 years have passed and we engaged in many reconstruction actions such as Disaster Science, Regional Health Care, Environmental Energy and Decommissioning of Nuclear Reactors. This is because we believe that giving back the knowledge, experience, and lessons learned from the disaster to communities is our mission as a university experiencing the disaster of unprecedented scale.

Now, 10 years after the disaster, the world is facing new challenges such as climate change, more severe and more frequent weather disasters, and the spread of COVID-19. Using our knowledge and experience from the disaster and reconstruction will be the new challenge for Tohoku University.



“Lessons from 3.11 - Toward the Future” Homepage:
<https://tohokuuniversity-lessonsfrom311.com/>

At “Lessons from 3.11 - Toward the Future”
we categorized Tohoku University’s “wisdom” in 4 fields.
We organized online symposia based on these categories to think about the future.

【 4 Topics for Living Together in the Future】





Earthquakes, tsunamis, typhoons, floods, volcanic eruptions, infectious diseases, we are always living close to the next disaster. And these disasters cannot be prevented with current technology. We have to face nature and be ready to live with the next disaster. We thought about the power of living with 10 years worth of disaster knowledge and experience.

First Online Symposium “Living with Disasters” (July 2020)

In July 2020, we held the First Online Symposium “Living with Disasters”. Thinking about three perspectives “Tsunami Disasters”, “Climate Disasters” and “Disasters by Infectious Diseases” three experts (Director Fumihiko Imamura from the International Research Institute of Disaster Science, Prof. Toshio Suga from the Graduate School of Science and Prof. Hitoshi Oshitani from

the Graduate School of Medicine) discussed topics such as “How can communities live with disasters that strike repeatedly and are inevitable?”, “What kind of future awaits us in the face of disaster?” Each of them introduced their latest research findings and preventive measures, and discussed commonalities as well as the new form of a resilient society they see.

[Special Discussion]

What we can learn from Tsunami Disasters × Climate Disasters × Disasters by Infectious Diseases (Part 1 & 2)



[Participants]
Fumihiko Imamura, Director of the International Research Institute of Disaster Science
Toshio Suga, Prof. at the Graduate School of Science
Hitoshi Oshitani, Prof. at the Graduate School of Medicine



[Lecture]

IRIDeS after the Great East Japan Earthquake and New Challenges

[Speaker]
Fumihiko Imamura,
Director of the International Research Institute of Disaster Science



[Lecture]

Increasing Risks of Climate and Oceanic Disasters Due to Climate Change

[Speaker]
Toshio Suga,
Prof. at the Graduate School of Science



[Lecture]

Disaster Risk Management Seen from the Great East Japan Earthquake and the COVID-19 Response

[Speaker]
Hitoshi Oshitani,
Prof. at the Graduate School of Medicine



◀ You can watch the online symposium here:

<https://tohokuuniversity-lessonsfrom311.com/>
 (“Lessons from 3.11 - Toward the Future” Homepage)



Many people help and support each other when faced with disasters such as the Great East Japan Earthquake to overcome hardship. These experiences provide a new perspective on life and an opportunity to reflect on what is actually important. We thought about future forms of life with 10 years worth of disaster knowledge and experience.

Second Online Symposium “Living with Being Alive” (September 2020)

The Second Online Symposium “Living with Being Alive” was held in September 2020 and we published three videos thinking about life and supporting each other.

In the first video, Executive Director Masayuki Yamamoto from the Tohoku Medical Megabank Organization was interviewed by Singer-songwriter miki, talking about activities of the Organization, the creation of the biobank and Next Generation Medicine.

The second video was a lecture by Prof. Tadashi Ishii from the

University Hospital, presenting important aspects of emergency medical care seen through the experiences of the 3.11 disaster and the COVID-19 crisis.

In the third video, Prof. Yozo Taniyama from the Graduate School of Arts and Letters discussed actions of Tohoku University’s Interfaith Chaplains with TBS Producer Yutaka Tawada, talking about a new form of mental health care.

