



仙台市

SENDAI CITY

杜の都

# Sendai

“Disaster-Resilient and Environmentally-Friendly City”

## Bosai & Beyond: Building Disaster Resilient Cities

- Overview of the City of Sendai
- Footsteps after the Great East Japan Earthquake
- Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City
- Urban development towards 2030

February 2022

# 1 Overview of the City of Sendai

- A city with a population of approx. 1.09 million
- Called the “City of Trees”
- Massively damaged by the GEJE on March 11, 2011
- Host city for “The 3rd UN World Conference on Disaster Risk Reduction (WCDRR)” held on March 2015
- Promote efforts to disseminate the “Sendai Framework for DRR 2015-2030” to citizens and build a “Disaster-Resilient and Environmentally-Friendly City”



“Jozenji-dori Avenue,” a symbolic road of the City of Trees



“The 3rd WCDRR”

## 2 Footsteps after the Great East Japan Earthquake (Lessons Learned)

**Lessons Learned** “Preparedness” leads to **minimization of damage and early recovery and reconstruction**

### Utilities and related matters

#### Preparedness of water supply facilities

**Seismic resistance rate of water pipes** • • • **84.5%** (AS OF MARCH 2010)

**Multiple water sources systems**

**Zoning of water distribution areas**

➡ **18 days**, except for areas affected by the tsunami and landslides (1 month for full restoration)

#### Preparedness of gas facilities

**Seismic resistance rate of gas pipes** • • • **80.9%** (AS OF MARCH 2010)

**Duplex supply lines**

**Zoning of gas distribution network**

➡ **Early recovery in about 1 month**

## 2 Footsteps after the Great East Japan Earthquake (Lessons Learned)

### Constructions/Houses and Buildings

Seismic retrofitting of roads

Seismic resistant rate of Bridges

• • • **85.5%** (AS OF DECEMBER 2010)



**No massive damage excluding that caused by tsunami  
Quick restoration of emergency transportation roads or bus routes, etc.**

Seismic retrofitting of buildings

Seismic resistant rate of Housing

• • • **83.0%** (AS OF OCTOBER 2003)

Seismic resistant rate of private sector designated buildings

• • • **84.0%** (AS OF MARCH 2007)



**Only a few cases of building destruction except areas devastated by tsunami or landslide**

Seismic retrofitting of school facilities

Percentage of buildings that have been made earthquake-resistant

• • • **99.6%** (AS OF APRIL 2010)  
(ordinance-designated-city average **79.3%**)



**Zero children/student death under school management**



## 2 Footsteps after the Great East Japan Earthquake (The 3rd WCDRR and the Sendai Framework for DRR 2015-2030)

- 6,500 participants from 185 countries
- Presented the recovery status of the Great East Japan Earthquake
- Adopted Sendai Framework for Disaster Risk Reduction (2015-2030)



## 2 Footsteps after the Great East Japan Earthquake (Outcome / Challenges from the WCDRR)

Adoption of Sendai Framework  
(2015-2030)

- ① Presenting new ideas such as **“Build Back Better”** in the recovery process (※)
- ② Clarify the **participation and involvement of various actors (multi-stakeholders)**

※ The idea is to not only restore the area to its pre-disaster state, but also to improve it in preparation for the next disaster.



**Foundation of the Disaster-Resilient and  
Environmentally-Friendly City**

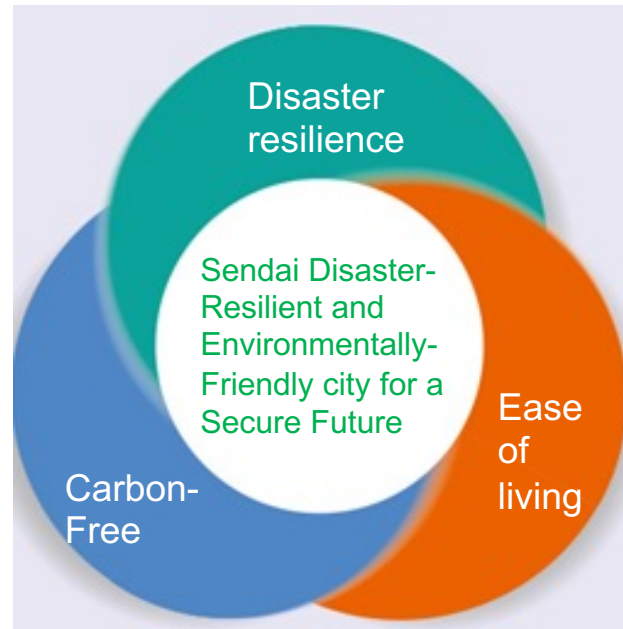
# 3 Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City

