

# Housing Recovery Six Years after the 2011 Great East Japan Earthquake



Liz Maly  
IRIDeS, Tohoku University  
APRU Summer School 7.18.2017



# Outline

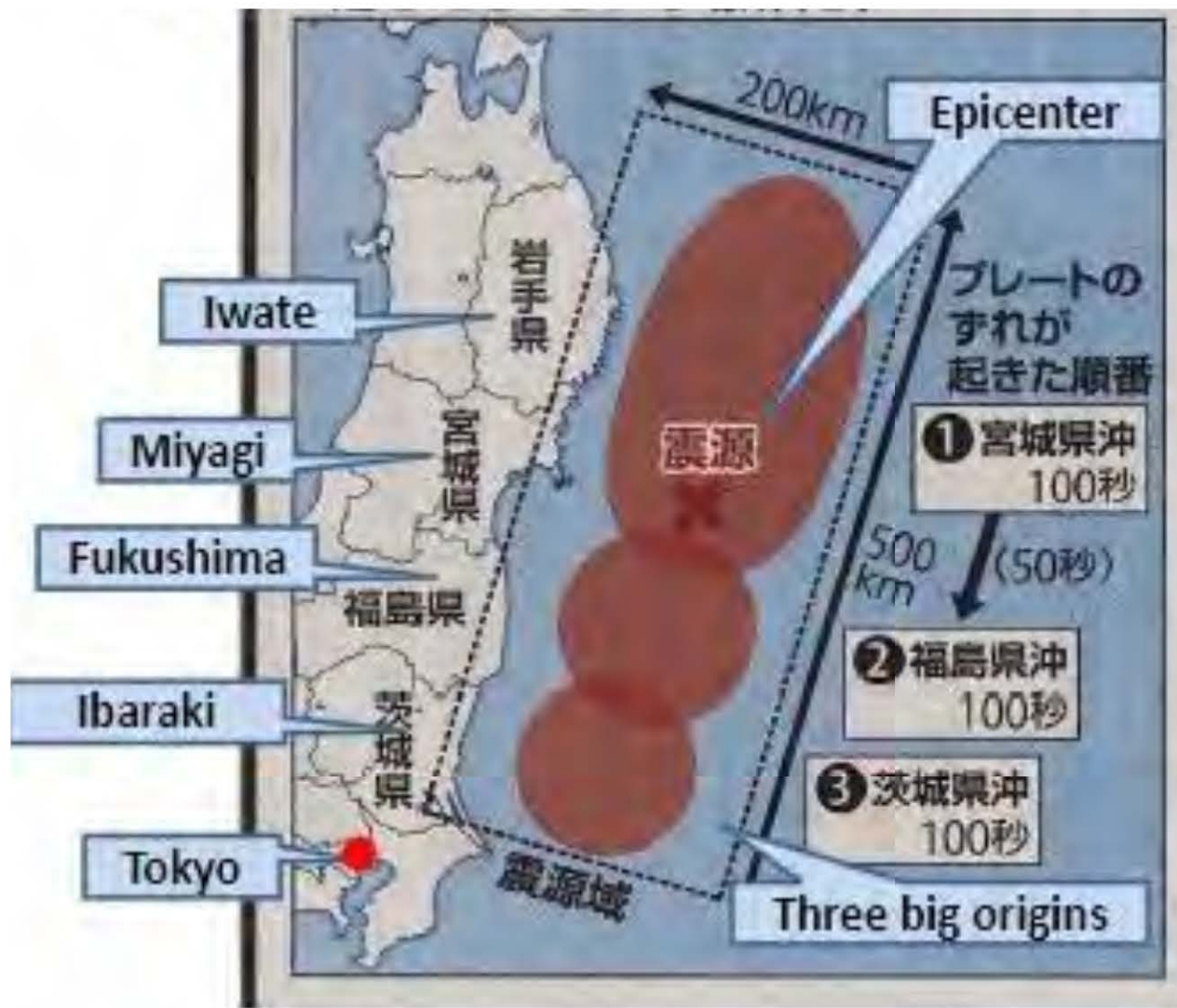
- 1) 3.11/Great East Japan Earthquake and Tsunami/  
Tohoku triple disaster
- 2) 3 contexts: society, geography, disaster history
- 3) Community and Housing Recovery

# 2:46 pm, March 11, 2011

- 9.0 magnitude earthquake
- tsunami-40 meters run up
- fires
- nuclear accident



# Massive damage, vast/varied affected area

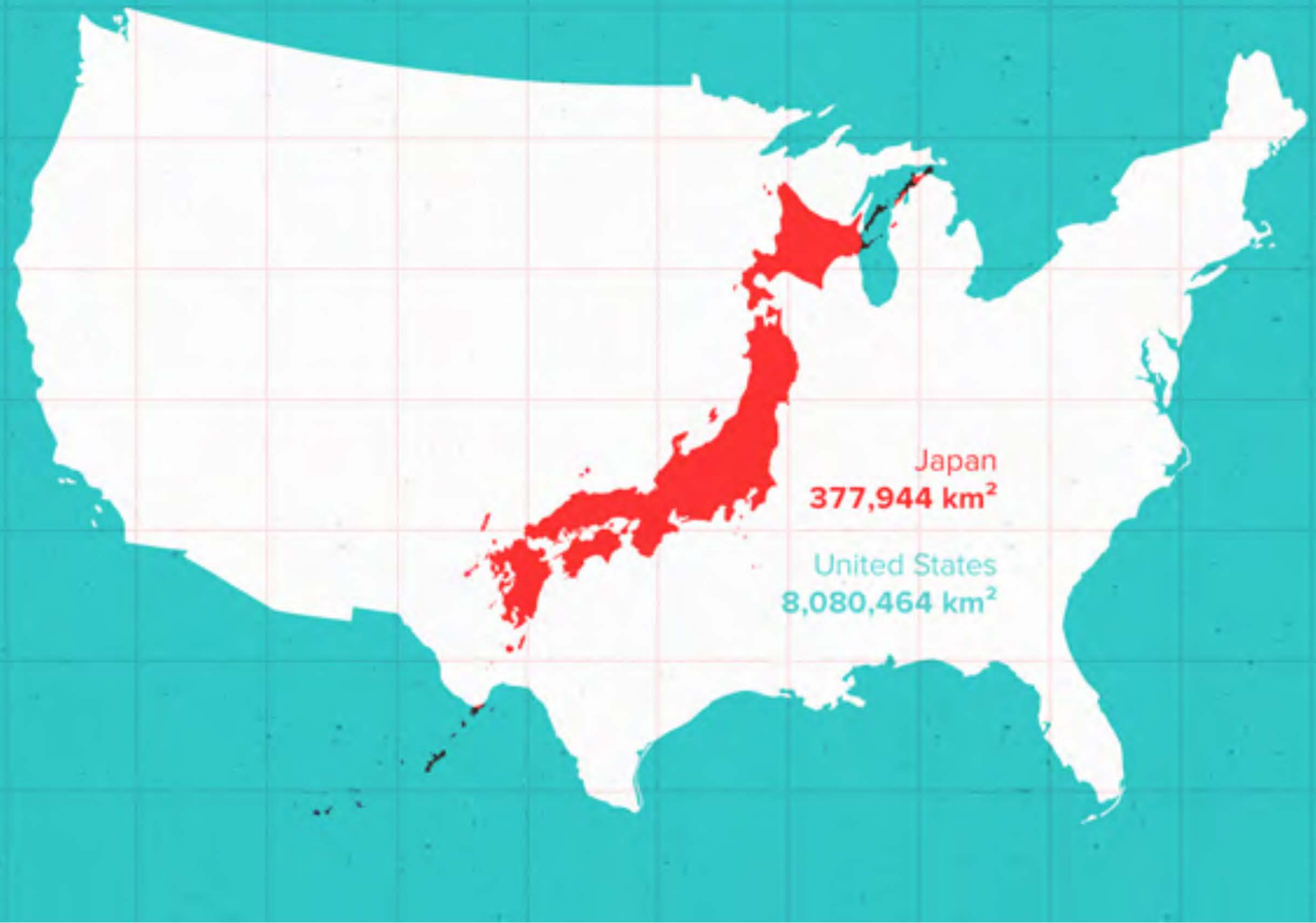


Yomiuri Shinbun ©

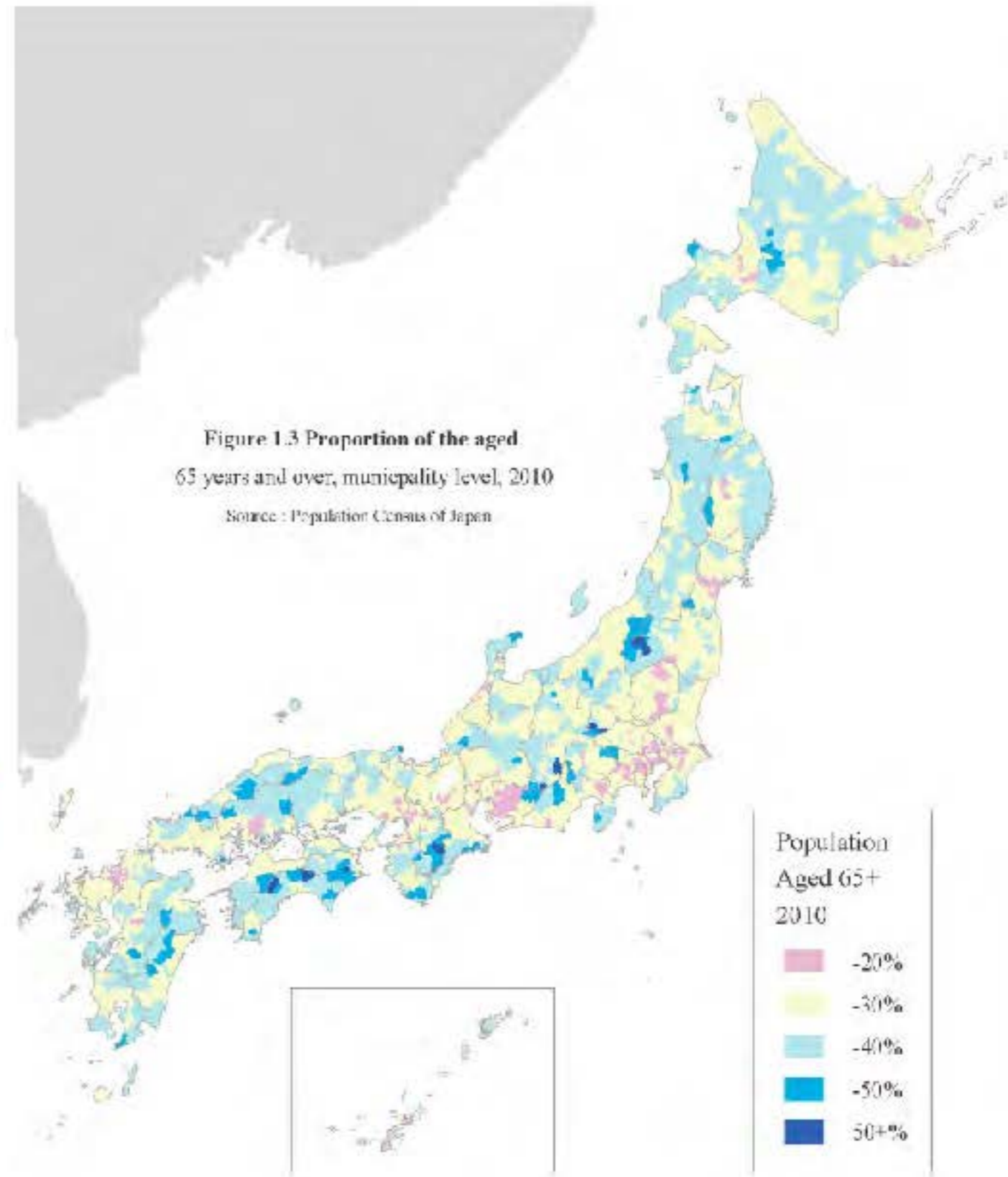
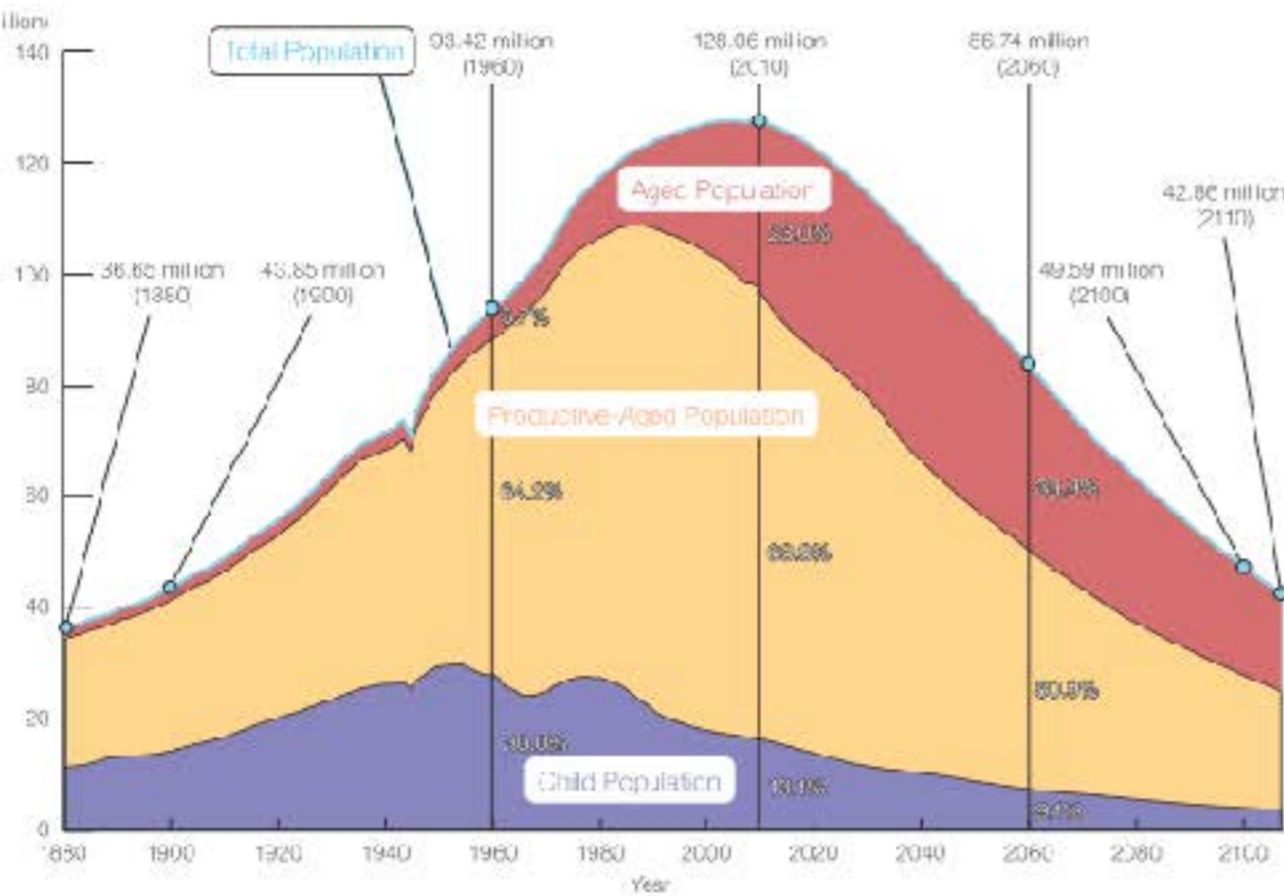


