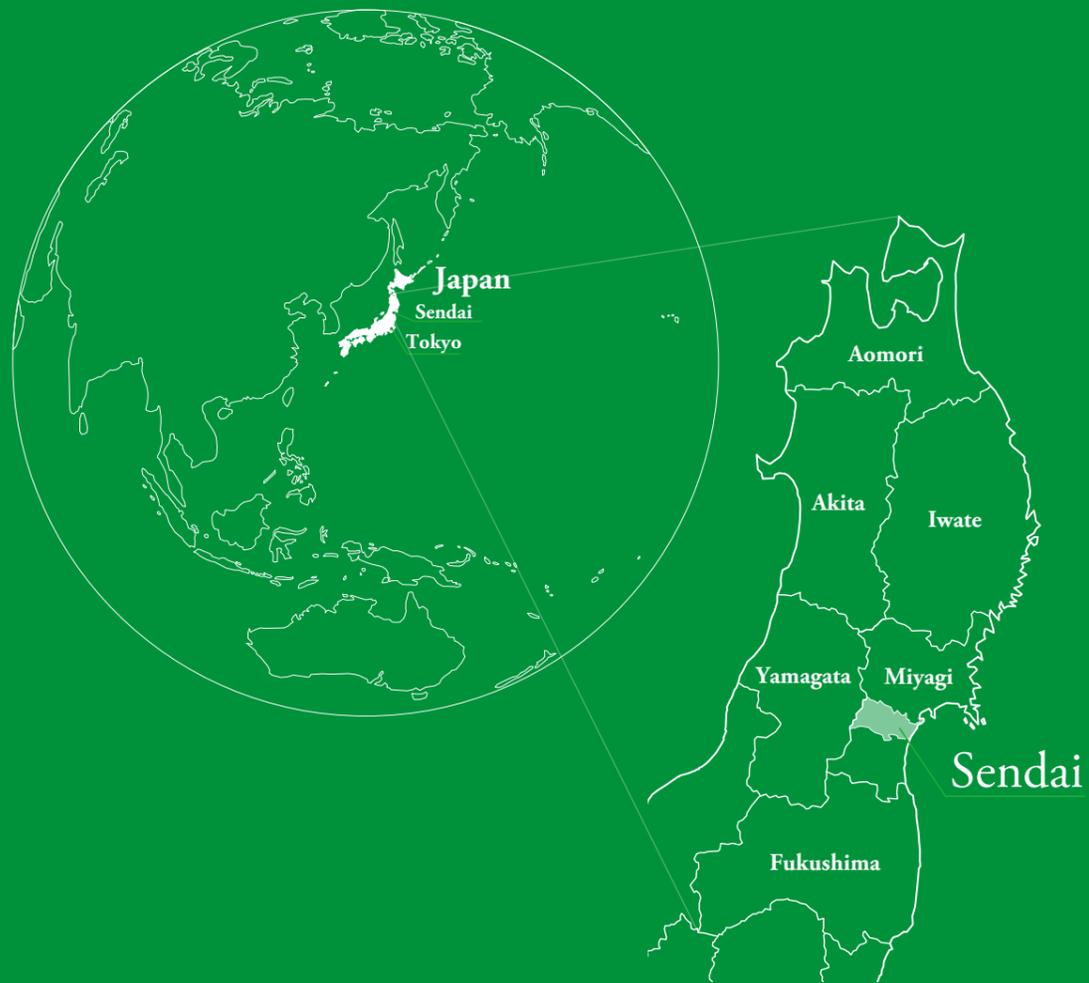


Road to Recovery SENDAI



Tsunami Defense



Rebuilding Everyday Life



Economy



Agriculture



Disaster Risk Reduction
in Communities



International Community



Children



Culture



Passing Down and
Sharing Experiences

The Great East Japan Earthquake



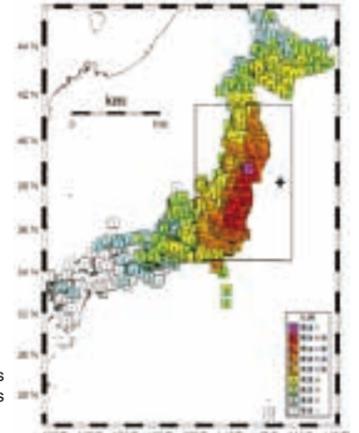
Sendai Arahama Elementary School, isolated by the tsunami

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This section introduces reconstruction activities by various citizens
- Page 26: Earthquake and Tsunami Mechanisms
- Page 28: Sendai Reconstruction Data
- Page 30: Sendai Reconstruction Chronology

Earthquake

Earthquake date and time: Friday, March 11, 2011, 2:46 PM
Formal name: The 2011 off the Pacific coast of Tohoku Earthquake
Epicenter: Off the Sanriku coast (38°6.2'N, 142°51.6'E)
Magnitude: 9.0
Tsunami height¹: 7.1 meters (estimated at Sendai Port)



On this map of Japan, the strength of the tremors caused by the Great East Japan Earthquake is shown by color from red (strong) to white (weak)

Source: Japan Meteorological Agency web site

Damage in Sendai (as of March 1, 2017)

Casualties: Death toll²	904	Damage to buildings:	
Missing	27	Completely collapsed	30,034
Injured	2,275	Severely damaged	27,016
Flooded households:	8,110	Partially damaged	82,593
Damage to residential lots:	5,728	Suffered minor damage	116,046

¹ 16.7 meters (estimated) size of Ofunato City, Iwate Prefecture was largest

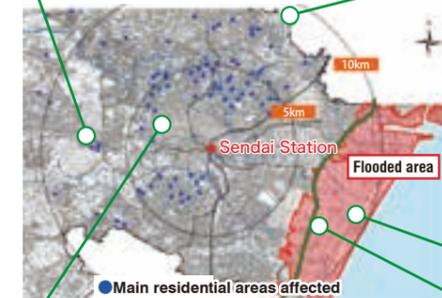
² Approximately 19,000 people died around Japan, mostly in the Tohoku region, in which Sendai is located



Damage to an inland residential area on a hill



Damage to a road



Main residential areas affected



Search and rescue operations



Emergency water supply aid



The looming tsunami

Damage

- 1 The Arahama area of Wakabayashi ward, looking out at the inland area near the coast
- 2 The tsunami engulfing the Minami-Gamo Wastewater Treatment Plant
- 3 Residential land damage in the inland hilly area
- 4 Rescuing people by helicopter
- 5 The Japan Self-Defense Forces delivers relief supplies

- 6 An evacuation center at an elementary school
- 7 People lining up outside of a supermarket seeking food
- 8 Removing debris
- 9 Damage at a public facility
- 10 The Great East Japan Earthquake Sendai Memorial Service (July 2011)