## Background

History of Environment Building in the "City of Trees"

Experiences and Lessons of Major Earthquakes and the Earthquake Disaster Reconstruction Plan

UN World Conference on Disaster Risk Reduction and the adoption of the Sendai Framework for DRR, etc.



## Measures

DRR and environment-focused city planning

DRR and environment-focused "human capacity building"

Passing down experiences and lessons

Disaster Recovery Efforts

# 3 Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City

## Strengthening utility infrastructure

### ■ Enhanced DRR and environmental friendliness



## Energy efficiency measures at designated shelters

### ■ Installation of disaster resilient solar panels



DRR and environment-focused city planning

## Tsunami DRR

### ■ Multiple defenses

(Take from the roof of Sendai Arahama Elementary School: Ruins of the GEJE)





# 3 Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City (Example of urban development①)

## Minami-Gamo Wastewater Treatment Plant

- Facility facing the pacific ocean
- Completely destroyed by the tsunami
- The natural flow function continues

**Functional Restoration**, rather than restoration of original infrastructure

Restoration of the damaged water treatment facilities by making them **multi-storied** and more **compact**

### Effect

#### Cost Reduction

Reduced by JPY 27 billion (30%)

#### Shorter construction period

Shortening of 9 months (55 mo. → 46 mo.)

#### Improved Disaster Prevention

- Tsunami safety measures through three-dimensional design
- Secure natural flow of water in case of emergency

#### Environmental Improvement

- Solar power generation
- Small-scale hydroelectric power generation incorporating the difference in elevation between facilities

(March 11, 2011)



(March 2016. Restoration work completed)





### 3 Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City (Example of urban development②)

#### Installation of Photovoltaic System for Disaster Prevention

- Fuel outages due to disaster occurrence
- Interruption of Power Supply Affecting Management of Evacuation Center, etc.



Secure power supply during disasters and reduce CO2 during normal times

System image

Solar panels



Lights

Storage battery

TV

Outlet

Radio

Installed at 198 Designated Evacuation Centers

# 3 Restoration/Reconstruction towards a Disaster-Resilient and Environmentally-Friendly City (Example of urban development③)

“Multiple Defenses” to prepare for the largest scale tsunami similar to the GEJE

Once-in-decades to once-in-centuries (tsunami)

GEJE-scale tsunami

- Defenses by development of coastal/river levees
- Reduction by several facilities such as the “Elevated Road”
- Measures to “Evacuate”

Shelter



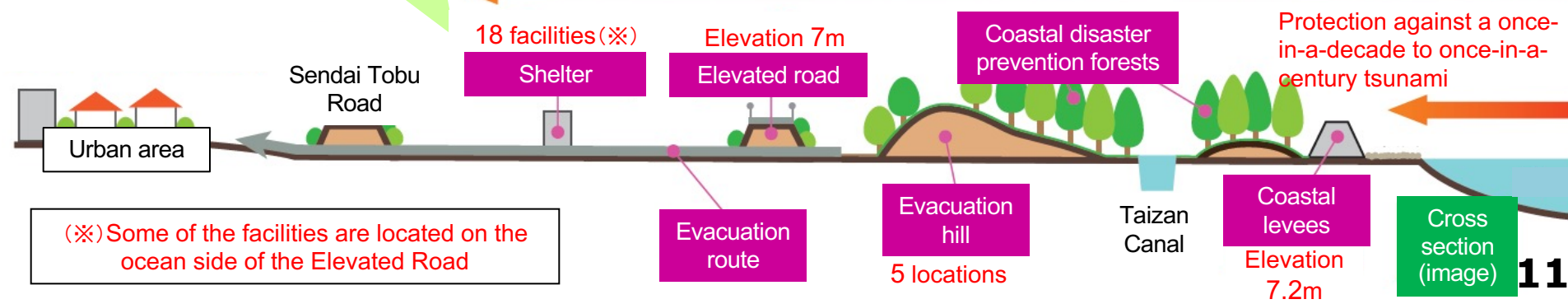
Shiogama Watari Prefectural Road (Elevated road)