- 20,000 deaths
- 561 square kilometers inundated by tsunami
- 129,000 houses totally damaged
- at the peak, there were 470,000 evacuees, over 350,000 evacuees (in March 2011)
- now in May 2017, more than 97,000 people still living in evacuation/displacement

# Size comparison of Japan and the contiguous United States



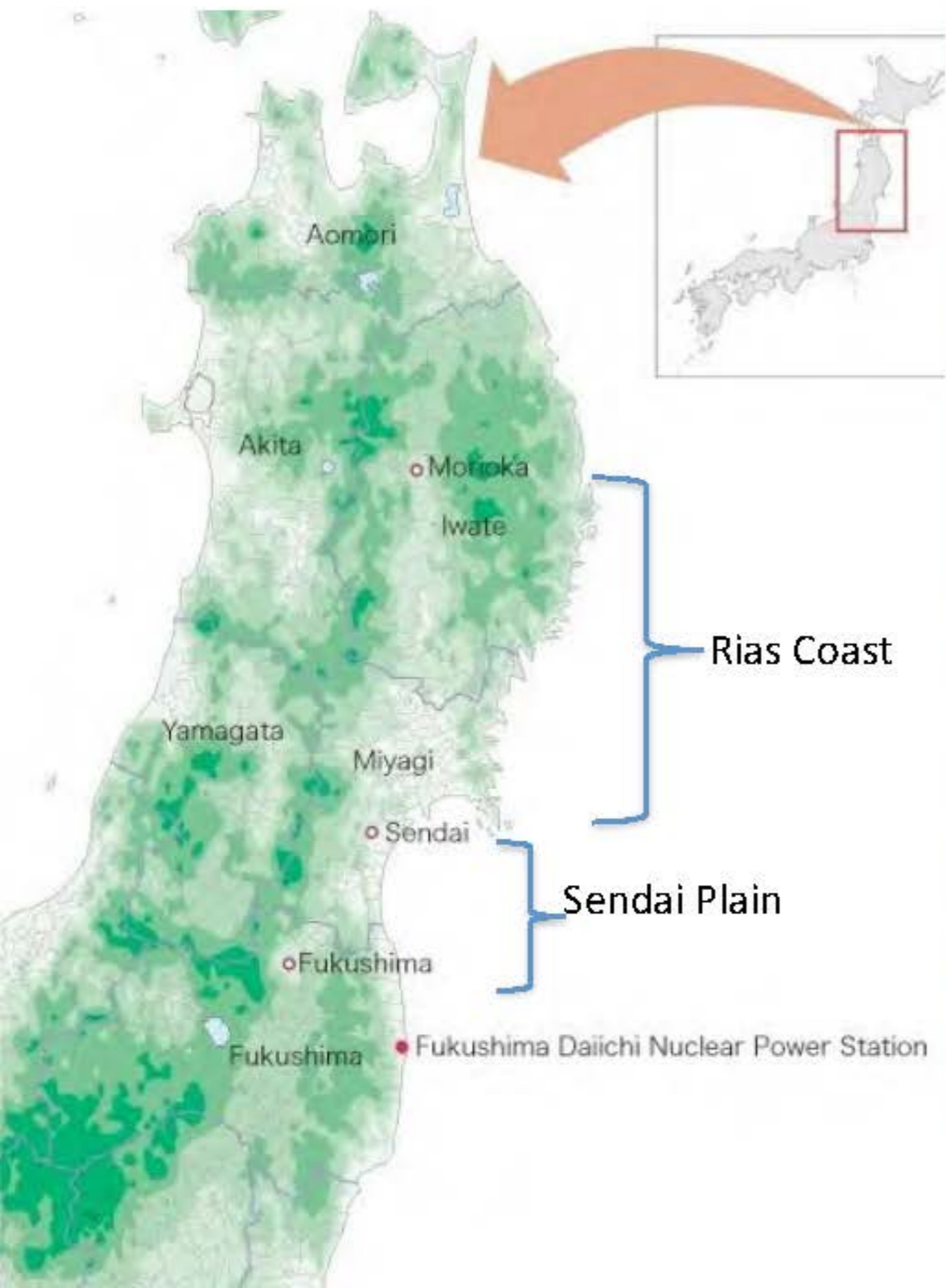
# Social context of 3.1 1: aging society



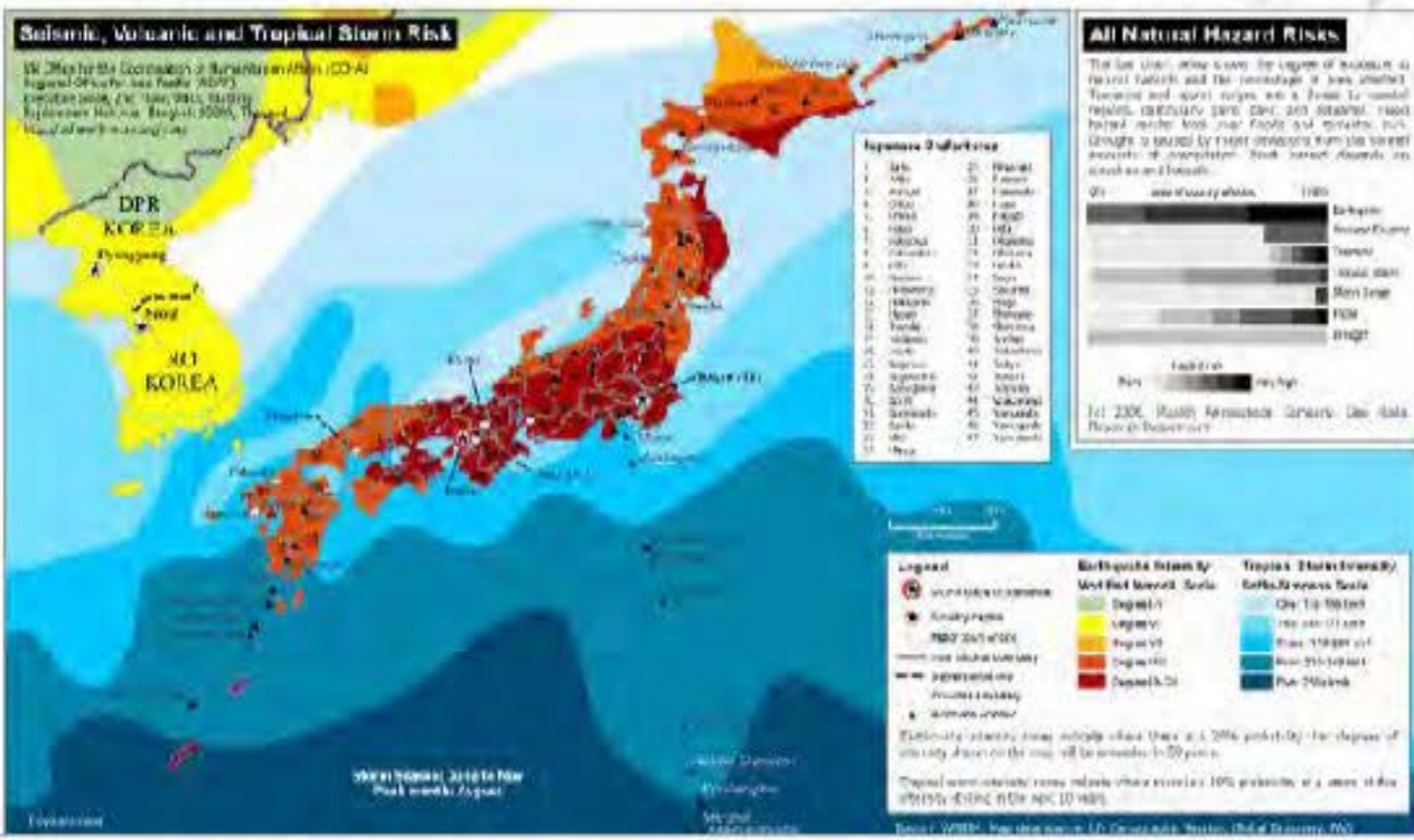
National Institute of Population and Social Security Research  
<http://www.ipss.go.jp/pr-ad/e/eng/03.html>  
 Sources: Population Estimates by the former Statistics Bureau, "Population Census of Japan", "Population Estimates", by Statistics Bureau, Population Projections for Japan: 2011-2060 (Medium Variant)