Reconstruction

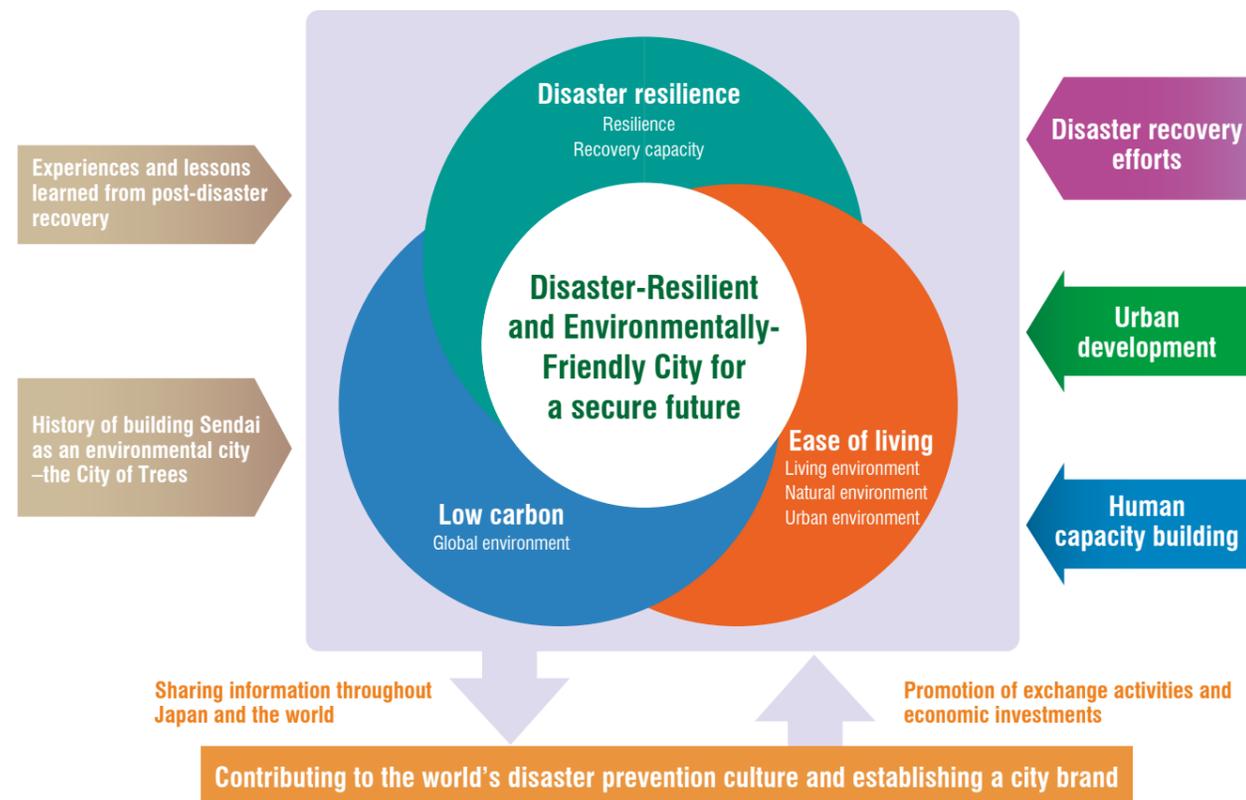
- 1 The first Sendai Aoba Festival after the earthquake, in May 2012
- 2 Residents gathering around prefabricated temporary housing
- 3 Construction to repair disaster damaged residential land
- 4 Evacuation stairs built along the Sendai Tobu Road
- 5 Foreign residents taking part in local disaster prevention drills
- 6 Disaster Reconstruction Municipal Housing unit built for disaster-affected persons

- 7 An exchange meetup at a Disaster Reconstruction Municipal Housing
- 8 The Sendai Subway Tozai Line opened
- 9 A housing complex site for the Disaster Prevention Collective Relocation
- 10 Redeveloping the coastal levee to an elevation of 7.2 meters
- 11 The Sendai 3/11 Memorial Community Center opened at Arai Station on the Tozai Line



Disaster-Resilient and Environmentally-Friendly City, Sendai

Having learned from the lessons of the Great East Japan Earthquake, Sendai is on its way to becoming a “Disaster-Resilient and Environmentally-Friendly City” that is both flexible and resilient to future risks, such as natural disasters and climate change. In order to achieve this goal, in the lush environment that earned the city its nickname of “the City of Trees”, the city is focusing on three elements. First is urban development that pursues ways of city planning leading to robust infrastructure and improved disaster risk reduction in energy supplies. Second is human capacity building that will help support disaster prevention activities in local communities. Third is passing on information about the experiences and lessons learned from the disaster.



Minami-Gamo Wastewater Treatment Plant applied the concept of “Build Back Better” and made recovery efforts which have taken into consideration both earthquake resilience and energy saving.



Solar panels installed on the roofs of schools and other facilities that will function as evacuation centers in disaster situations.



Disaster prevention drills based on the lessons learned from the earthquake.



Sendai Symposium for Disaster Risk Reduction and the Future, to be held every year since it began in 2016.



The Third United Nations World Conference on Disaster Risk Reduction, at which the Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted.

Towards the Realization of the Sendai Framework for Disaster Risk Reduction 2015-2030



Fumihiko Imamura

Director, International Research Institute of Disaster Science (IRIDeS), Tohoku University

A professor of tsunami engineering. Since 2014, Imamura has acted as director of the International Research Institute of Disaster Science (IRIDeS), Tohoku University. IRIDeS is an international research center located in Sendai that is focused on studying natural disaster science. The center researches a range of fields including the humanities, social sciences, science, engineering, informatics, medicine, and more. It also encompasses the Global Centre for Disaster Statistics, which works with the United Nations Development Programme (UNDP).

No matter where one may be in the world, there is the risk of being struck by a natural disaster. In recent years, with a growing population, socio-economic globalization, as well as increasing climate change, better response to disasters has become an issue of utmost urgency.

The 2011 Great East Japan Earthquake caused major damage to the Pacific Ocean side of the Tohoku region, such as that in Sendai. This calamity must never again be repeated. We feel we must convey the lessons we learned from this experience far and wide and reduce the disaster risks that other regions and the next generation may be exposed to. As people living in the stricken regions, we faced this issue head-on.

The Sendai Framework for Disaster Risk Reduction 2015-2030 was created at the Third United Nations World Conference on Disaster Risk Reduction, held in Sendai in 2015.

This framework describes a series of targets and priorities for action for countries around the globe to implement over the next 15 years in order to reduce damage caused by disasters. People who come from overseas to visit Sendai show an interest in both how the reconstruction is proceeding and in what things citizens are doing at the local level. The impression one gets is that they are deeply interested in changing the established thought that disaster risk reduction is something achieved top-down by governmental administration and not citizens. The way in which local residents, NPOs, corporations, specialists, and many other stakeholders have come together for Sendai’s reconstruction will prove to be a vital case study for other regions.

As the name bearer of the Sendai Framework, the world is looking to Sendai to foster a culture of disaster risk reduction. Utilizing opportunities such as the World Bosai Forum/International Disaster Risk Conference 2017 in Sendai, which will be held every other year from 2017 on, we must foster the further sharing of information and collaboration.

The Sendai Framework for Disaster Risk Reduction 2015-2030

The Sendai Framework for Disaster Risk Reduction 2015-2030 is the outcome document of the Third United Nations World Conference on Disaster Risk Reduction, held in March 2015 in Sendai, and outlines a range of international disaster risk reduction policies towards the year 2030. The lessons learned from the Great East Japan Earthquake are incorporated into the framework as key concepts and priorities for action. Many countries have started to implement measures for disaster risk reduction based on this framework.

As the city where this framework was adopted, we are improving essential utilities and other infrastructure as well as promoting disaster prevention and disaster risk reduction with a variety of entities playing a main role in the efforts.

- Features
1. Establishment of seven global targets such as reducing the mortality rate from global disasters for the first time.
 2. Presentation of new ideas, such as mainstreaming disaster prevention, pre-disaster investment to be used in measures for disaster prevention and disaster risk reduction, and the concept of “Build Back Better”.
 3. Emphasis on the roles of various relevant stakeholders¹, including not only the local governments, citizens organizations and research institutes, but also women, youth and the private sector taking action to prevent disaster and reduce disaster risks.

¹ Stakeholders: The wide range of people and entities who hold a stake or interest in a given activity in society.



Tsunami Defense

The tsunami that far exceeded prior estimations caused extensive damage—both to citizens and structures—in Sendai City, flooding an area larger than 4,500 ha. Since the disaster, in order to prepare for another potential tsunami, we have developed multiple lines of protection against tsunamis, such as a coastal levee, disaster prevention forests, and an elevated road. The areas that are still not guaranteed to be safe have been designated as Disaster Risk Areas¹; in such locations, the construction of homes is prohibited and former residents have moved to safer inland areas.



Enormous tsunami engulfing the coastal areas of Sendai



Evacuation Hill, recently developed in the Kaigan Park area



One of the Disaster Prevention Collective Relocation sites developed inland

Achieving Collective Relocation with Active Participation of Residents



Kaoru Suenaga

Arahama Relocation Town Planning Council

The Arahama area, where we used to live, was destroyed by the tsunami. In order to prevent our children from having to endure the same hardship, we decided to move to a safer inland area by utilizing the Disaster Prevention Collective Relocation Promotion Project². The former residents established a council to conduct negotiations with the City of Sendai and to hold study sessions on building houses. We also organized a festival to facilitate the exchange and sharing of information among former residents who were evacuated to various locations. The council disbanded in 2014, when the handing over of housing land at the relocation site was completed for every member of the council, followed by the rebuilding of their houses. We all strongly feel it is crucial for disaster-affected people to take action themselves, and that was what made it possible for us to rebuild homes at such an early stage.