Coastal levees



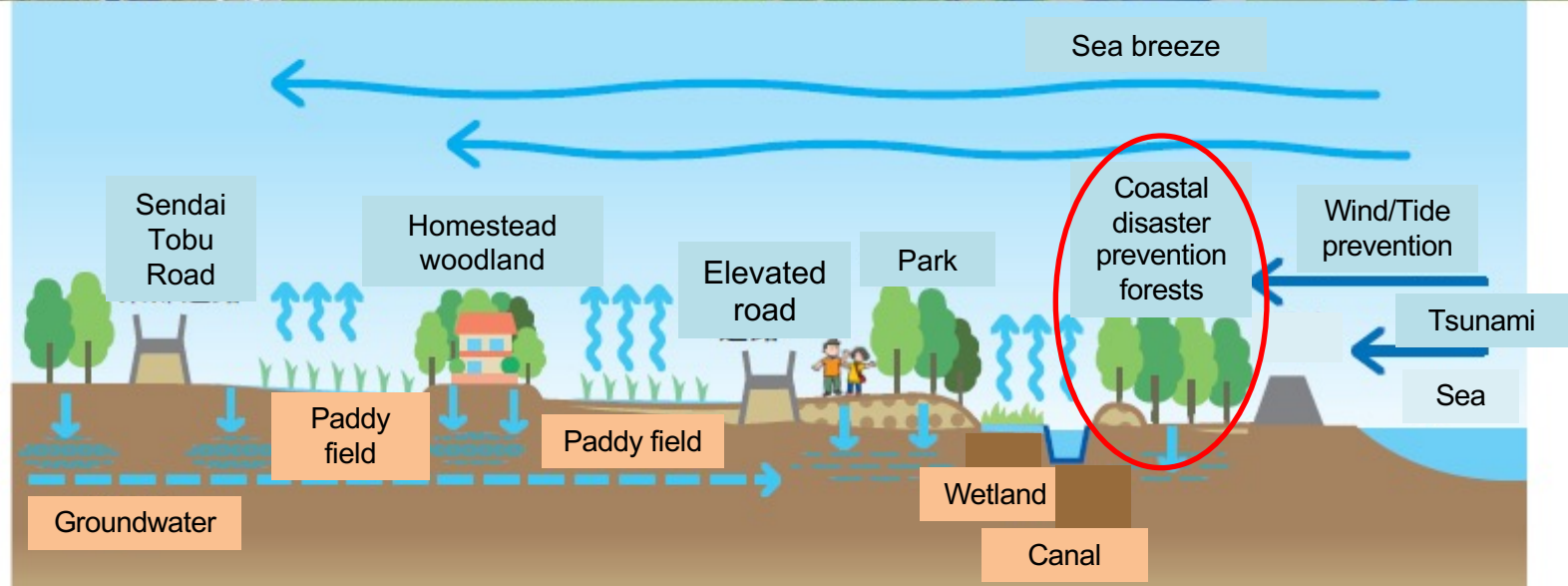
Protection against tsunamis in the largest category