[Interview]

Chances for Next Generation Medicine with Disaster Knowledge



[Participants]
Masayuki Yamamoto,
Executive Director of the Tohoku Medical Megabank Organization
miki, Singer-songwriter



[Lecture]

Healthcare Actions in Emergencies - Using Knowledge from the Great East Japan Earthquake and COVID-19 Response -

[Speaker]
Tadashi Ishii, Prof. at the University Hospital



[Discussion]

Supporting Life - A New Form of Mental Health Care with Disaster Knowledge -

[Participants]
Yozo Taniyama, Asso. Prof. at the Graduate School of Arts and Letters
Yutaka Tawada, Producer at TBS



◀ You can watch the online symposium here:

<https://tohokuuniversity-lessonsfrom311.com/>
 (“Lessons from 3.11 - Toward the Future” Homepage)



One big topic throughout reconstruction actions was regional community regeneration and the restoration of regional industries. We thought about sustainable regional developments and important basics for a prosperous community with 10 years worth of disaster knowledge and experience.

Third Online Symposium “Living with the Community” (January 2021)

The third online symposium “Living with the Community” was published in January 2021, discussing fundamental questions such as “What is a regional community?”, seeking answers through interviews with people from disaster stricken areas such as Onagawa and Marumori. Based on the

results, three experts (Deputy Dean Makoto Hisada of the Graduate School of Engineering, Prof. Sinichiro Ogura from the Graduate School of Agricultural Science and Director Hiroki Takakura of the Center for Northeast Asian Studies) discussed future tasks and how to approach communities.



[Documentary]
What is a “Regional Community”?
 - Onagawa -

[Participants]
 Yoshiaki Suda, Mayor of Onagawa
 Motoyuki Takaizumi, Oyster Farmer in Onagawa
 Akihiro Kijima, Prof. at the Graduate School of Agricultural Science

[Documentary]
What is a “Regional Community”?
 - Marumori -

[Participants]
 Kunio Hoshina, Mayor of Marumori
 Hikaru Yoshitaka, Representative of Domegi Garden & Cafe
 Takashi Yamaki, Manager of Marumori Agriculture and Forestry, Forestry Promotion
 Junichi Monma, Deputy Director of General Inc. Asso. “Azudasu”



[Discussion]
What is a “Regional Community”?
 - Summary -

[Participants]
 Makoto Hisada, Deputy Dean of the Graduate School of Engineering
 Sinichiro Ogura, Prof. at the Graduate School of Agricultural Science
 Hiroki Takakura, Director of the Center for Northeast Asian Studies



◀ You can watch the online symposium here:

<https://tohokuuniversity-lessonsfrom311.com/>
 (“Lessons from 3.11 - Toward the Future” Homepage)

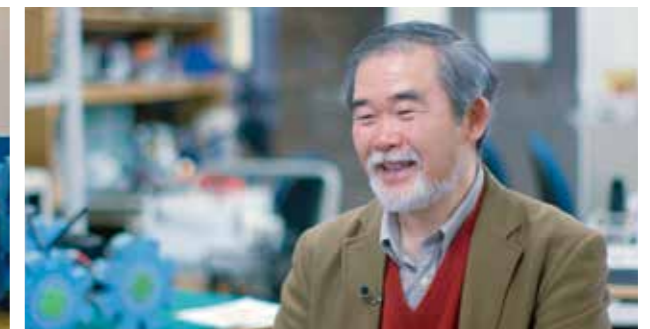


The Great East Japan Earthquake brought a devastating disaster and destruction to the communities. But we also learned a lot from the reconstruction and new technology emerged during the process. Reconstruction is not just a recovery to the old state, but a challenge to create a more prosperous, safer future for everybody. We thought about new ways of exploration with 10 years worth of disaster knowledge.

Fourth Online Symposium “Living with Exploration” (February to March 2021)

The fourth online symposium was held February to March 2021 with the topic “Living with Exploration”. We asked Director Yutaka Watanabe of the Center for Fundamental Research on Nuclear Decommissioning and Prof. Kazuya Yoshida from the Graduate School of

Engineering about the decommissioning of nuclear reactors and space robotics as well as students and graduates of the fields. We thought about how to connect the spirit and knowledge of exploration to a better future for everybody and how research will evolve with time.



[Documentary]
The Rugged Planet! - Adventures of Space Robots -

[Participant]
 Kazuya Yoshida, Prof. at the Graduate School of Engineering

[Discussion]
Nuclear Decommissioning - Challenges for the Future -



[Participants]
 Yutaka Watanabe, Director of the Center for Fundamental Research on Nuclear Decommissioning
 Kenji Ohwada, TEPCO



◀ You can watch the online symposium here:

<https://tohokuuniversity-lessonsfrom311.com/>
 (“Lessons from 3.11 - Toward the Future” Homepage)

10 Year Memorial Symposium

New Communities in New Times after the Disaster
- Experience and Knowledge from Reconstruction for a Better Future -



From March 5-11, 2021, we held the Tohoku University 10 Year Memorial Symposium “New Communities in New Times after the Disaster - Experience and Knowledge from Reconstruction for a Better Future -” (online).