The summer festival organized by the council in 2013. The former residents got together and enjoyed the occasion.

Safe Living Thanks to Multiple Defenses



Shinetsu Hirayama

Shinhama Neighborhood Association

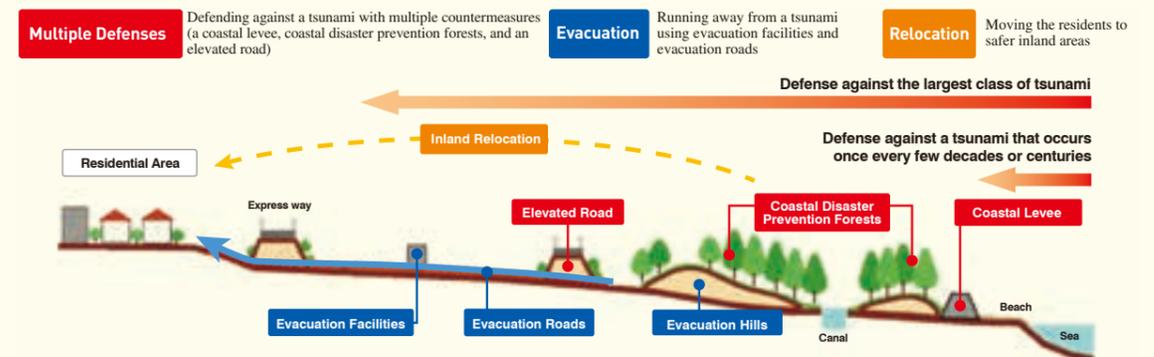
The tsunami engulfed the Shinhama area. Some residents lost their lives and the disaster left the district covered with mud and debris. Following the tsunami, the area closer to the sea was designated as a Disaster Risk Area, although the zone that is inland from the elevated road remained available for rebuilding homes. The City of Sendai decided to build tsunami evacuation towers. As the representative of the area, I attended meetings to express opinions on matters such as the appropriate location for the tower. Now that the tsunami evacuation tower has been completed, the residents can evacuate on foot when an emergency arises. There are about 70 households in the area and, thanks to the multiple defenses including the coastal levee and the elevated road, we are feeling safer and safer each day.



This tsunami evacuation tower, completed in 2016, makes it possible to evacuate to levels above 6 meters, which is high enough in relation to the estimated height of inundation.

SENDAI INFORMATION

Three Measures for Tsunami Defense



¹ **Disaster Risk Area:** These areas are designated by local government regulations as being highly vulnerable in a disaster situation. Building new residential structures is prohibited in the area.

² **The Disaster Prevention Collective Relocation Promotion Project:** This is a project to promote collective relocation to safer areas for those who used to live in a Disaster Risk Area. The national government's fund is used to develop residential land at the relocation destination and for subsidies to those who relocate.



Rebuilding Everyday Life

Many people lost their homes as a result of the Great East Japan Earthquake. These individuals were forced to live in temporary housing, and the number of displaced households exceeded 12,000 at its peak. After the disaster, the City of Sendai and NPOs collaborated to provide support to those households by responding to actual situations and requests. After individuals rebuilt their everyday lives via the Disaster Prevention Collective Relocation or Disaster Reconstruction Municipal Housing, a number of activities in various locations were also created to prevent isolation in a new environment and to build a new community.



By June 2011, 1,505 units of prefabricated temporary housing had been built



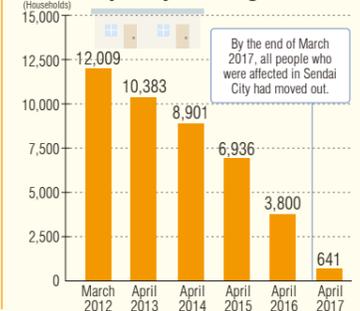
A student volunteer gives a moment of relaxation to a disaster-affected person with a hand massage



Disaster Reconstruction Municipal Housing built for disaster-affected people

SENDAI INFORMATION

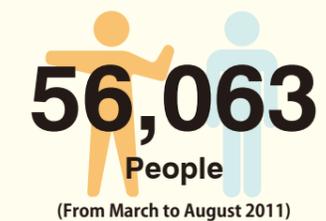
The Number of Households Living in a Temporary Housing



The Number of Households in Disaster Reconstruction Municipal Housing



The Number of Registered Disaster Volunteers



Joining Forces for a New Life



Katsunori Sugawara (pictured in center) and residents of the Asuto Nagamachi Disaster Reconstruction Municipal Housing

After living in evacuation centers and temporary housing following the Great East Japan Earthquake, we moved into municipal housing that was developed in 2015 for disaster-affected people. This is an apartment-style municipal housing structure with 13 stories and 163 houses; it also accommodated those who evacuated from disaster-affected areas outside of Sendai. Following advice from the ward office that "It is crucial that people get to know each other so that you can live safely in a new area," residents began drinking tea together. As they got to know each other, their exchanges became more active and led to a variety of collaborative, spontaneous activities, such as passage cleaning, summer festivals, and visiting single elderly people.



Talking while cleaning makes it a fun activity

Supporting the Disaster-Affected People Psychologically by Keicho (Attentive Listening) Activities

We have been conducting attentive listening to people's problems and anxieties since 2008. After the Great East Japan Earthquake occurred, we learned that mental care for disaster-affected people was essential; we then began visiting evacuation centers. By talking, people are able to cleanse what has accumulated in their mind; as a result, they feel lighter. We have regularly visited prefabricated temporary housings and meetings for disaster-affected people, conducting activities to support those who have problems. We believe that seeing more and more people who are overcoming sorrow and living positively is the real reconstruction.



Support for disaster-affected people continues with roughly 200 members



Eiko Moriyama
Sendai Keicho Society



Economy

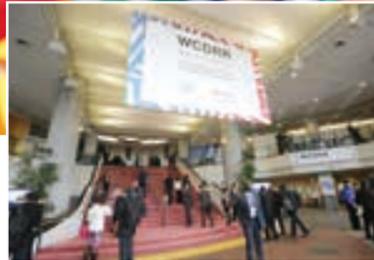
Sendai is the economic center in the Tohoku region, with a population of 1.08 million people. Numerous major corporations have branches here. Many of the local companies are small/medium enterprises and have developed around a focus on the service industry. The Great East Japan Earthquake caused damage to vast numbers of facilities and equipment of private companies, caused a loss to sales channels, and a decrease in tourists, leading to serious damage to the local economy. As part of the reconstruction, administrative policy and a range of ideas and initiatives by business operators came together to revitalize the local economy.



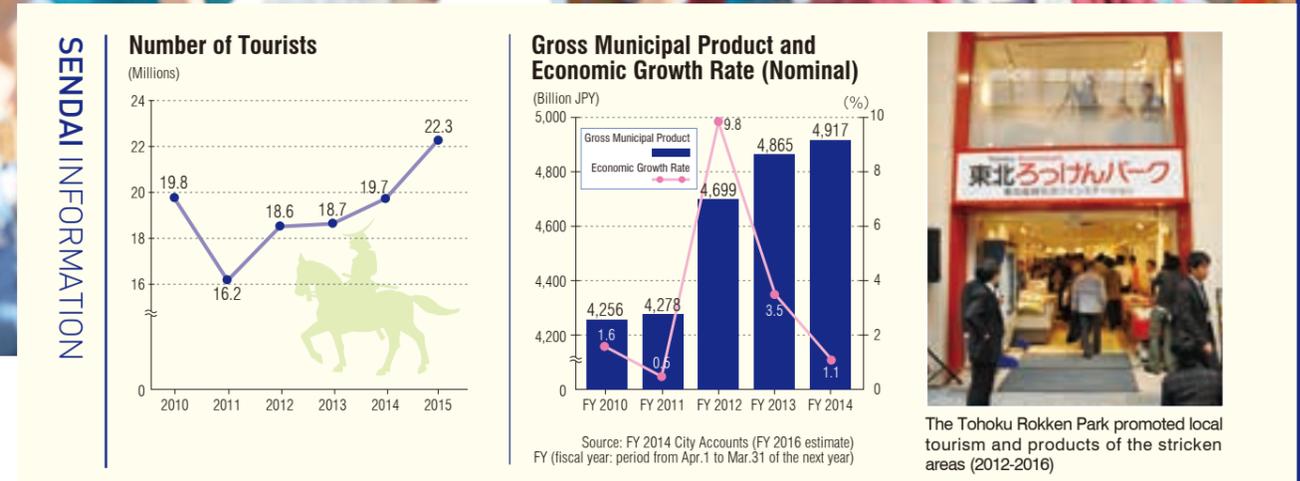
The City of Sendai and private sectors coming together to support entrepreneurs