<http://www.ipss.go.jp/s-info/e/ssj2014/001.html>

# Geographic context of Tohoku, area affected by 3.11

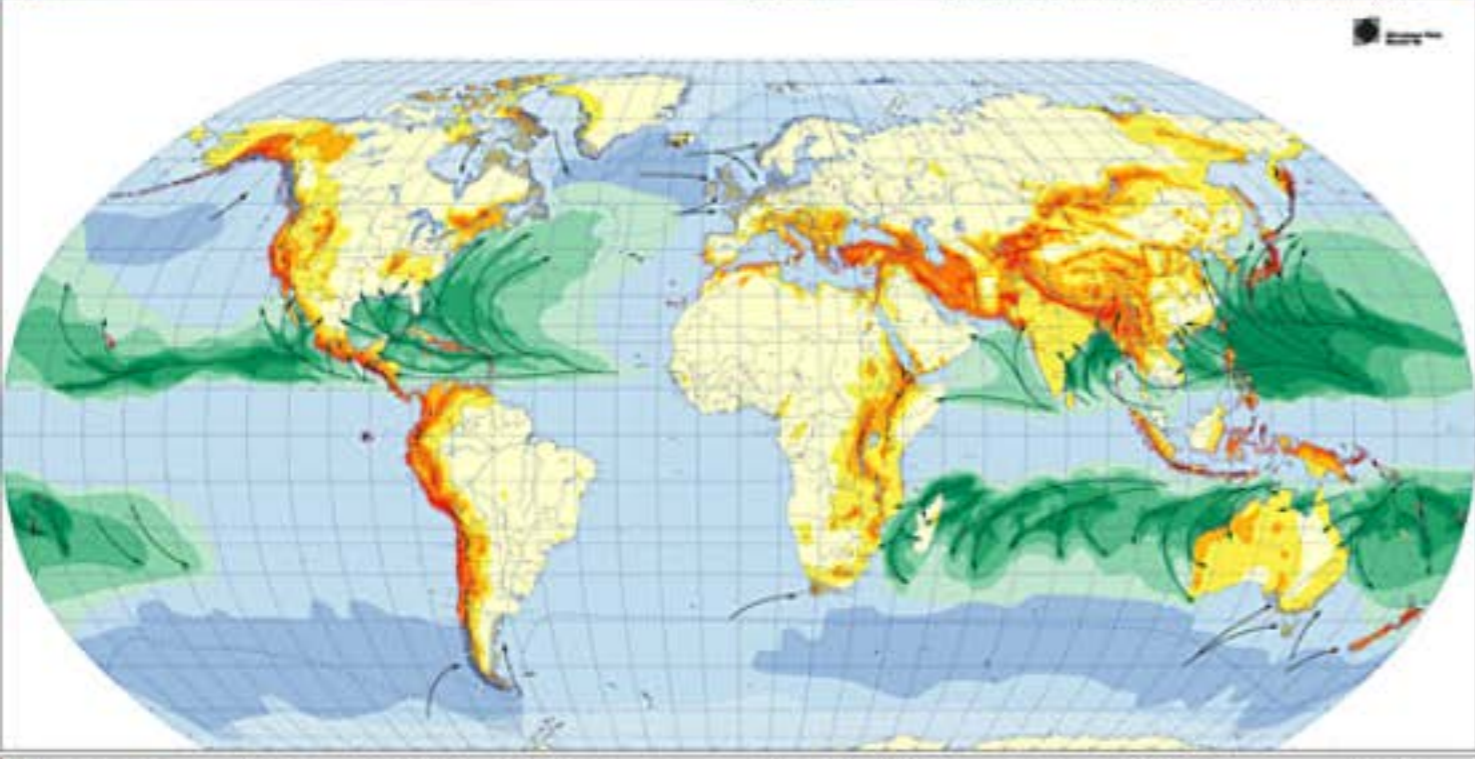


Source: Mainichi Shinbun,  
<http://mainichi.jp/graphs/20160311/hpj/00m/040/002000g/12>



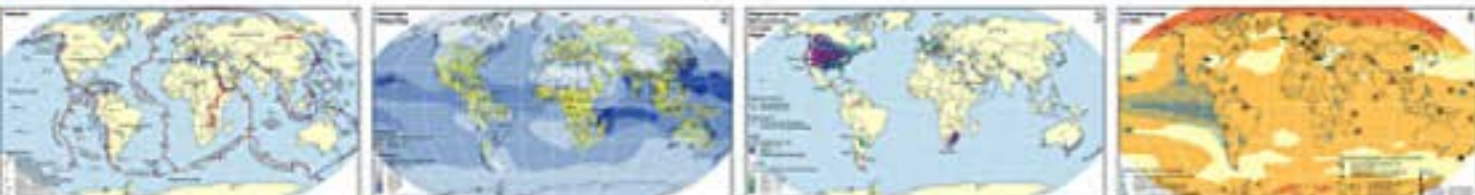
# Disaster risk and policy context

Japan has high risk for various natural disasters, and has experienced many disasters



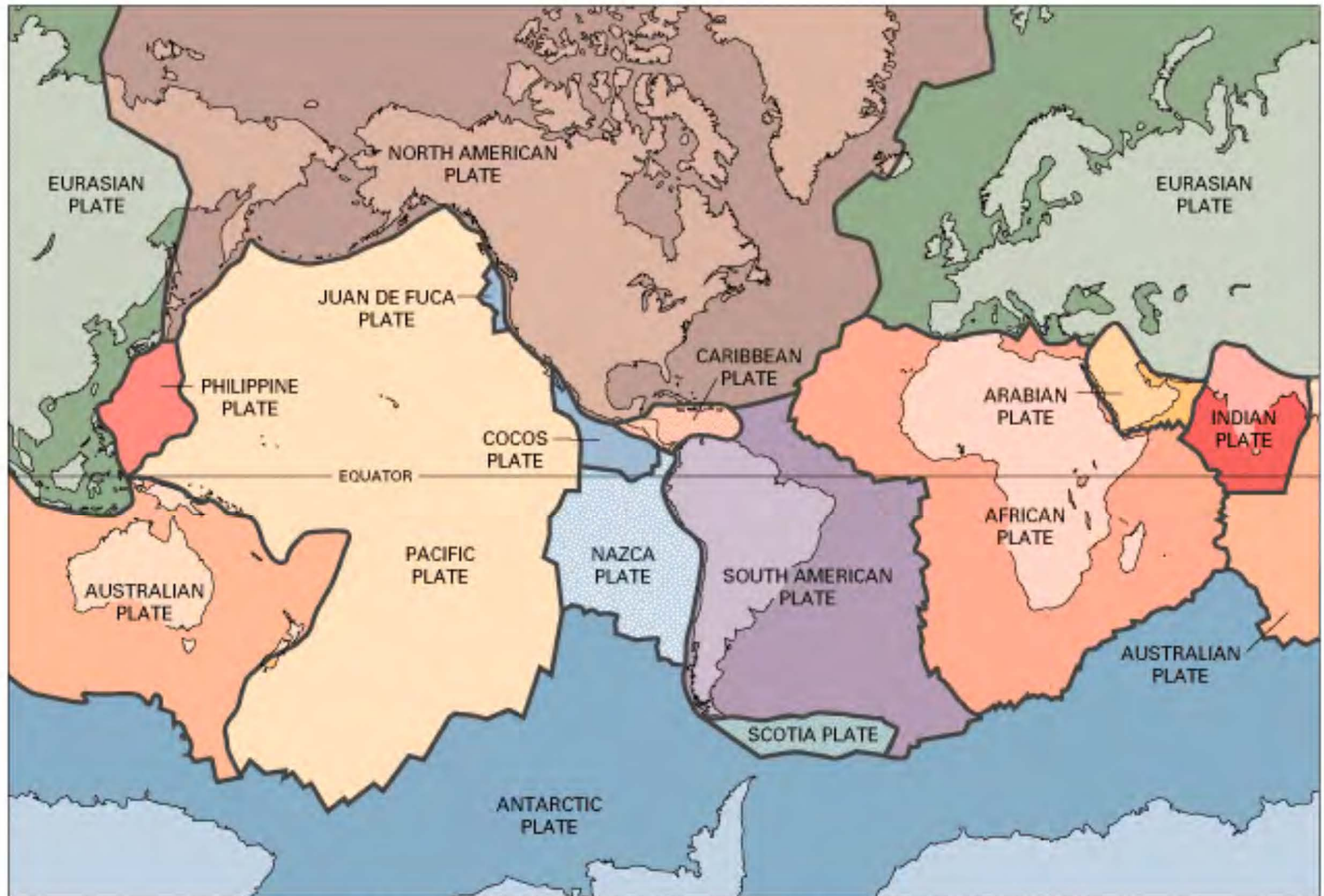
[http://www.nytimes.com/interactive/2011/05/01/weekinreview/01safe.html?\\_r=0](http://www.nytimes.com/interactive/2011/05/01/weekinreview/01safe.html?_r=0)