Looking back at 10 years of Reconstruction Actions of Tohoku University, we discussed new threats and risks such as natural disasters and infectious diseases as well as the need to establish a resilient, green society.

MEXT Minister Koichi Hagiuda, Minister for Reconstruction Katsuei Hirasawa, Miyagi Governor Yoshihiro Murai and Sendai City Mayor Kazuko Kori contributed online messages as special guests. As keynote speakers, President Makoto Iokibe from the Hyogo Earthquake Memorial 21st Century Research Institute and University of Hyogo as well as Sandra Wu, Chairperson & CEO of Kokusai Kogyo Co., Ltd. presented their opinion on disaster reconstruction. Furthermore, Executive Vice President Nobuyoshi Hara and President Hideo Ohno presented a summary of Tohoku University’s actions and future plans at an online live event. Additionally, YouTuber Takushi Izawa and Singer-songwriter Ai Kawashima presented “Messages to Support the Disaster Region”, showing their passion for the disaster stricken areas and the reconstruction actions. Videos as well as the 9th edition of “Reconstruction Actions” were also published, summarizing 10 years of Tohoku University’s efforts.

During the event, more than 25,000 people participated online, showing the high interest in our activities even 10 years after the Great East Japan Earthquake.

[Program]

Messages from Special Guests

10 years since the Great East Japan Earthquake, the participants talked about their thoughts on reconstruction and their expectations for Tohoku University in the future.



Koichi Hagiuda, Minister of Education, Culture, Sports, Science and Technology



Katsuei Hirasawa, Minister for Reconstruction



Yoshihiro Murai, Miyagi Governor



Kazuko Kori, Sendai City Mayor

Keynote Speakers

10 Years of Disaster Recovery
- Living in Times of Megadisasters -

Makoto Iokibe
(President of Hyogo Earthquake Memorial 21st Century Research Institute and University of Hyogo/former Chairperson of the Great East Japan Earthquake Reconstruction Planning Committee)

He spoke about the changes in Japanese society’s response to recovery and reconstruction in times of huge disasters, including the Great Hanshin-Awaji Earthquake, the Great East Japan Earthquake, other frequent major earthquakes, and the recent wind and flood disasters, as well as how communities should prepare for disaster risk reduction and the importance of international collaboration to overcome COVID-19.



10 Years After the Great East Japan Earthquake and Towards 2030
- A Perspective from the Private Sector

Sandra Wu
(Chairperson & CEO of Kokusai Kogyo Co., Ltd./Prof. at the International Research Institute of Disaster Science/UN Global Compact Board Member/Global Compact Network Japan board member)

During the speech, she explained how the role of corporations has changed through the Sendai Framework for Disaster Reduction and where Japan’s private sector stands internationally in terms of disaster risk reduction, as well as how the private sector and Japan should work towards 2030.



Summary

10 Years of Tohoku University Reconstruction Actions

Nobuyoshi Hara, Executive Vice President for Outreach Activity and Earthquake Disaster Reconstruction/Director of the Institute for Disaster Reconstruction and Regeneration Research

After the disaster, the Institute for Disaster Reconstruction and Regeneration Research had the central role to promote 8 priority projects such as disaster science, regional health care as well as decommission of nuclear reactors. Individual members also voluntarily contributed to reconstruction actions in the framework of “Reconstruction Action 100”. Based on the knowledge and experience of these activities, interdisciplinary research and comprehensive approach became important as well as collaborations with communities and co-creation to find solutions for critical problems.



Toward a Green Future (Plans after the 11th Year)

Hideo Ohno, President of Tohoku University

The knowledge and experience obtained through Reconstruction Actions have essential applications when dealing with environmental or societal problems. After the 11th year, the accumulated wisdom will be used to realize a resilient and green future for everybody. Furthermore, the “Green Goals Initiative” was announced as a new basis for Tohoku University’s future actions.



What is Tohoku University’s Green Goals Initiative?

In addition to the projects promoted by the Institute for Disaster Reconstruction and Regeneration Research objectives important to solve environmental and societal issues are included under a new, comprehensive umbrella. All projects will be reorganized into 3 pillars, “Green Technology”, “Recovery & Resilience” and “Social Innovation & Inclusion” to clarify the university’s goals to contribute to a sustainable future. We will continue to utilize the knowledge, experience and lessons of disaster reconstruction to support safe and secure communities and promote community collaboration to present solutions to issues such as climate change as well as environmental and societal problems. Readiness for natural disasters or infectious diseases can only be achieved through the realization of a resilient and green future not only at home but abroad.