Developing new sales channels at a trade fair



Aiming for an increased exchange population through inviting conventions



The Tohoku Rokken Park promoted local tourism and products of the stricken areas (2012-2016)

Initiatives to Support Recoveries of Businesses

In June 2011, the Sendai Chamber of Commerce and Industry drew on the nationwide network of chambers of commerce and industry to launch a project to provide machinery that disaster-affected businesses needed. Over five years, more than 3,200 spare pieces of machinery were utilized to make major contributions to restarting business and restoring the enthusiasm company operators had towards their businesses. In addition, many firms lost ties to their trading partners and clients as they had to suspend business or downsize their operations. To that end, we are organizing trade fairs to allow them to carve out sales channels anew.



Restarting business with donated equipment



Mitsuaki Sato
Sendai Chamber of Commerce and Industry

The Joy of Working with Colleagues

My home, farmland, warehouse, and equipment were all damaged by the tsunami. I had almost given up hope of restarting agriculture, but the female farmers said they wanted to continue working together and voiced their support. Thanks to their enthusiasm, we restarted making miso that we had been working on since before the tsunami. In 2013, we opened a new restaurant-cum-market together. The large rice balls and homemade side dishes have built up a reputation by word of mouth, and the shop is always packed. I am so grateful to have a place to work that the busy schedule doesn't feel like a bother at all. I feel that what those affected by the disaster need is work.



The signature large rice balls



Chikako Sasaki
Onigirichaya (rice ball tea house)
Chikachan



Agriculture

The plains spanning throughout eastern Sendai are where the staple crop of rice, as well as various vegetables, are grown. At the time of the Great East Japan Earthquake, the tsunami flooded 1,860 hectares of farmland, submerged them in mud and debris and salinated the soil. Through reconstruction efforts, the debris was cleared, the area desalinated, and repairs made to farmland and equipment. In order to enhance the management of farms that sustained damage, farmland development for larger zoning is underway.



Bringing Back Vitality to the Region by Restoring Agriculture



Yasunori Suzuki
Ido Agricultural Cooperative

In the earthquake and tsunami, my home was washed away, and my farm, which was on a plain, was covered in mud and debris. Many of my friends were also lost to the disaster. I was despondent for some time, but I worked together with 15 colleagues with the same passion for agriculture and we founded an agricultural cooperative in 2013. After the soil was desalinated, we began testing crops. Through trial and error such as losing all the lettuce crops, we planted green onion and succeeded in harvesting a crop of sweet and delicious plants. The Green Onion Festival celebrates the harvest, and it was lively with many guests. Going forward, we want to continue making the venture more profitable in order to increase employment and long-term residents of the area.



The Green Onion Festival (December 2016) lively with families

Supporting Affected Farmers from Their Perspective

Soon after the earthquake and tsunami, I set about volunteering to clear the mud and debris in the tsunami-affected areas. In April 2011, I launched a group with the students I had worked with at that time, and we began helping the disaster-affected farms rebuild. We brought on young volunteers from around the country and worked together. We aimed to look at things from the perspective of the disaster-affected people and to support their lives and livelihoods.



Tsuyoshi Hirose
ReRoots Foundation

Since farming has resumed, various programs like farm work, sale of crops, and events have allowed us to continue engaging with local residents towards reconstruction and vitalizing the region.



Harvesting plentiful crops from the disaster-affected agricultural land



Reconstructing damaged farmland and starting up rice production again



A new agricultural firm dedicated to growing vegetables in large greenhouses



The Sendai Agriculture and Horticulture Center restored after the tsunami

SENDAI INFORMATION

Restoration of Damaged Farmland



Farmland Development



Right of the road: farmland pre-development
Left of the road: rezoned larger farmland

Eastern Sendai's farmlands, which were struck by the tsunami, are pursuing increased productivity and more efficient management, with smaller farms congregating together to rezone into larger one hectare plots. In 2014, farming began in the rezoned areas.



Disaster Risk Reduction in Communities

Drawing on the lessons learned from the 1978 Miyagi Offshore Earthquake, Sendai has been continuing its efforts to foster the creation of volunteer disaster-prevention organizations to act as the core for mutual assistance in a disaster. Following the 2011 earthquake, while aid from public organizations was delayed and there were some limits to what could be done, a range of independent activities were carried out to meet demand, raising awareness of the importance of local disaster preparedness. After the disaster, training and support for the Sendai City Community Disaster Preparedness Leaders was pursued. This resulted in the development of operation manuals tailored to each evacuation center, taking the actual situations of each community into consideration.



An evacuation center opened in the gymnasium of an elementary school (March 2011)



The Sendai Station bus stop area filled with stranded commuters right after the earthquake



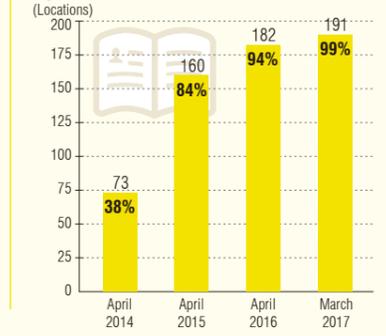
Sendai hosts workshops training Community Disaster Preparedness Leaders

SENDAI INFORMATION

Accumulative Community Disaster Preparedness Leaders



Evacuation Centers with Their Own Operation Manuals



¹ Stranded commuters: Workers, students, tourists, and other people stranded and unable to return to their homes after public transit facilities were halted following the disaster.

² Temporary stay locations: Sites used as temporary places for stranded commuters around the station. They also provide traffic information on how to get home. Twelve of these sites have been set up around Sendai Station after the Great East Japan Earthquake.

Leading Disaster Risk Reduction on a Community Level

I live in the Fukuzumimachi area, which was subject to flooding before. This led local residents to create an independent disaster preparedness manual and work with local organizations to hold drills. Thanks to these efforts, when the Great East Japan Earthquake struck, we were able to smoothly confirm the safety and whereabouts of elderly residents and other people needing care. After the earthquake, I took part in training courses put on by the City of Sendai, and now I am active as a Community Disaster Preparedness Leader. The disaster prevention and disaster risk reduction skills learned are put to use in operating the neighborhood association.



Collaborating with junior high schoolers on disaster prevention drills organized by the neighborhood association



Yukiko Ouchi
Sendai City Community Disaster Preparedness Leader

I believe that local safety is something residents are responsible for. To that end, interacting with others through local festivals and other events is important, as is conveying to children the importance of safe community building, both now and into the future.

Public and Private Sector Come Together for Measures Against Stranded Commuters¹

The Great East Japan Earthquake caused railroads and other public transportation to come to a halt, with JR Sendai Station being forced to close. The number of people who congregated at the station reached 11,000. The roads were overflowing with people, and the near by evacuation centers were also creating havoc. Based on this experience, in 2013 a council to plan measures against the possibility of stranded commuters in future disasters was launched.



Training held around Sendai Station had 350 participants based on a stranded commuter situation scenario.

This council consisted of the City of Sendai, railroad companies, businesses in local shopping arcades, universities, and other organizations and firms, twenty in total. A protocol for dealing with stranded commuters has been put in place, and temporary stay locations² have been secured within private sector buildings, with drills being held each year. Going forward, we want to get more collaborators and enhance our ability to cope with these cases.