<http://www.gerbusa.com/typo3temp/pics/a592dc4a09.gif>





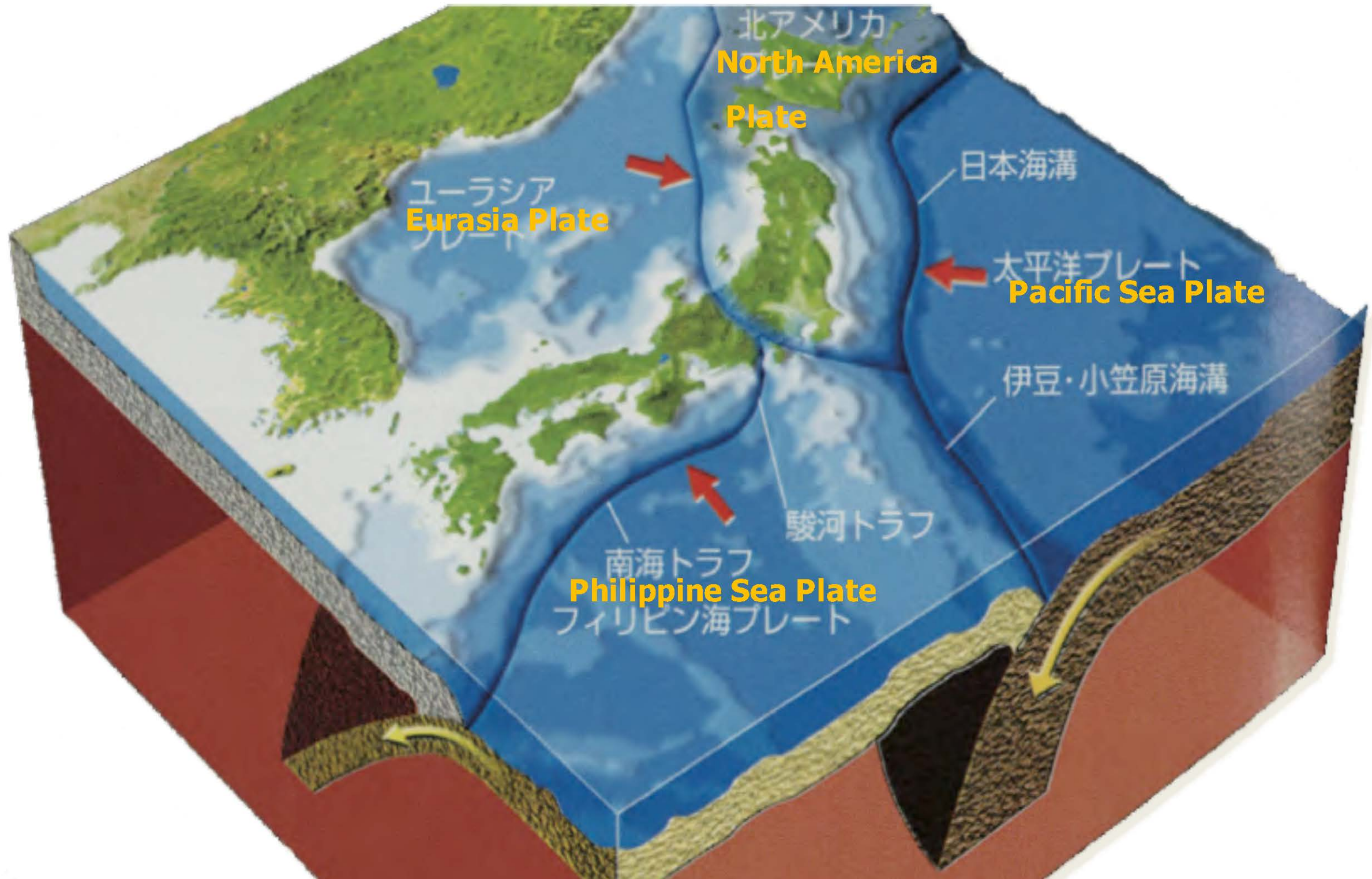
# Tectonic Plates



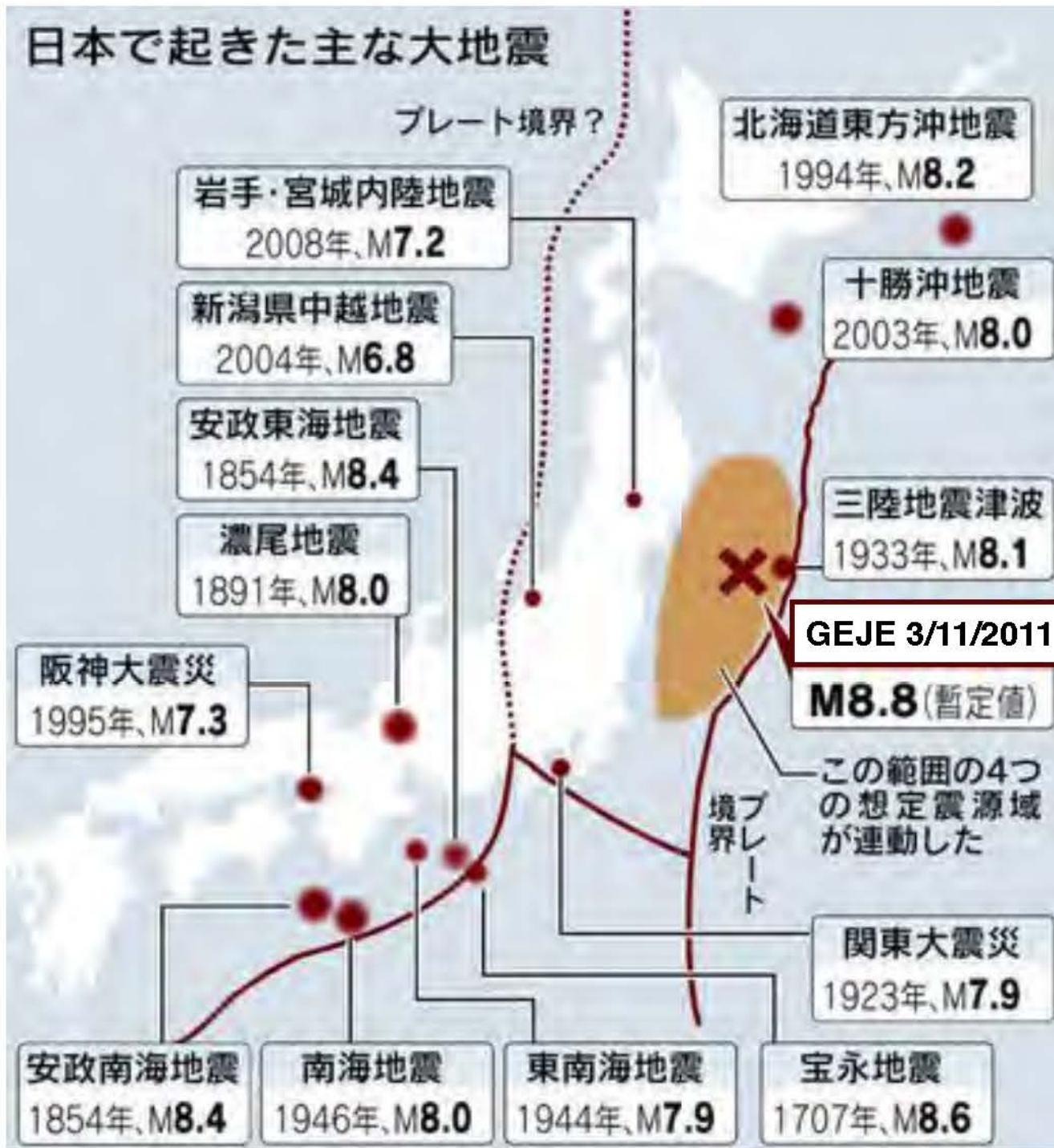
**The Earth's tectonic plates** courtesy of the U.S. Geological Survey

<http://viableopposition.blogspot.jp/2011/03/explaining-japans-earthquake.html>

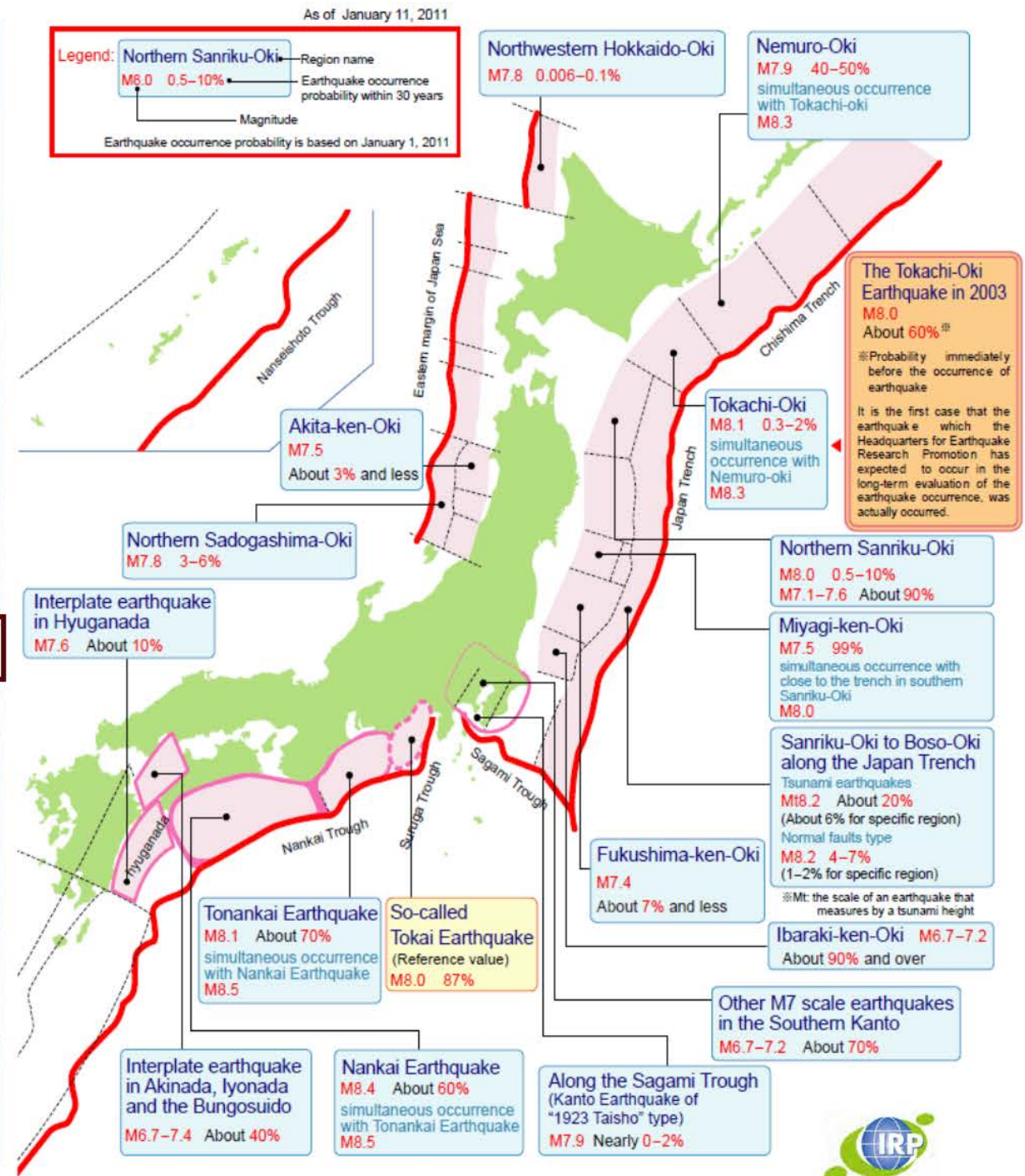
# Japan: sitting on 4 plates



# Past Earthquakes and GEJE



# Predicted Earthquakes (2011)





...and a long disaster history

# 大瀾極慘之圖

此圖係日本畫家松谷清之畫，描寫大瀾中慘狀。圖中可見房屋倒塌，家具傾斜，男女老幼在激浪中掙扎。此種慘狀，實為日本歷史上所罕見。此圖係松谷清之畫，描寫大瀾中慘狀。圖中可見房屋倒塌，家具傾斜，男女老幼在激浪中掙扎。此種慘狀，實為日本歷史上所罕見。



明治三十二年四月廿七日 大瀾 東京府大瀾中慘狀之圖 松谷清之畫 實為日本歷史上所罕見之慘狀也 全圖見於此

松谷清之

# Disaster recovery context in Japan after 3.11

- Laws, policies and precedents for disaster recovery exist; scale of 2011 disaster and recovery was unprecedented
- After 3.11, national government created a Reconstruction Agency, and a menu of 40 recovery projects fully funded by the national government.
- Municipal governments are responsible for making the recovery plans for their towns, choosing from these projects.
- Most municipal governments' recovery plans include **collective relocation for disaster mitigation** (which includes **providing land for private housing reconstruction**) and construction of **disaster recovery public housing**
- There are other recovery projects such as infrastructure carried out by other levels of government.

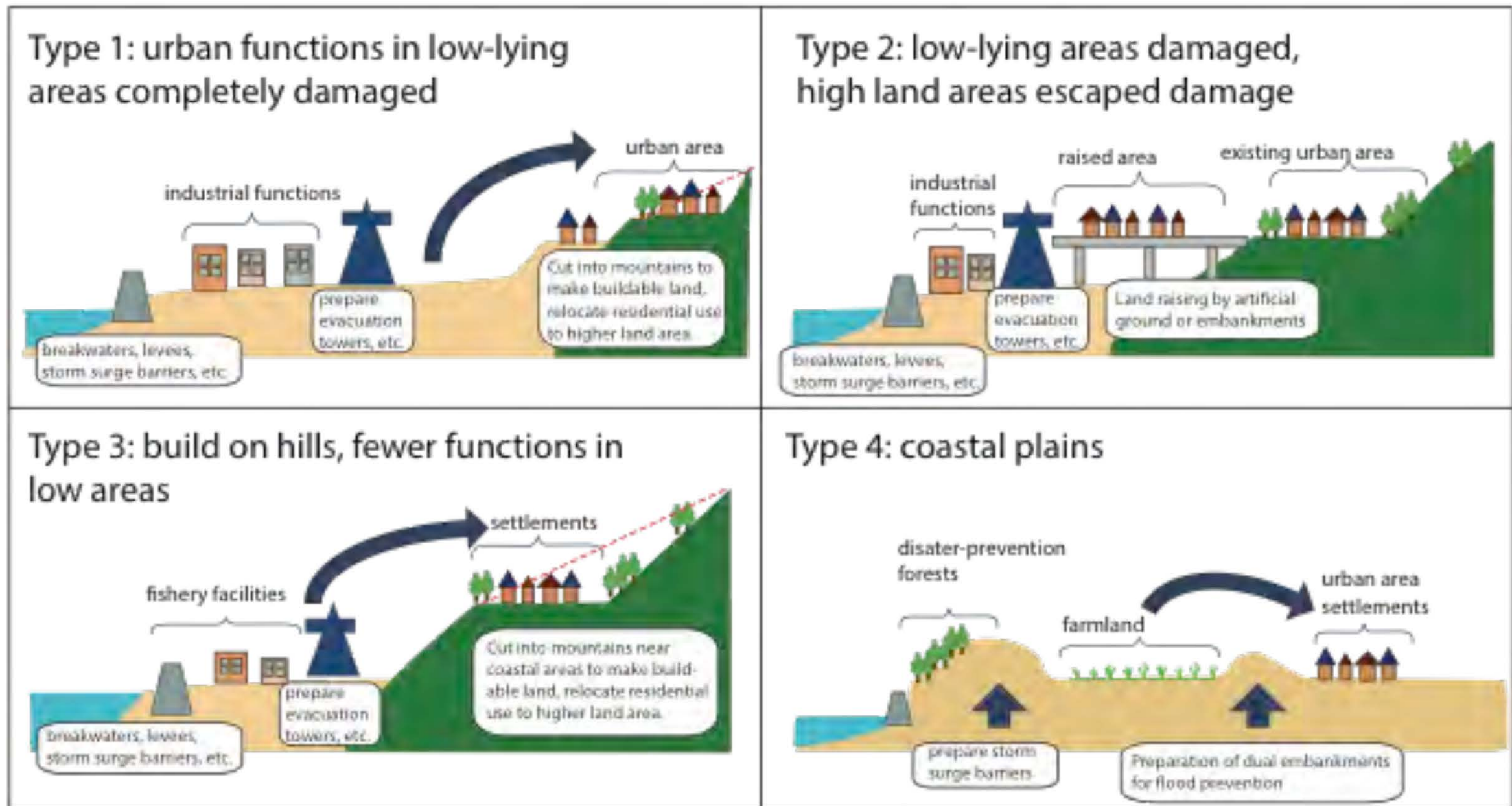
# Logic of Disaster Mitigation in Recovery Planning after 2011