Messages to Support the Disaster Region

YouTuber Takushi Izawa and singer-songwriter Ai Kawashima, who have been engaged in their own reconstruction support activities since the disaster, sent us episodes related to their reconstruction activities at the time of the disaster and afterwards, as well as their supportive comments for the communities.



Takushi Izawa
(YouTuber/CEO QuizKnock/Personality)



Ai Kawashima
(Singer-songwriter)

Presenting Reconstruction Actions

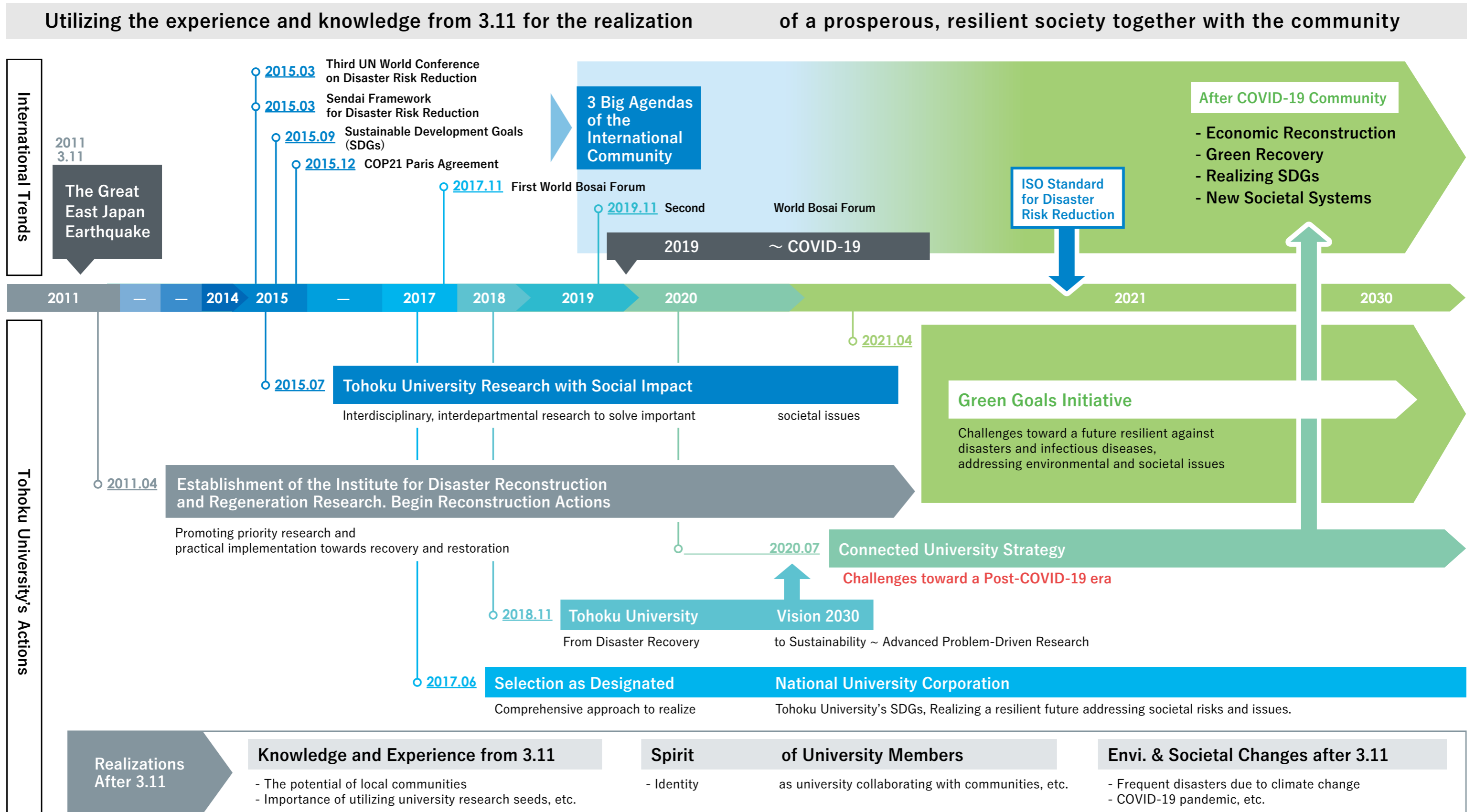
Among the “Reconstruction Actions” that Tohoku University has been working on, we distributed a video introducing the “Evaluation of Radiation Effects on Animals,” in which we are researching the effects of long-term exposure to low-dose and low-dose-rate radiation on human health using samples of Japanese macaques and other animals captured in the former warning area.