Osamu Yokoyama
Council for Countermeasures for Stranded Commuters around Sendai Station



International Community

In Japan, where the majority of the population speaks Japanese, providing information and communicating with foreign people in the event of a disaster is a major issue. Multi-lingual disaster support centers were opened during the disaster, with radio stations and other networks used to send out multi-lingual information. At the same time, in evacuation centers, where people struggled to communicate with foreign people, the prepared multi-lingual sheets were not used effectively. Since the earthquake, based on the lessons learned from this experience, international students, universities and local communities have worked together to pursue a range of disaster prevention initiatives.



Explaining hazard maps to foreign people



Disaster prevention workshops for foreign people



Multi-lingual disaster prevention video: "It's an earthquake! What should we do?"

Distributing Disaster Information in Multiple Languages

For foreign people in Japan, obtaining accurate information at the time of a disaster can be difficult. Since 2005, Sendai FM Broadcasting has been working with the Sendai Tourism and Convention and International Association (SenTIA¹) to offer space on radio programs where foreign residents discuss their own experiences with the earthquake and with disaster prevention. Since we knew each other, when the earthquake occurred, SenTIA members fluent in other languages came to the studio right away to help us convey disaster-related information



Noriko Ishigaki
Sendai FM Broadcasting, Inc.

in English, Chinese, Korean, and easy Japanese. In this way, these day-to-day efforts helped in the actual event of a disaster. We plan to continue broadcasting the program.



Recording the program in March 2011

Disaster Prevention in a Multicultural Community



Hitoshi Konno
Katahira Area Community
Planning Group

The Katahira area is located close to the center of Sendai and is where many foreign people such as international students live. During the Great East Japan Earthquake, foreign people came to the evacuation centers, but differences in culture and customs caused some confusion with local residents. What we learned was the need to pursue mutual understanding and interaction on a daily basis in order to prepare for emergencies. Seeking to have international students more actively take part in the disaster prevention drills after the earthquake, we have them engage directly from planning the drills to distributing rice and food on the days of the drills. We would like to keep creating an environment that is open and fosters better communication between residents.



Foreign residents taking part in local disaster prevention drills

SENDAI INFORMATION

Foreign Residents in Sendai
(Population based on basic resident register)

11,582

Estimated Population of Sendai

1,080,263

(as of April 1, 2017)



Multi-lingual sheets prepared in evacuation centers



Disaster prevention pamphlets in 11 languages

¹ SenTIA: a public interest organization that supports foreign people, promotes international understanding, and organizes various tourism-related programming. It is engaged in the work introduced on pages 18 and 19.



Children

Large earthquakes occur every few decades in Sendai, so schools in the city had been closely working with the community since before this earthquake to carry out disaster prevention drills, which enabled the children to smoothly evacuate. Since the disaster, schools have been pursuing a higher level of disaster prevention education. In addition, as the living environment for children has changed dramatically since the earthquake, a range of support and other activities were needed.

The Mobile Playground that Tours Around the Affected Areas

Prior to the Great East Japan Earthquake, I worked in running the Adventure Playground at Kaigan Park, but the park was closed after sustaining damage in the tsunami. Feeling that the children needed a place to play freely to their heart's content, we visited about 20 affected areas with a colorful van loaded with a range of playground equipment. Through playing, the children heal their psychological trauma by themselves. Seeing the children roll mud, plane wood, roll around on the ground, and find new forms of play cheered up the adults, too.



Akio Nemoto

Adventure Playground
Sendai Miyagi Network

Outdoor playgrounds have the power to bring people together.



Children happily playing with water

Fostering the Ability to Think Independently and Make Decisions

Yuko Tsutsumi

Sendai City Education Center

We want to raise children who will act as upstanding citizens in the event of a disaster and are able to not only protect themselves, but aid in supporting others. After the disaster, we engaged in a series of talks with educators interested in the idea and created supplementary readers on disaster risk reduction. These readers are used at schools in the city to foster a deeper understanding in children on a range of issues, such as disaster risk reduction at home, the

history of disasters in the region, what meals to eat in the event of a disaster, and more. It is important that the experiences and lessons of the disaster not be lost and are passed down to the next generations.



Fifth-year elementary school students learn how to interpret weather reports and risk forecasts



A supplementary reader containing details on subjects such as disaster preparation and disaster prevention map creation



Elementary school children visit the area devastated by the tsunami.



Active discussion and learning about disaster risk reduction



Playground equipment for children donated from Finland

SENDAI INFORMATION

Homeland Reconstruction Project

Children at schools around the city worked together to invigorate the community by volunteering, creating slogans and posters, and crafting original songs to promote the reconstruction. Since 2011, the Tanabata Festival, a signature of summer in Sendai and held every August, has exhibited origami cranes folded by more than 80,000 local children every year, conveying their hopes for reconstruction and the future.



A song of reconstruction sung at the Tanabata Festival venue



Culture

People sustained considerable trauma from this unprecedented disaster, and they were doing all they could to bounce back. Amid such chaos, we realized that we need something other than safety, food, lodgings, and money in order to make their daily lives feel normal again. It was music, art, sports, and other cultural activities in various ways, helped to soothe souls and give them strength. This hardship served as an opportunity to take stock of how important these elements of culture are in our daily lives.



Photo: Katsuichi Ohazama



The Book Wagon, a mobile library, making the rounds of the temporary housing (2011–2012)



A chorus formed of disaster-affected persons has been active since 2013



People in affected areas were impassioned by the activity of the local soccer team (2012)

SENDAI INFORMATION

Art and Reconstruction



Over 100,000 people visited the special exhibition



Workshops for children by the Prices

The Price Collection: The Joy and Beauty of Edo Painting was held in 2013 at the Sendai City Museum. The Prices, American art collectors, are known for their collection of Edo-period Japanese art. They wanted to bring courage and motivation to the Tohoku region through the beauty of Edo paintings. The Prices visited the venue numerous times and interacted with museum visitors during the exhibition period.

Supporting through Music



Miya Ito
Center for Recovery through
the Power of Music, Tohoku

Two weeks after the earthquake, daily life was at a standstill. Everyone was full of anxiety. It was precisely then that the Center started its musical activities. At the time, the performers had questioned themselves about whether it might be too soon to be engaging in music, but we went forward with the plan out of the conviction that we wanted to support disaster-affected people. When performances began in the midst of towns still being rebuilt, the music stirred the hearts of many, unlocking the emotions they had bottled up within them. The concerts held at evacuation centers and temporary housing, as well as at Disaster Reconstruction Municipal Housing, numbered over 700. We hope to continue delivering music that brings cheer and vitality to the affected areas.



Memorial concerts for the disaster were held on the 11th of each month during 2016

Beloved Baseball Keeping the Spirit Up

The Okada Elementary School youth baseball team lost all of its equipment when it was washed away in the tsunami. We are deeply grateful to the groups and companies nationwide who supported us by donating equipment which allowed us to practice once again. Being able to get absorbed in baseball to forget the hardship proved a major help to both children and adults alike. Children who entered elementary school the same year as the earthquake have today graduated and are now in junior high schools. Looking back on these six years, our community supported each other immensely.



Baseball is popular among children in Japan, with many elementary schools having their own teams



Takayuki Kawashita
Shigeki Mikami (pictured at left)
Megumi Mikami (pictured at right)
Okada Elementary School Club



Passing Down and Sharing Experiences

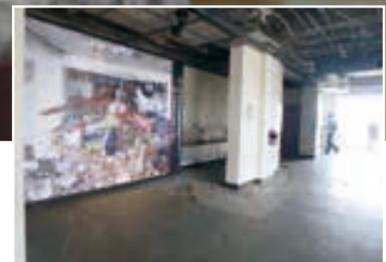
Sendai's plains area was hit by tsunami damage previously in 869 and 1611. Legends of tsunamis still remain at shrines in eastern Sendai, indicating that those who came before sought to share the history of disasters. Unfortunately, we were unable to fully make use of this knowledge in preparing for disasters in the present. To that end, we are engaging in a range of efforts to pass down our experiences and lessons learned, as well as to share information far and wide throughout Japan and the world to contribute to disaster prevention and risk reduction.