	Design tsunami	Required performance
Level 1	Largest tsunami in modern times (return period: around 100 years)	<ul style="list-style-type: none"> <li>To protect human lives</li> <li>To protect properties</li> <li>To protect economic activities</li> </ul>
Level 2	One of the largest tsunamis in history (return period: around 1000 years)	<ul style="list-style-type: none"> <li>To protect human lives</li> <li>To reduce economic loss, especially by preventing the occurrence of severe secondary disasters and by enabling prompt recovery</li> </ul>



from Sendai City Recovery Plan

# Principles of relocation to higher land for disaster prevention





# Relocation concept in Tohoku

concept image of different relocation strategies in Miyagi Prefecture: ① high land relocation, ② multiple defenses, and combination (grey area in between)



Land readjustment and leveling

宮城県復興計画案  
の防災イメージ

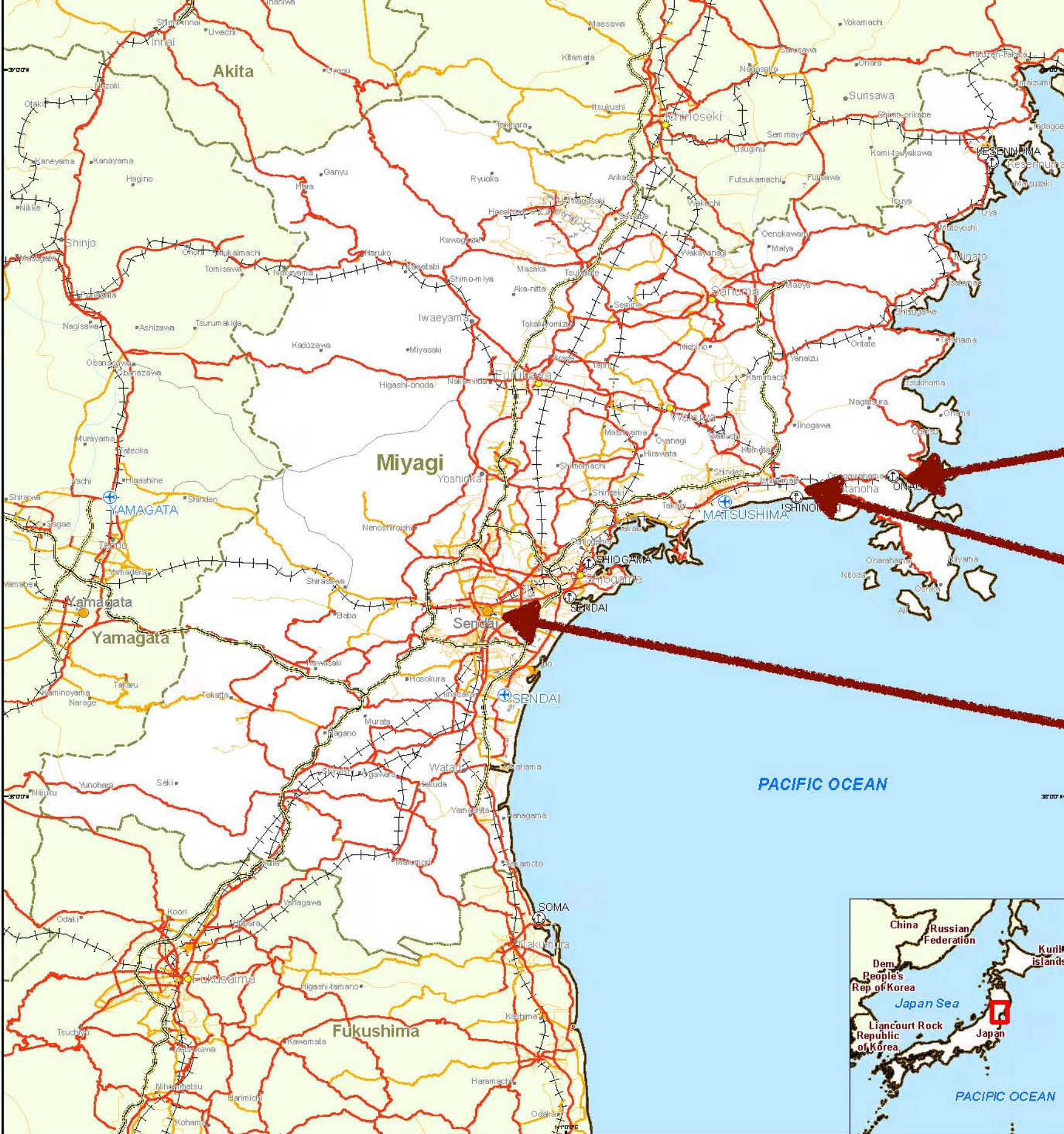


① 高台移転・職住分離



② 多重防御



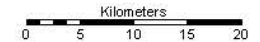


Onagawa

Ishinomaki

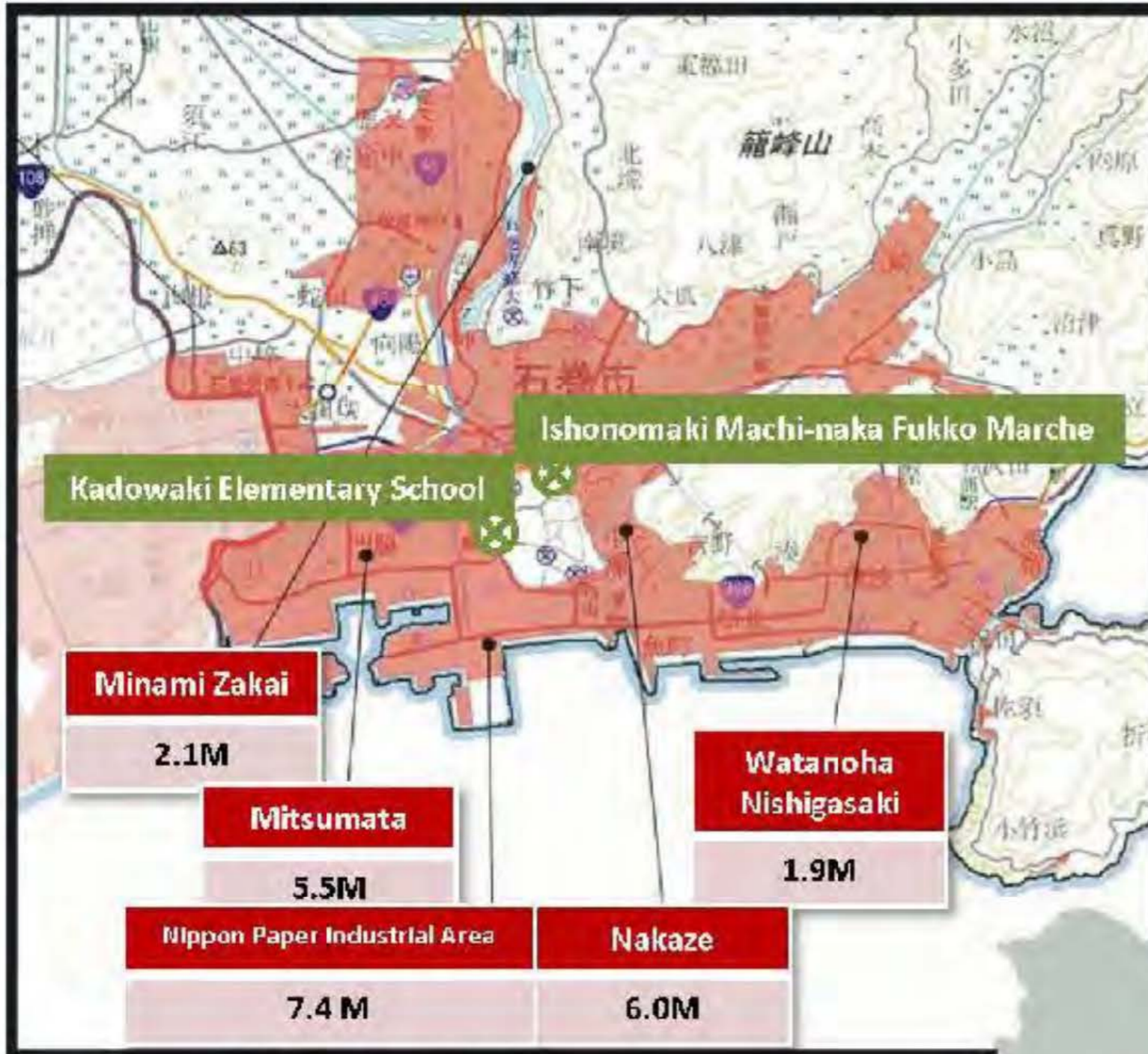
Sendai


**Miyagi Prefecture**  
 General Logistics Planning Map



- |  |  |   |   |
|--|--|---|---|
| <ul style="list-style-type: none"> <li><span style="color: orange;">●</span> Major Town</li> <li><span style="color: yellow;">●</span> Intermediate Town</li> <li><span style="color: grey;">●</span> Small Town</li> <li><span style="color: grey;">●</span> Village</li> </ul> | <ul style="list-style-type: none"> <li> Airport</li> <li> Airfield</li> <li> Port</li> <li> Railway</li> </ul> | <b>Road Network</b> <ul style="list-style-type: none"> <li> Highway</li> <li> Primary</li> <li> Secondary</li> <li> Tertiary</li> <li> Residential/Track</li> </ul> | <ul style="list-style-type: none"> <li> National boundary</li> <li> First level admin boundary</li> <li> Surface Waterbody</li> <li> River</li> </ul> |
|--|--|---|---|

Date Created: 31-MAR-2011  
 Map Num: LogCluster-JPN-005-A2  
 Coord System/ datum: Geopack/KMGS84  
 GLIDE Num:  
 The boundaries and names and the designations used on this map do not imply official endorsement or acceptance by the United Nations.  
 Small map: logcluster.org  
 Website: www.logcluster.org  
 Global Logistics Cluster Support Cell, Rome, Italy