# 4 Urban development towards 2030

## Sustainable urban development being harmonized with nature : Example ①

### Paddy field and farmland / Coast

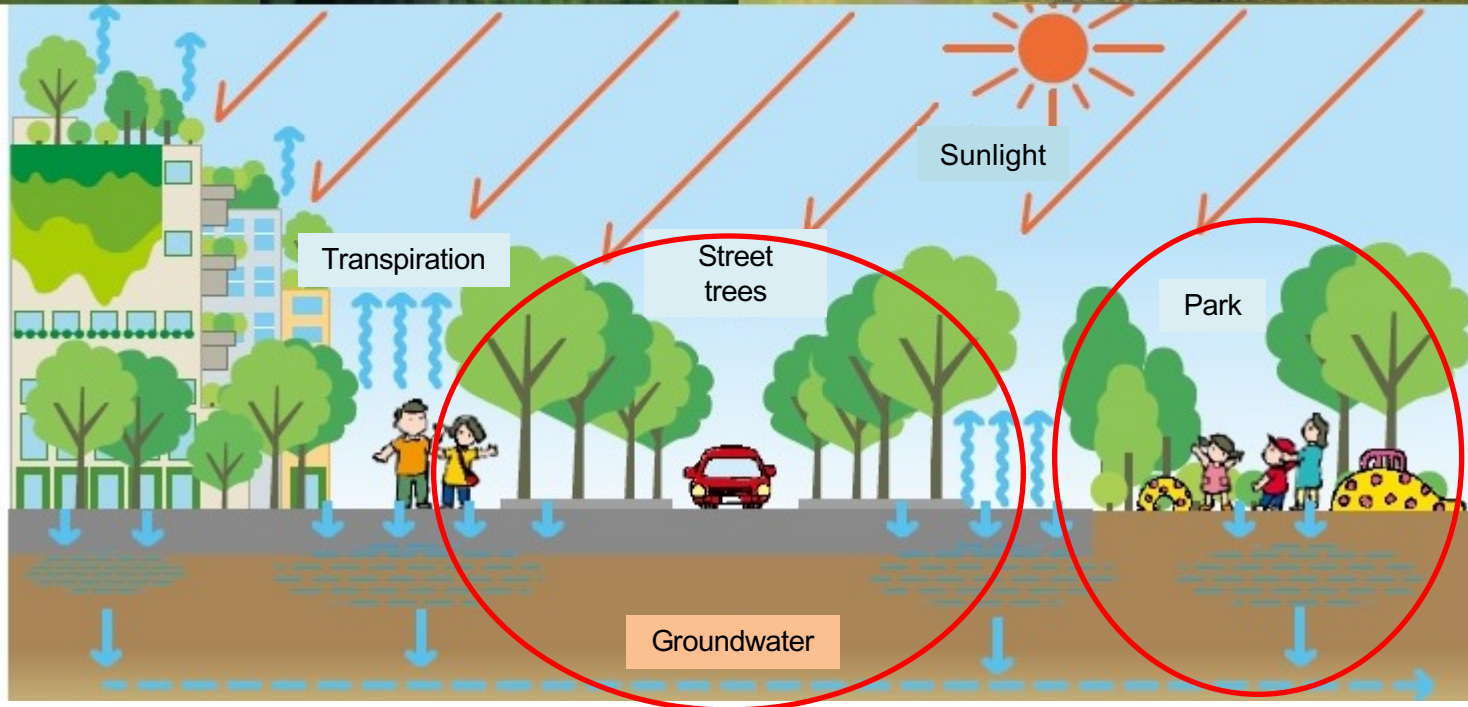




# 4 Urban development towards 2030

## Sustainable urban development being harmonized with nature : Example ②

### Urban area (Downtown)



# 4 Urban development towards 2030

## Green Infrastructure of the “City of Trees”

Satoyama landscape (area with various types of ecosystems and farmland, etc.)



Urban area



Downtown



Rivers



Paddy field and farmland / Coast



➤ Improve “**Green Infrastructure**,” which builds a living foundation using various functions of nature, and respond to **risks of climate**



# Conclusion

- ✓ **City Planning** that incorporates “Build Back Better”, with DRR and environmental consideration
- ✓ **Human Capacity Building** that supports Community Disaster Management
- ✓ **Passing down** experiences and lessons learned to the world and to the future

**“Building a Comfortable and Disaster-Resilient City”**

**“Contributing to save **lives, livelihoods, and economies** for everyone”**



**Further **challenges** as the  
Disaster-Resilient and  
Environmentally-Friendly City**