An exhibition on tsunami damage (tsunami remains courtesy of: MMIX Lab; video courtesy of: Hikaru Fujii)



Preservation of records about the disaster



Preservation and exhibition of disaster ruins



SENDAI INFORMATION

Legends of Tsunamis at Religious Facilities



Namiwake Shrine



Takoyakushi

Namiwake Shrine in the east of Sendai is where legend says that in a tsunami, a sea god riding a white horse parted the sea in two and stopped the tsunami. Takoyakushi in the south of Sendai is where legend says that in a flood, an octopus attached to Bhaisajya-guru was washed ashore.

Valuable Materials Linking People and Conveying the Experience of the Earthquake



Hideki Sakamoto (pictured at right)
Masami Sato (pictured at left)
20th Century Archive Sendai

Since 2009, we have been collecting old photographs and videos. Twelve days after the disaster, we drew on that experience to call on local residents on social media to contribute their own content and help us preserve the memory of the earthquake and tsunami at the grassroots level. The content we received included scattered debris and people eating by candlelight. This content was published online, through exhibitions, and in booklets. We also created a project that used footage we collected before the disaster to talk about memories. Seeing nostalgic footage, people opened up and spoke actively with each other. We would like to continue utilizing the strengths of the media we have collected to tie people together.



"Discussing the past society"
—fostering spontaneous interaction

The Disaster Ruins: A Message for the Future



Participants of the G7 Finance Ministers and Central Bank Governors' Meeting, Sendai (2016) visited Sendai Arahama Elementary School

Sendai Arahama Elementary School stands about 700 meters away from the coastline. I was an elementary schooler at the time and was at school when the earthquake struck. The tsunami which came after the enormous earthquake reached the second floor of the school building, but we quickly rushed to the top floor and escaped. The school building was the only high and durable building in the Arahama area, which meant the local residents also evacuated there. Amid uncertainty and cold, we supported each other and 320 of us survived, among them children, teachers, and local

residents. Our day-to-day training allowed for a smooth evacuation process. Today, the school ruins remain open as a means of preserving and exhibiting the damage of the earthquake. We truly want to convey our experiences and lessons we learned to the rest of the world in order to reduce the impact of disasters.

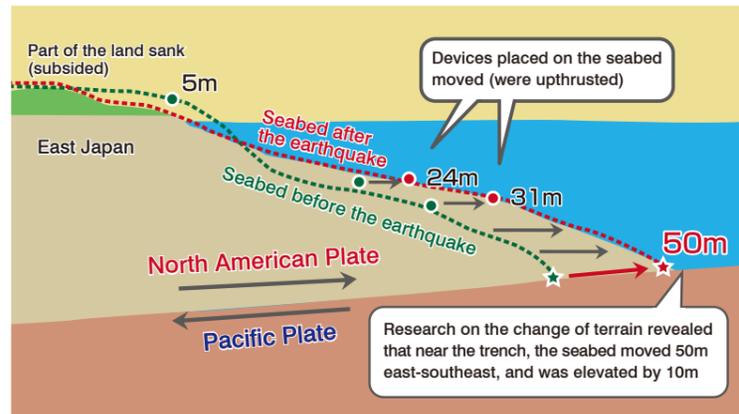


Koki Daigaku
Graduate of Sendai Arahama Elementary School (in sixth-year of elementary school at the time)

Mechanisms

Earthquake Generation

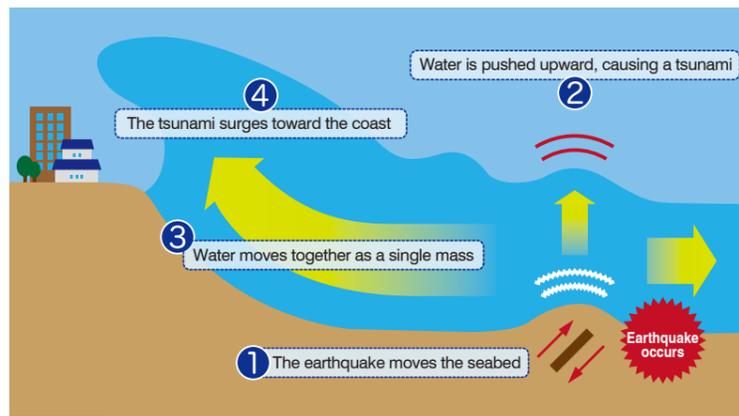
Every year, the tectonic plates covering the Earth move a few centimeters. Around Japan, when oceanic plates sink, inland plates are pulled under. When an inland plate cannot withstand this strain anymore, it springs back, causing an earthquake at the boundaries of the plates. Japan is subject to the complex movements of four plates—the Pacific Plate, Philippine Sea Plate, North American Plate, and Eurasian Plate, making it one of the world’s most active earthquake regions.



Tectonic plate movement in the main shock of the Great East Japan Earthquake by courtesy of JAMSTEC

Tsunami Generation

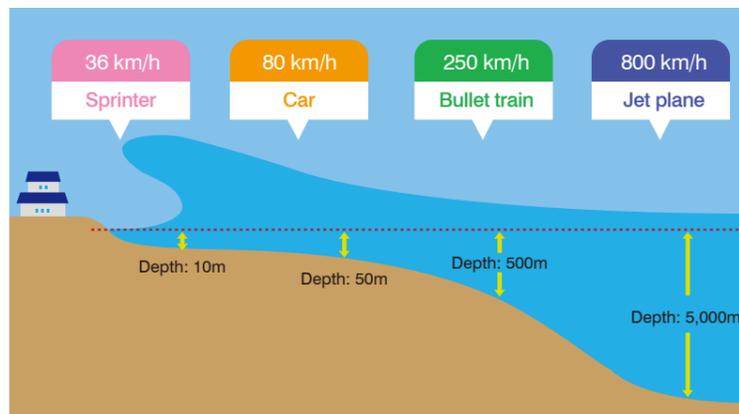
When a large earthquake occurs under the sea, the seabed is pushed up and then submerges. The sea level also changes accordingly, causing large waves to move in all directions. This is a tsunami. The commonly observed phenomenon of the tide drawing in before a tsunami is not one that is definite. There are cases where there is an initial large wave which reaches the coast without the tide receding.



Mechanisms of tsunamis, generation and propagation

Speed and Force of Tsunamis

The deeper the ocean, the faster the tsunami will travel. As the wave nears the shore, the subsequent waves catch up and amplify the wave height, increasing the wave force. In a tsunami, the waves become a single mass capable of sweeping away homes and vehicles.



Relationship between tsunami speed and water depth

Course of the Tsunami

How did the tsunami occur and travel during the 2011 Great East Japan Earthquake? Simulations conducted by the International Research Institute of Disaster Science (IRIDeS), Tohoku University are used to model the movement of the waves during the disaster (Simulations show the waves higher than their actual height).

Simulated images of the tsunami reaching the coastal regions of Tohoku

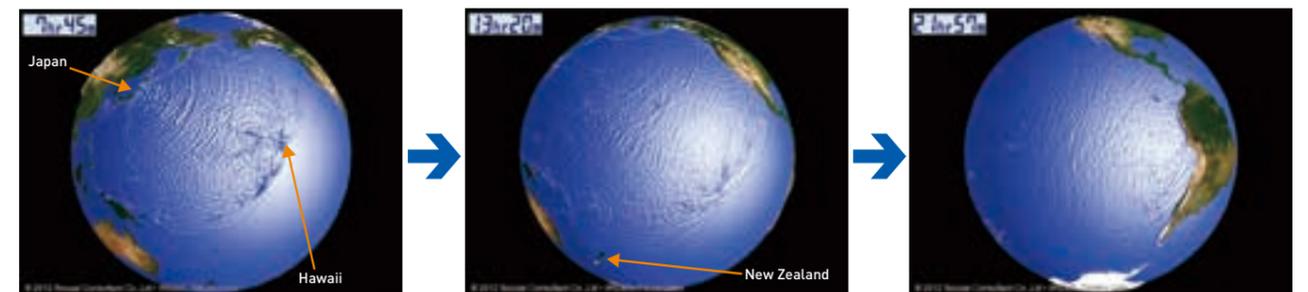


Approximately 20 minutes after the earthquake. The first large tsunami hit Japan.