**Legend**

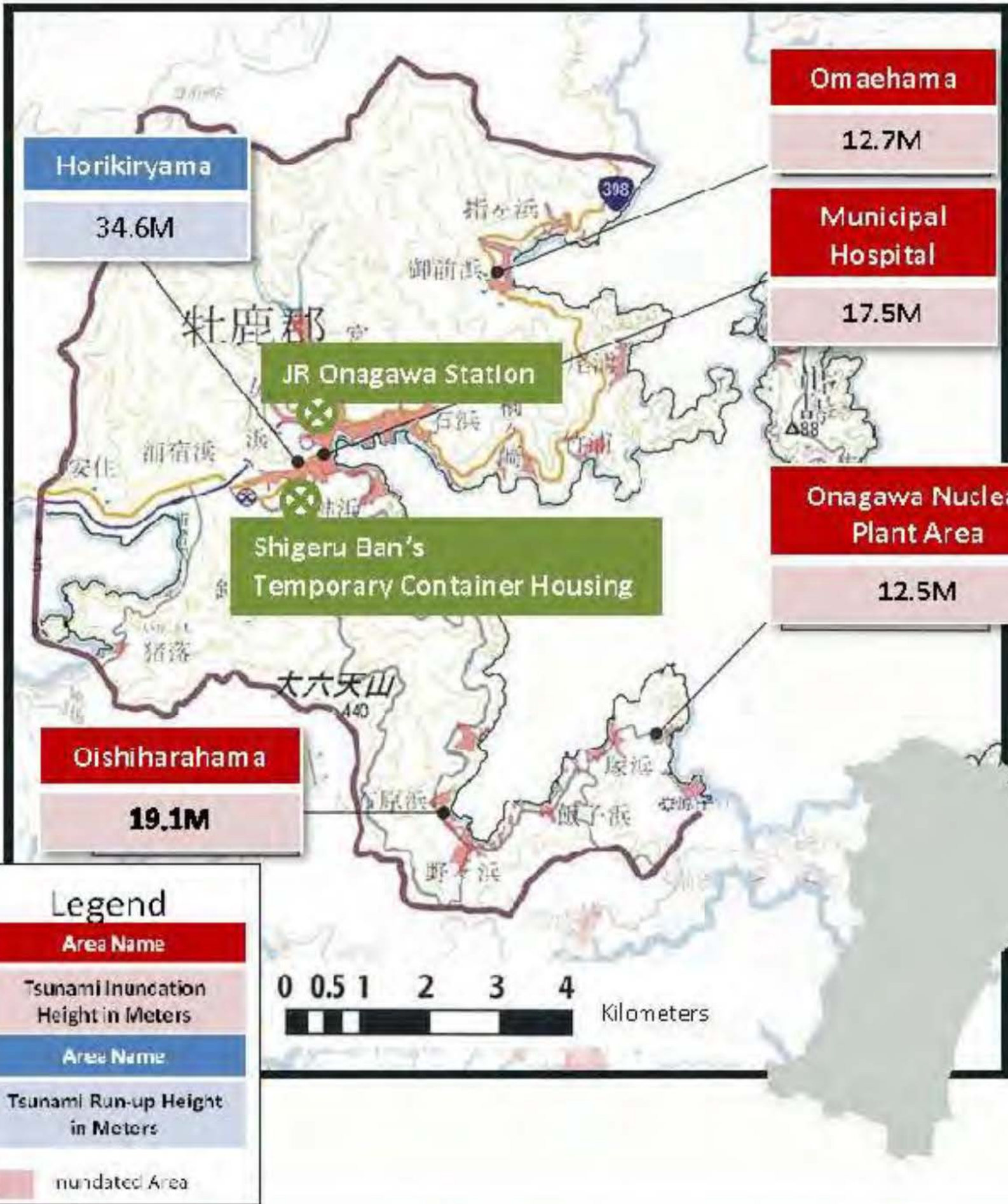
- Area Name
- Tsunami Inundation Height in Meters
- Area Name
- Tsunami Run-up Height in Meters
- Inundated Area



**Damages in Ishinomaki**

Human Casualties		Physical Damage		
Deaths	3,132	Area Inundated	73km <sup>2</sup>	
Missing	1,012	Percentage of Town/City	46%	
		Population in Inundated Area	112,276	
Damaged Houses	Destroyed	Mostly Destroyed	Partially Destroyed	Small Damage
Total	18,900	2,089	752	9,750
Evacuees		Temporary Housing		
Peak Time 3/17	50,758	Number of units needed to be built	7,900	
End of June 2011	5,021 people evacuated into 82 locations within the city	Number of units under construction	7,900	
		Number of units completed	4,076	

Tohoku University Study Tour



Damages in Onagawa				
Human Casualties		Physical Damage		
Deaths	500	Area Inundated	3km <sup>2</sup>	
Missing	420	Percentage of Town/City Population in Inundated Area	48% 8,048	
Damaged Houses	Destroyed	Mostly Destroyed	Partially Destroyed	Small Damage
Total	2,937	165	161	609
Evacuees		Temporary Housing		
Peak time 3/11	3,721	Number of units needed to be built	1,221	
End of June 2011	1,034 people	Number of units under construction	1,221	
	evacuated into 13 locations within the city, 108 to locations outside the city	Number of units completed	607	

# Ongoing Town and Housing Recovery

- Municipalities in disaster area are implementing recovery projects.
- Most rely on physical infrastructure:
  - Construction of Levees/Sea Walls
- and rezoning of areas near the sea (no houses)



# Ongoing Town and Housing Recovery

- Most recovery projects rely on physical infrastructure:
  - Relocation of residential areas to higher land
    - Created by cutting mountains, or building up land
    - including **lots for private rebuilding or public housing**



# Backbone structures of Onagawa central part

## Concept of value-up plan of Onagawa central area

Sea can be seen from here and there

Desire to live in, desire to visit, to brag the creation of landscape

Safe, secure, and easy to live community development



### 3 basic policies

#### 1. Make the most of the presence of sea

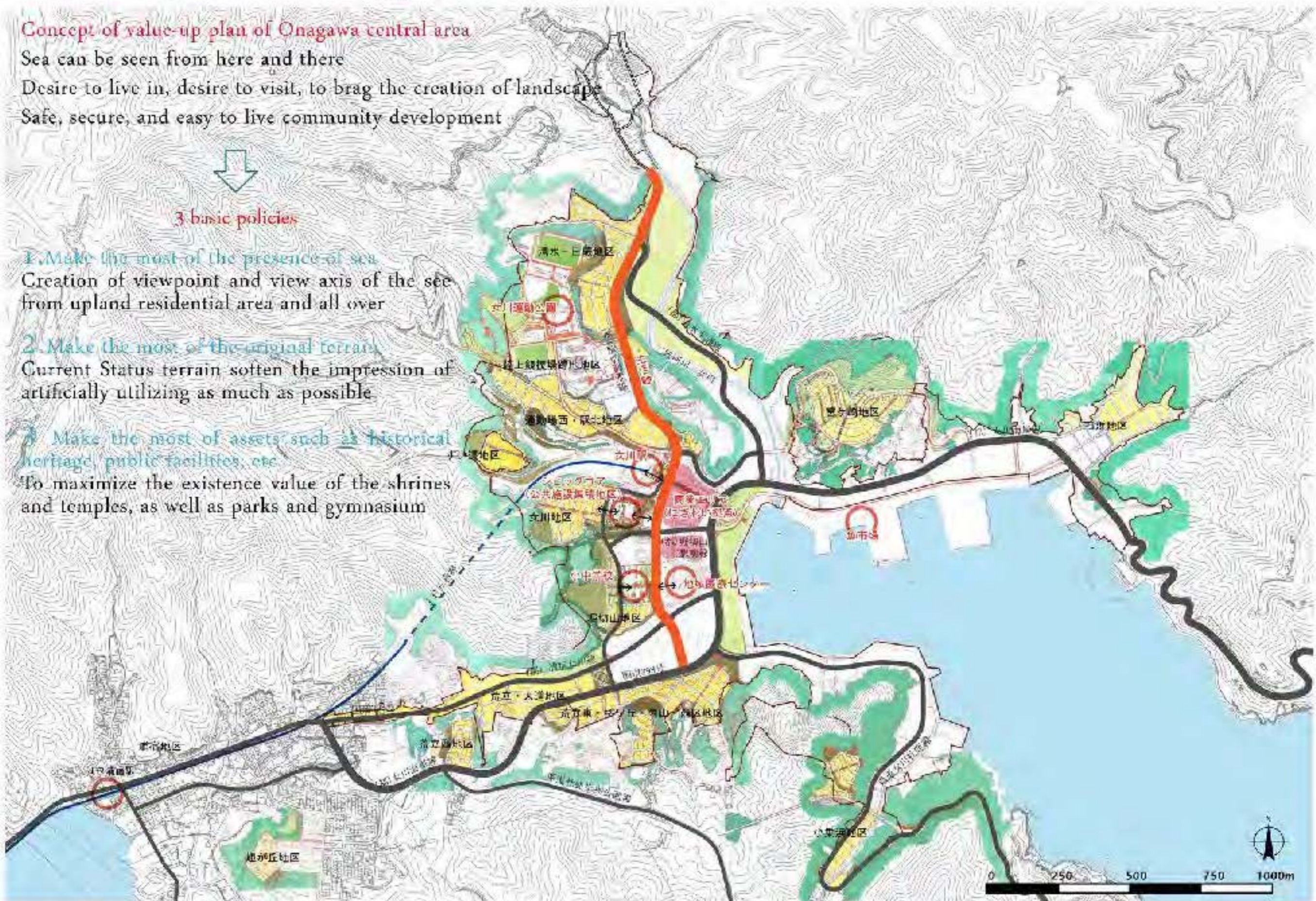
Creation of viewpoint and view axis of the sea from upland residential area and all over

#### 2. Make the most of the original terrain

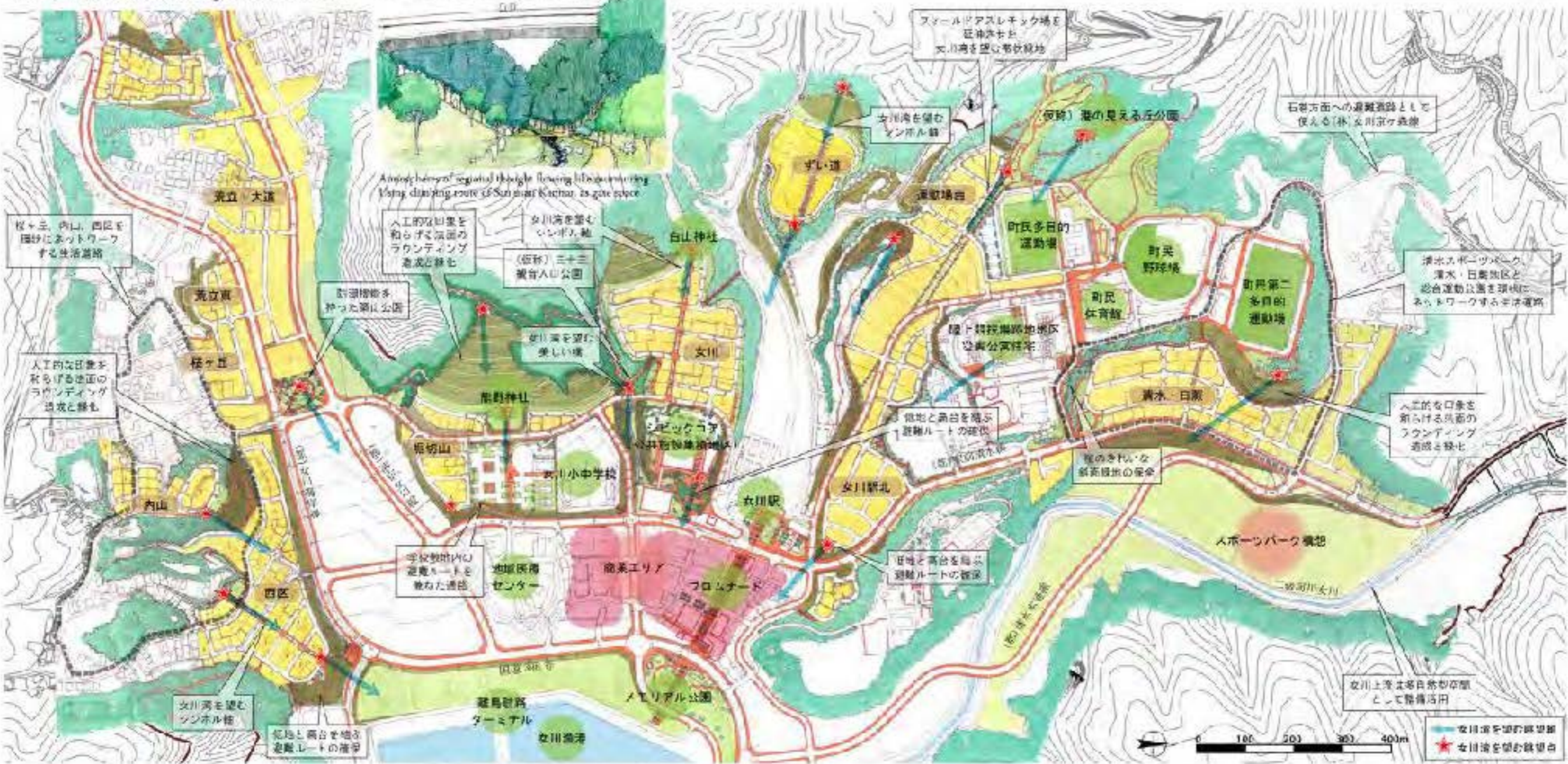
Current Status terrain soften the impression of artificially utilizing as much as possible

#### 3. Make the most of assets such as historical heritage, public facilities, etc

To maximize the existence value of the shrines and temples, as well as parks and gymnasium



Towards the sea opened town The entrance of Sanjusan Kannon Park



Symbol axis of the West Zone residential area to open the view to Onagawa river



Landscape of south direction from Onagawa Station Civic core are integrated public facilities in right hand side of hill and looking at the front of Onagawa elementary and junior high schools



A pleasant ribbon park which can view Onagawa river from anywhere Multipurpose green open space for variety of usage such as daily walk and events



The information in this document is currently under consideration (study), we subject to change.