Research on Effects of Radiation Exposure to the Environment and Animals
Masatoshi Suzuki, Senior Assistant Professor at the International Research Institute of Disaster Science



11 Years after the Disaster

From Reconstruction Actions Toward Resilient Communities after COVID-19



Tohoku University Leading the Way

山形 女子

There was always the feeling that the dead of 3.11 were alive somewhere. That somewhere all the dead, the children, the adults, gathered and lived happily together. And that they would look at us saying

“It’s time to cheer up again. We are fine.”

If it was so, people who lost their loved ones, their family or friends, these people would probably feel some sort of relief... that’s what I thought.

Because as well as the recovery and reconstruction of towns and industry might be important, we also need to take care of the mental health of people. Every time I met with friends, and when I heard stories from people with depression and other mental issues, I thought to myself “The government and local administration as well as the individual have to stand up and look at the issues of mental health. What is it I can do?”

Precisely at that time, Tohoku University launched the Interfaith Chaplains Project. It was 2012. The role of ‘Interfaith Chaplains’ began at that moment. After his

graduation of Tohoku University’s School of Medicine, Doctor Ken Okabe, who did the christening of the project, devoted his life to hospice and other palliative care, supporting those with most severe experiences. As such, he must have felt the importance of addressing the mental state of disaster victims the most.

Interfaith chaplains receive special training and become experts beyond their own religion. Whether Buddhists or Christians, experts of their own religion become further specialists. And of course, without any recruitment or invitation to join a religion.

I once read “The fact that Tohoku University started training Interfaith Chaplains is good. A university without any religious color leading a national trend, that’s good”. And that is entirely true. Nowadays, it has become a trend many universities in many regions follow. Interfaith chaplains can help and support people in a different way to doctors and psychologists. That is obvious from the fact that Tohoku University Hospital also employed a regular Interfaith Chaplain.

Then in summer 2018, I received the offer from Sendai’s TBC “Would you like to write a drama about the 10 year memorial of 3.11”.

And immediately I said, I want to write a story where “the dead live happily somewhere together”. The story got the title “A Festival of Little Gods” and was turned into a drama with Yudai Chiba (from Tagajo, Miyagi) in the main role and the comedians Sandwich-Man (from Sendai) also appearing. The fact the story received so many awards, both nationally and internationally, made me very happy.

But more than that, disaster victims telling me that “the story gave [them] strength. That the families and everybody else is living happily” was something that filled me with joy.

I cannot become an Interfaith Chaplain, but I had the feeling I was at least a little bit contributing to the mental care Tohoku University was aiming for.

(Titles, etc. are omitted.)



From “A Festival of Little Gods” ©TOHOKU BROADCASTING CO.,LTD.

Makiko Uchidate

Screenwriter. Born 1948 in Akita.
NHK Morning Drama “Hirari”, NHK Drama “Motonari Mori”, TBS Drama “A Festival of Little Gods” and others. April 2003, admission to the Master course of Tohoku University’s Graduate School of Arts and Letters. Specialization in Religious Studies, analyzing Sumo as Shinto ritual, graduation in March 2006. President of the Sumo Club of Tohoku University in 2005. As of April 2011, Member of the “Great East Japan Earthquake Reconstruction Committee”, contributing to the recovery of communities and the region. In March 2013, presentation as a keynote speaker with the title “Tohoku’s Spirit, Technique and Body: How to be Japan’s Yokozuna” at the Institute for Disaster Reconstruction and Regeneration Research Symposium



**Tohoku University Reconstruction Action
2011-2021
Leading the Restoration of Tohoku and the
Regeneration of Japan
Vol. 9**

Publication & Editorial:
March 2021 by
Institute for Disaster Reconstruction
and Regeneration Research
Tohoku University
2-1-1 Katahira, Aobaku, Sendai 980-8577 JAPAN
TEL: 022-217-5009
E-mail: skk-som@grp.tohoku.ac.jp
<http://www.idrr.tohoku.ac.jp/>

Copyright © 2021 by Tohoku University