Approximately 43 minutes after the earthquake. The large waves approached the coastline. The maximum estimated height was 16.7 meters.

Approximately 70 minutes after the earthquake. The estimated height of the tsunami in Sendai was about 7.1 meters. Not only around the coastline, but a wide area of the sea surface fluctuated, conveying the tsunami.

Simulated images of the tsunami traveling across the Pacific Ocean



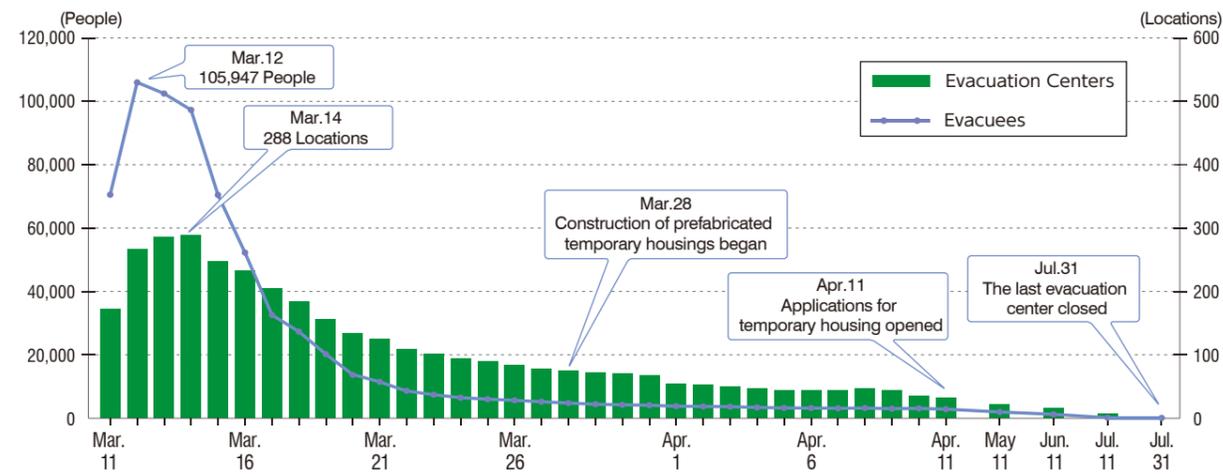
Approximately 7 hours and 45 minutes after the earthquake. The tsunami had reached as far as Hawaii.

Approximately 13 hours and 20 minutes after the earthquake. The tsunami had reached as far as New Zealand.

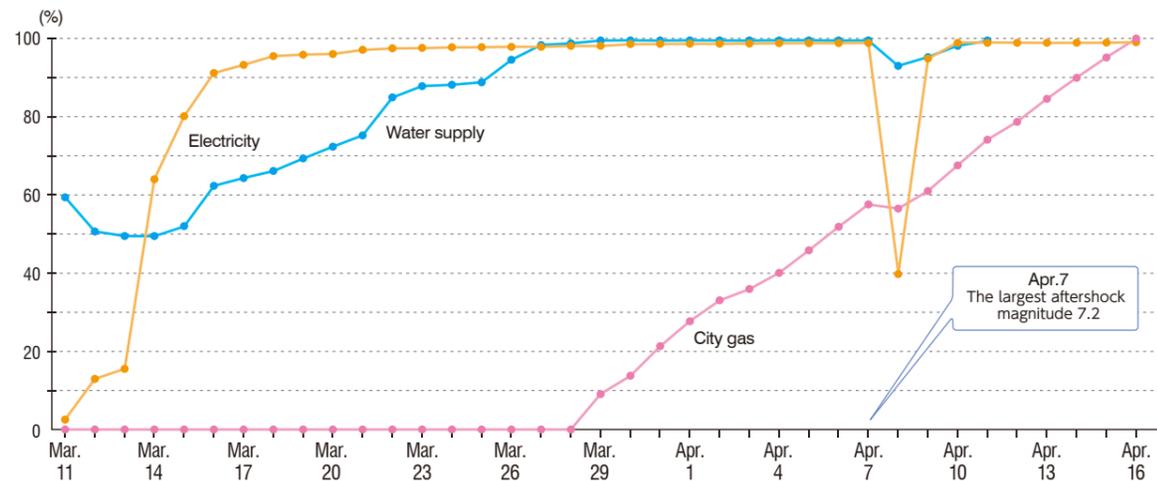
Approximately 22 hours after the earthquake. The tsunami had reached the southern tip of the South American continent.

Data

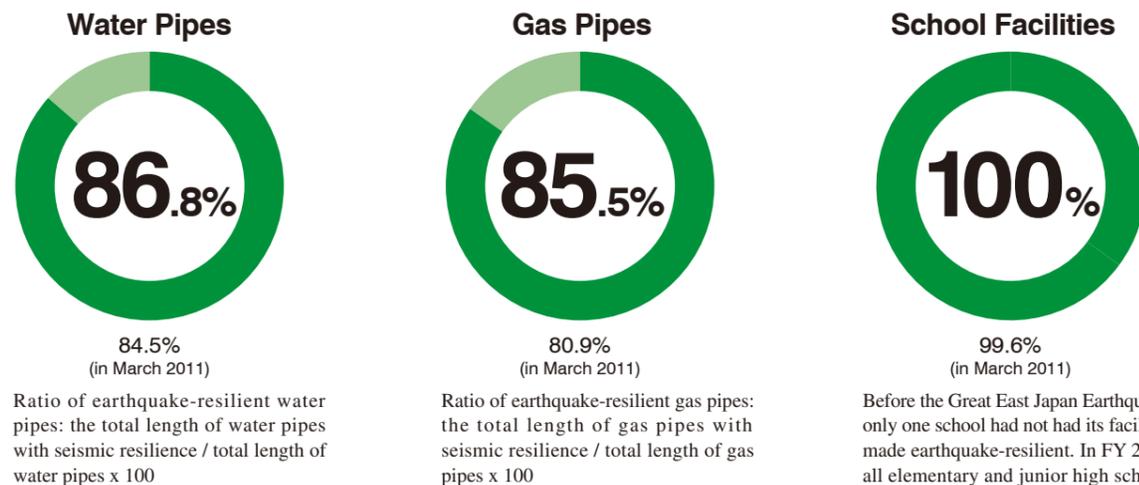
Evacuees and Evacuation Centers (2011)



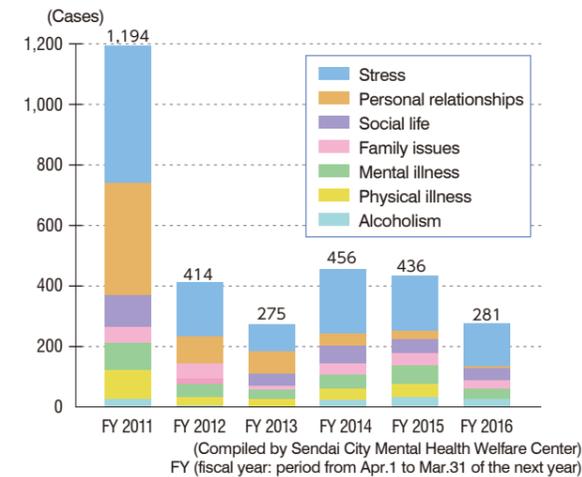
Ratio of Recovery of Essential Utilities (2011)



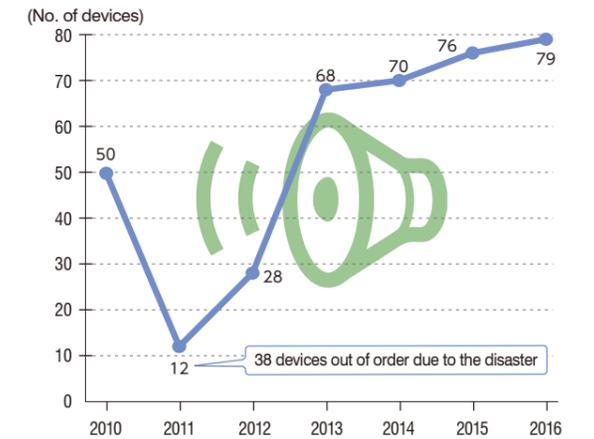
Ratio of Earthquake-resistant Pipes and School Facilities (in March 2017)