# Massive scale land works in Onagawa City



Massive land works in Onagawa City **2014 April**



**2016 March**



# Temporary Housing: various types—prefabricated, wooden, private apartments

- Some keep residents together, but many inconvenient—far from school, hospital, shopping, work
- Small (less than 29m<sup>2</sup>), hot in summer, cold in winter, noisy, poor construction, uncomfortable, quality varies, not good for 5 years. Basic limit: 2 years 3 months, extended +1 year + 1 year...
- Loss of community, (residents determined by lottery)
- Expensive for government to build (6,000,000 yen/unit)



# Providing Public Housing



Multifamily public housing in Ogagawa City, Miyagi



Multifamily public housing in Koriyama City, Fukushima



single family detached public housing (Left) and private reconstruction (right)



single family detached public housing in Minami Soma City, Fukushima



single family detached public housing in Onagawa, Miyagi

83% of 30,553 planned units of public housing complete as of May 2017 (Reconstruction Agency)

# Challenges for community recovery

- Recovery is mainly large scale infrastructure and massive modification of landscape.
- Former communities had integrated workspace, shops, housing; relocation projects are housing only-exclude other uses.
- For fishing villages, relocation moves people away from sea.
- Creating new residential areas, in inconvenient places, for mostly elderly residents. In the future, may be no residents.
- People get tired of waiting for reconstruction project, move away and/or don't return.

# Collective housing design in relocation, Takeura area, Onagawa Town, Miyagi Prefecture



# Collective housing design in relocation, Takeura area, Onagawa Town, Miyagi Prefecture











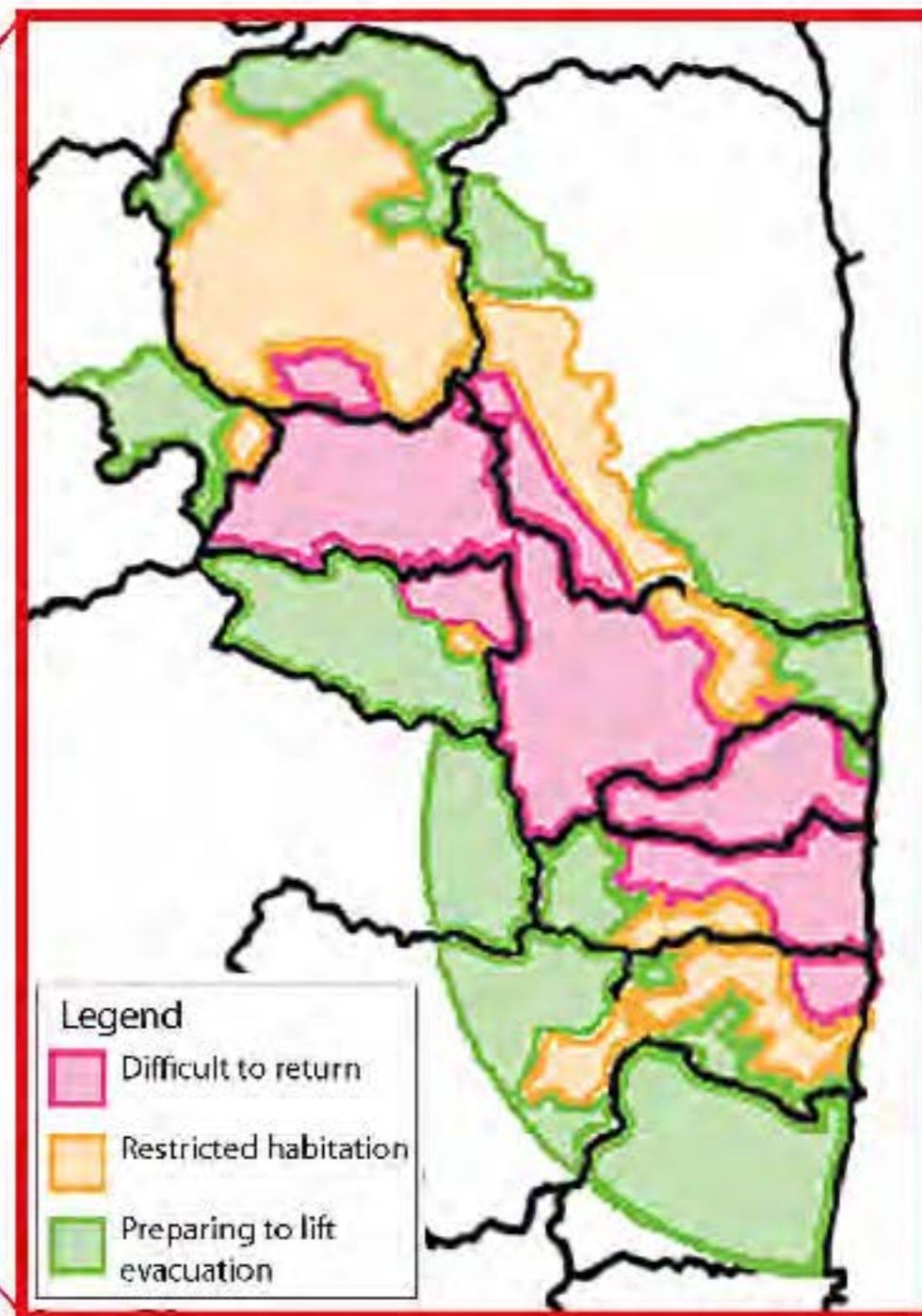
# Fukushima: more complicated recovery

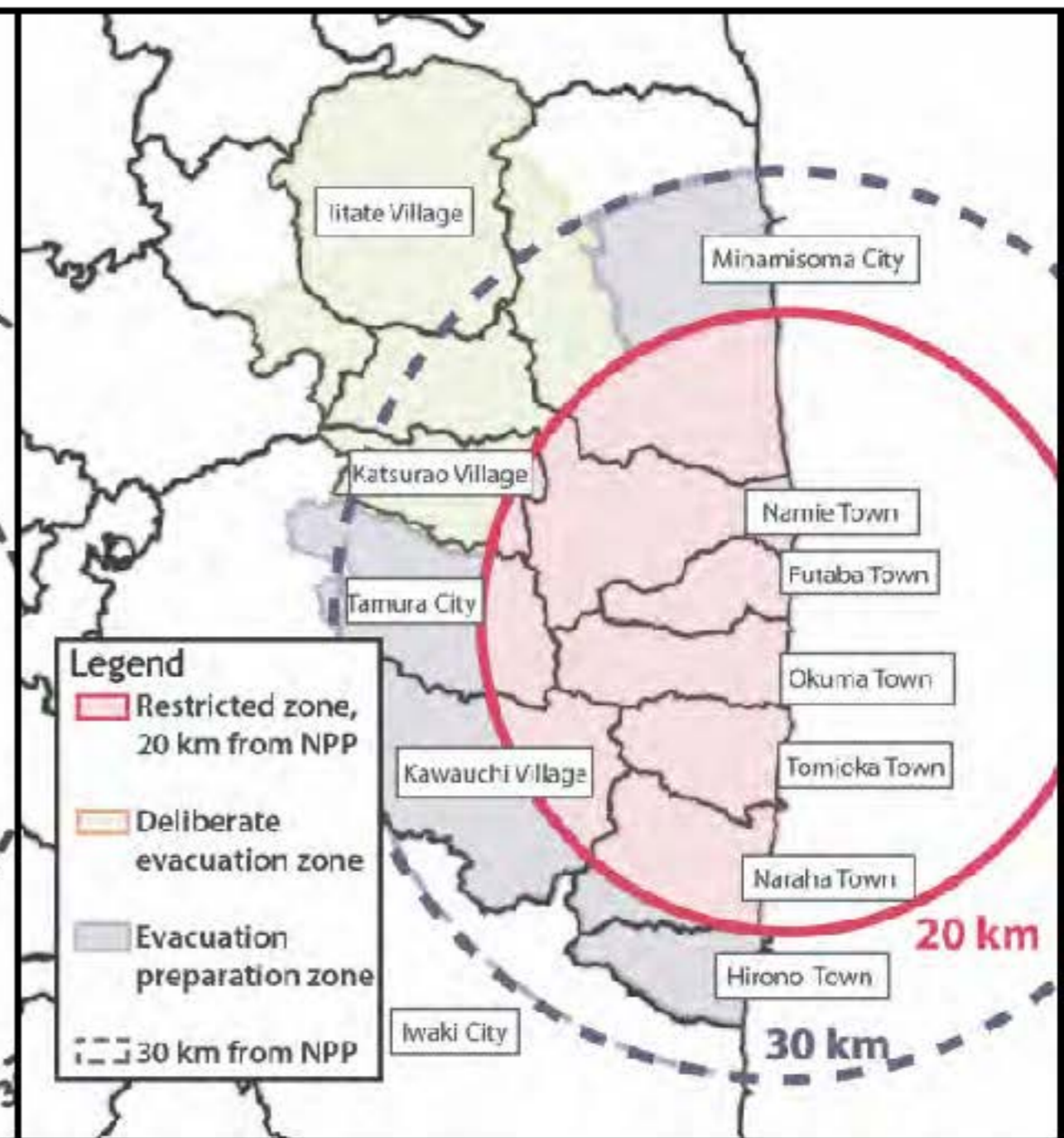
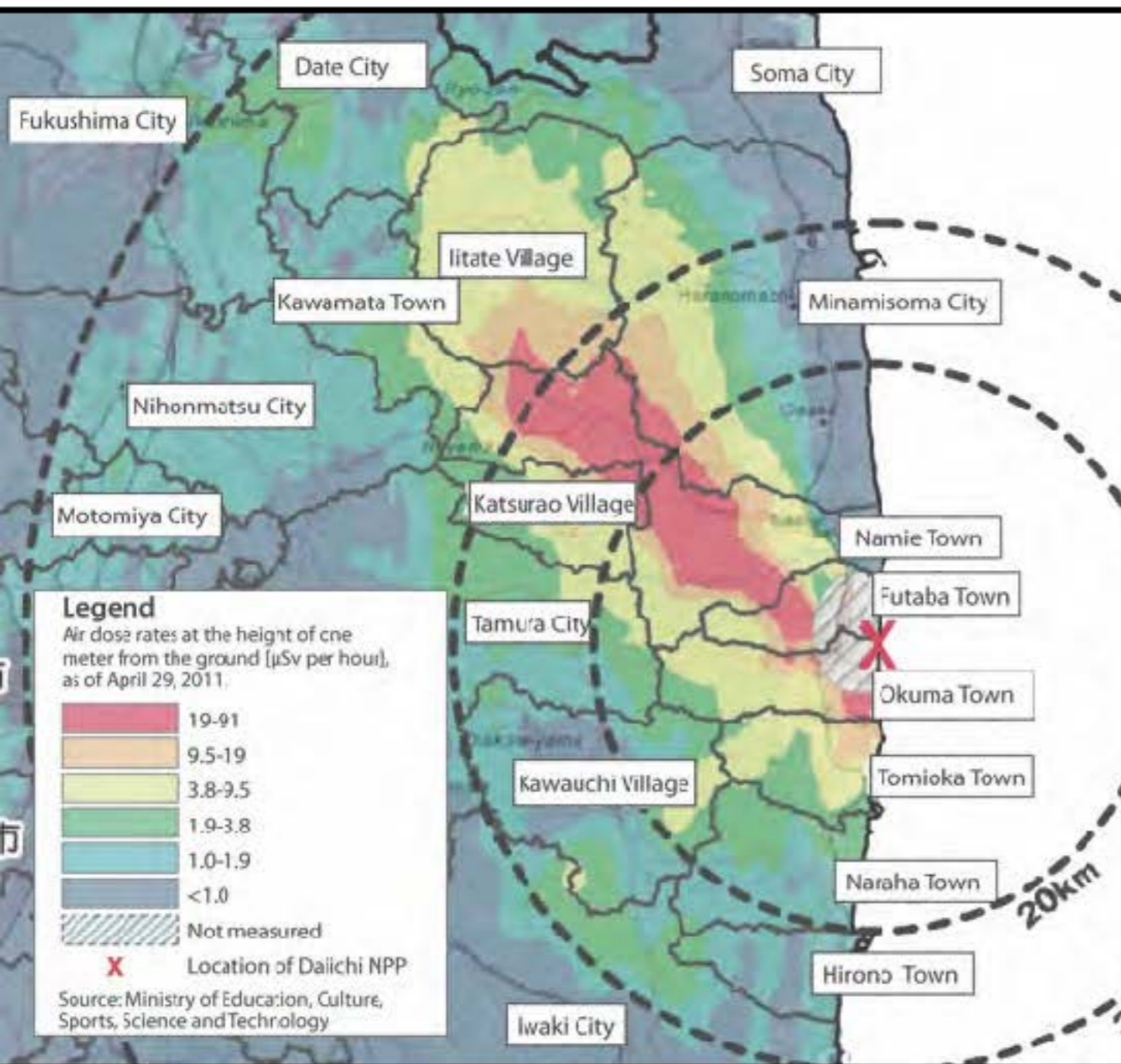
## Damages from the Great East Japan Earthquake