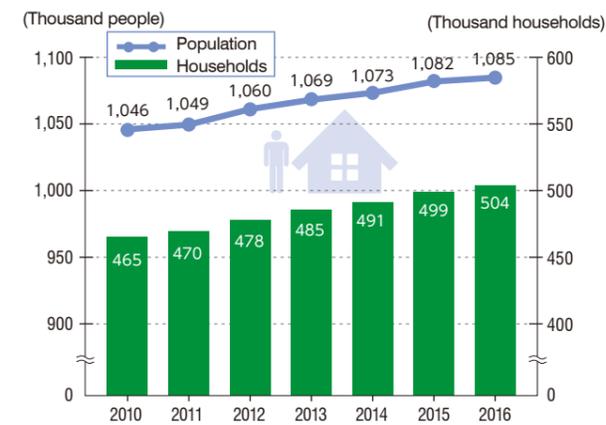
Breakdown of Counseling Related to the Disaster



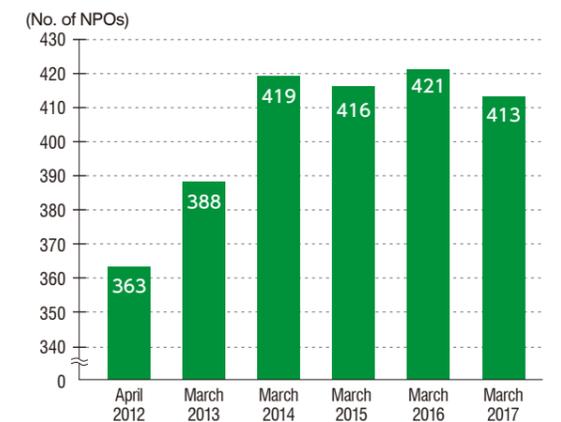
Tsunami Information Transmission System Outdoor Loudspeakers (at March 31 of every year)



Estimated Population of Sendai (at October 1 of every year)



NPOs (Registered in Sendai)



Donations Raised by Sendai, the City of Trees Kizuna Donation Campaign



Processing of Debris



Trees Planted by Citizens in the Eastern Coastal Area



(Processing completed in December 2013)

(in March 2017)

Before the Great East Japan Earthquake, only one school had not had its facilities made earthquake-resistant. In FY 2011, all elementary and junior high schools in Sendai completed their reinforcements against earthquakes.

Chronology

2011

- March 11 Great East Japan Earthquake (magnitude 9.0) struck, and tsunami hit the area
Evacuation centers opened
- March 15 Disaster Volunteer Centers opened (until Aug.10)
- March 28 Construction of prefabricated temporary housing began
- April 1 Sendai City Basic Policy for Earthquake Disaster Reconstruction announced
- April 7 Largest aftershock struck (magnitude 7.2)
- April 11 Applications for primary recruitment of emergency temporary housing opened
- April 16 Gas utilities fully recovered (excluding evacuation advisory areas, etc.)
- April 22 Tsunami-flooded residential area debris removal began (tsunami-flooded eastern area)
- May 23 Applications accepted for demolition and removal of destroyed houses
- May 30 Sendai City Earthquake Disaster Reconstruction Vision formulated
- June 1 Reception of personnel from local governments nationwide on long-term assignment began
- June 12 Opinions exchanged on reconstruction and community building (seven meetings through Jun.26)
- June 15 All 1,505 prefabricated temporary housing units completed
- July 11 Great East Japan Earthquake Memorial Service held in Sendai
- July 16 Tohoku Rokkon Festival held in Sendai (until Jul.17)
- July 31 Debris removal in tsunami-flooded residential area completed (tsunami-flooded eastern area)
All evacuation centers in Sendai closed
- October 1 Debris incineration began with temporary incinerators
- November 30 Sendai City Earthquake Disaster Reconstruction Plan formulated
- December 16 Disaster Risk Areas designated (tsunami-flooded eastern area)
- December 17 Briefing sessions began for the Disaster Prevention Collective Relocation Promotion Project (until Dec.26, tsunami-flooded eastern area)
- December 28 Debris removal in farmland completed (tsunami-flooded eastern area)



2012

- January 10 Consultation desk for recovery in affected inland hilly residential areas opened
- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- April 1 Sendai City Post-Disaster Reconstruction Bureau established
- May Farming restarts on farmlands where recovery work and desalination was completed
- June 5 Applications accepted for residential reconstruction aid for eastern Sendai (tsunami-flooded eastern area)
- September 3 Minami-Gamo Wastewater Treatment Plant repairs began (groundbreaking ceremony)
- October 10 Elevated road project started on Shiogama-Watari Prefectural Road
- November 11 Applications accepted for residential areas for Disaster Prevention Collective Relocation (tsunami-flooded eastern area)
- December 21 Applications accepted for 12 units in first Disaster Reconstruction Municipal Housing

2013

- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- April 1 Sendai City Regional Disaster Prevention Plan revised (general information, earthquake and tsunami measures)
- September 17 Applications accepted for 661 units in Disaster Reconstruction Municipal Housing
- September 29 Debris (combustible) incineration completed
- October 25 National Eastern Sendai Land Improvement Project (farmland development) groundbreaking ceremony
- December 27 Debris treatment and disposal completed

2014

- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- March 16 Road elevation work on Shiogama-Watari Prefectural Road began
- March 31 Program for the Rebuilding of Disaster Victims' Lives formulated
Reception of personnel on long-term assignment ended
- May 10 Applications accepted for residential land in seven areas for Disaster Prevention Collective Relocation (tsunami-flooded eastern area)
- July 10 Applications accepted for 2,447 units in Disaster Reconstruction Municipal Housing
- November 18 Damage recovery work began in Kaigan Park



2015

- February 14 Construction completed on the first Tsunami Evacuation Tower
- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- March 14 The Third UN World Conference on Disaster Risk Reduction took place in Sendai (until Mar.18, adaptation of Sendai Framework for Disaster Risk Reduction 2015-2030)
- March 23 Program for the Speedy Rebuilding of Disaster Victims' Lives formulated
- March 26 Residential land for seven areas of Disaster Prevention Collective Relocation Land Handing-Over Ceremony and all residential land completed (tsunami-flooded eastern area)
- August 10 Northern Gamo Disaster-Affected Area Urban Redevelopment Project started (tsunami-flooded eastern area)
- August 12 Construction started on Kaigan Park Evacuation Hill
- December 6 Sendai Subway Tozai Line began operation



2016

- February 3 Concept for use of land after collective relocation announced (tsunami-flooded eastern area)
- February 13 Sendai 3/11 Memorial Community Center fully opened
- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- March 12 2016 Sendai Symposium for Disaster Risk Reduction and the Future held
- March 31 Sendai City Post-Disaster Reconstruction Bureau closed in connection with the end of the Sendai City Earthquake Disaster Reconstruction Plan
- April 1 Minami-Gamo Wastewater Treatment Plant repairs fully completed
Agriculture and Horticulture Center is renovated and reopened
- April 19 Open call for ideas for use of land after collective relocation began (tsunami-flooded eastern area)
- May 20 G7 Finance Ministers and Central Bank Governors' Meeting, Sendai held (until May 21)
- June 30 All 3,206 houses for Disaster Reconstruction Municipal Housing completed
- September 20 Construction began to preserve the Disaster Ruins of Sendai Arahama Elementary School
- September 30 Four Kaigan Park Evacuation Hills completed
- October 15 Part of Kaigan Park reopened for use
- October 28 Provision of prefabricated temporary housing completed

2017

- March 11 Great East Japan Earthquake Memorial Service held in Sendai
- March 12 2017 Sendai Symposium for Disaster Risk Reduction and the Future held
- March 28 All 13 Tsunami Evacuation Facilities completed
- March 31 Provision of temporary housing for disaster-affected households in Sendai completed
- April 30 Disaster Ruins of Sendai Arahama Elementary School opened to the public
- June 10 Tohoku Kizuna Festival held in Sendai (until Jun.11)