	Casualties (as of 6/10/2015)			Evacuees (as of 7/29/2016)		Damaged houses (as of 9/12/2016)		Inundated area
	Direct (12/9/2016)	Missing (12/9/2016)	Indirect (kanrenshi)	Within pref	Outside pref	Totally damaged	Partially damaged	
Iwate	4,673	1,123	459	18,788	1,390	19,507	25,528	58 km <sup>2</sup>
Miyagi	9,540	920	920	33,970	5,930	83,000	387,258	327 km
Fukushima	1,613	197	2,038	47,850	40,982	15,194	222,441	112 km <sup>2</sup>
Total	15,893	2,556	3,472	147,772		121,739	1,019,466	561 km <sup>2</sup>

Data sources: [Reconstruction Agency \(2016b, 2016c\)](#), [National Police Agency of Japan \(2017\)](#), [Fire and Disaster Management Agency \(2017\)](#)





**As of May 2017, 35,818 evacuees from Fukushima outside the prefecture (Fukushima Pref. website)**

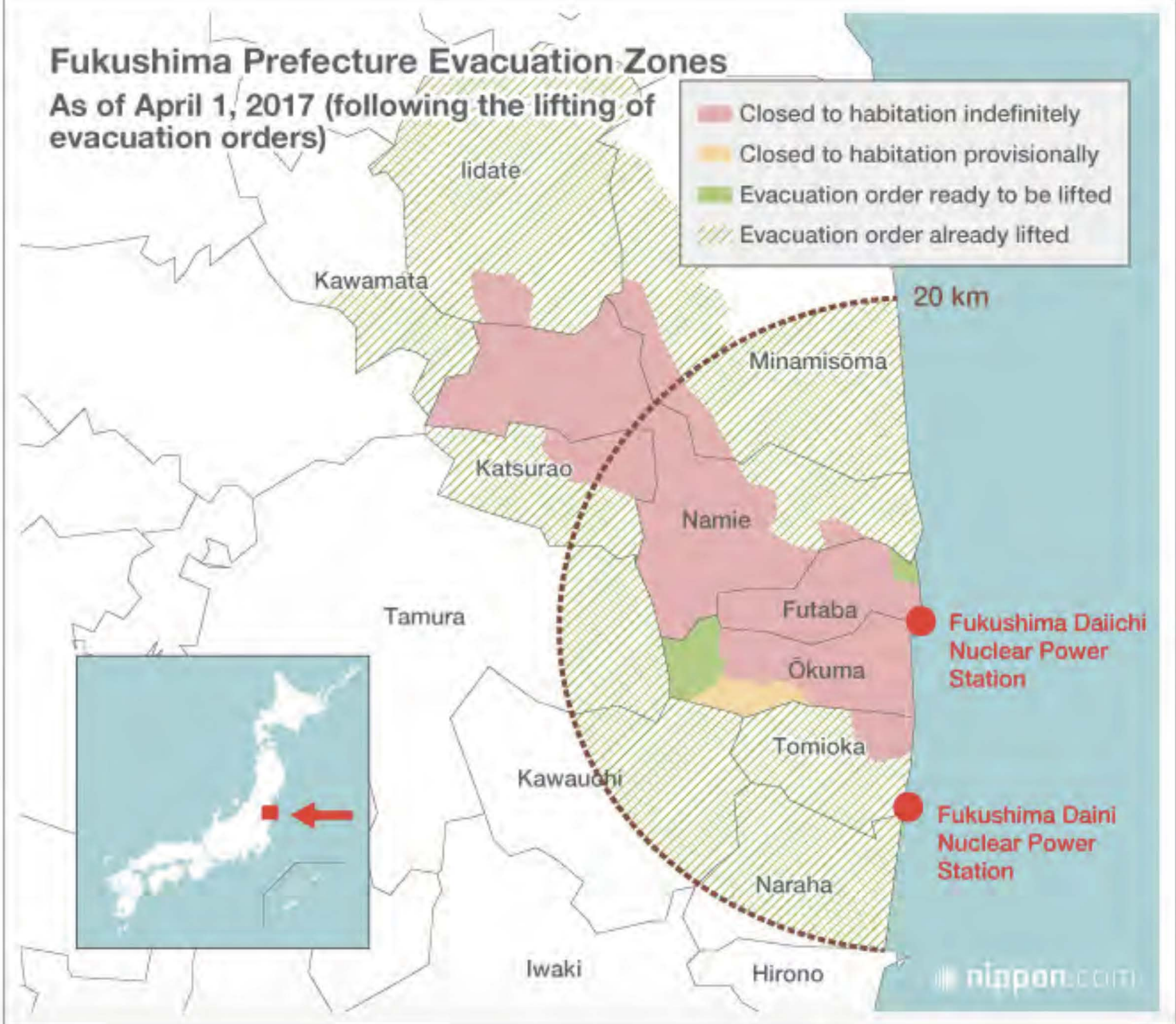




# Fukushima Prefecture Evacuation Zones

As of April 1, 2017 (following the lifting of evacuation orders)

-  Closed to habitation indefinitely
-  Closed to habitation provisionally
-  Evacuation order ready to be lifted
-  Evacuation order already lifted





H.25.10.21  
10区大久保  
0.40μS/L

H.25.10.21  
10区大久保  
0.45t  
X.074501

H.25.10.21  
10区大久保  
0.35t  
X.074003 0.36μS/L  
秀和建設

H.25.10.21  
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0.45t  
X.074501

H.25.10.21  
10区大久保  
0.40t  
X.075272

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0.35t  
X.074751 0.38μS/L

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0.45t  
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H.25.10.21  
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秀和建設  
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X.075272  
0.42μS/L

H.25.10.21  
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秀和建設  
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X.074523 0.35μS/L



サンミュージック

BOOK  
DVD・CD

BOOK★CD

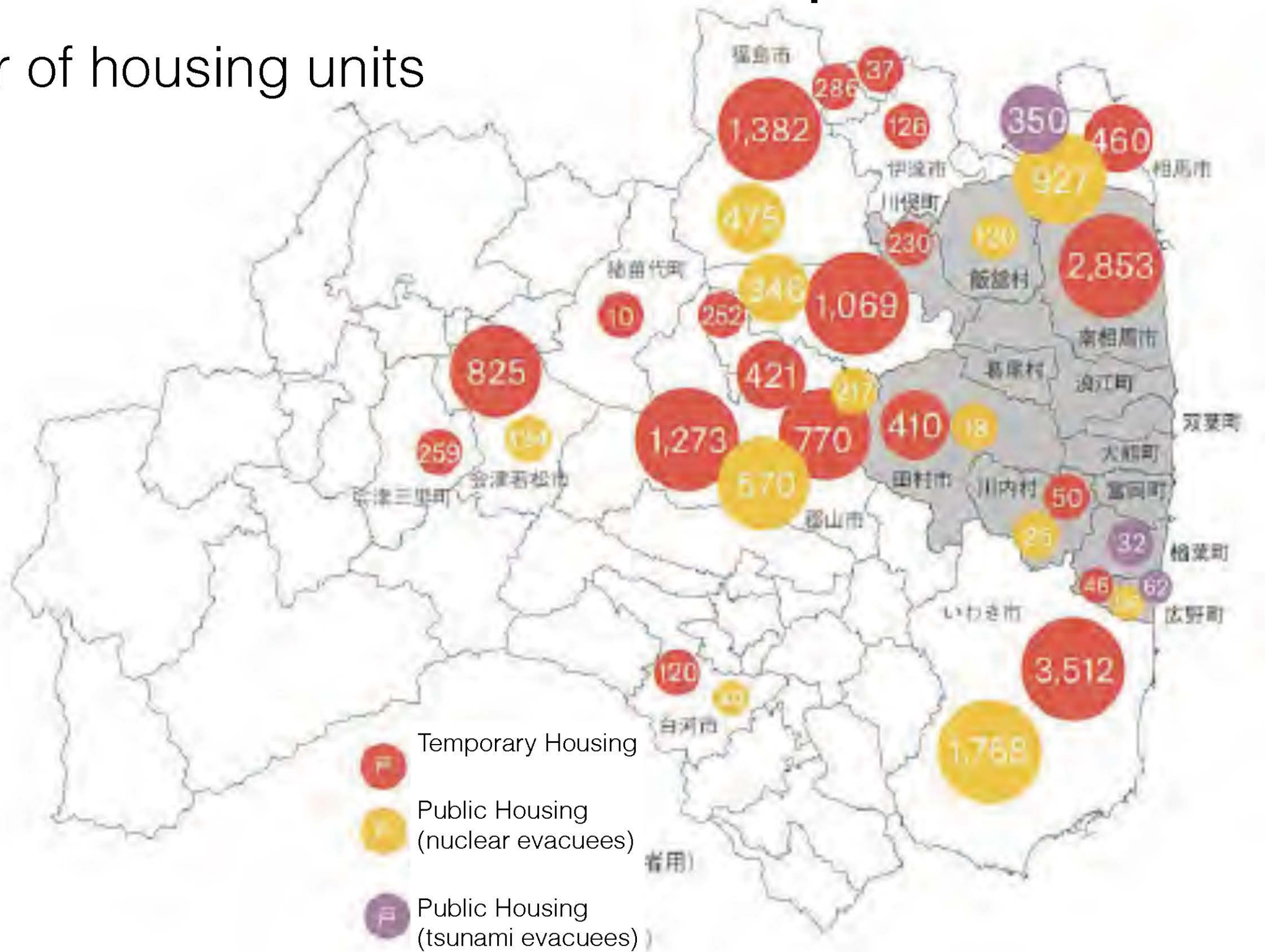
DVD・CD

サンミュージック

BOOK

# Fukushima and Displacement

Number of housing units



One innovative solution in Tohoku  
Fukushima Prefecture built more than 6700  
wooden temporary houses  
(Temporary housing) + (wooden) + (local builders)



Temporary housing in Aizu Wakamatsu, Fukushima



Temporary housing in Iwaki City, Fukushima



Temporary housing in Miharu Town, Fukushima

# Public housing in Fukushima

Fukushima Prefecture plans to build public housing:

- 2,807 units for earthquake/ tsunami evacuees
- (95% done as of 2.2017)
- 4,890 units for nuclear evacuees
- (66% done as of 2.2017)

Source: Fukushima Pref. as of 2.2017



**FAIRDO2013**  
Challenges of Decontamination,  
Community Regeneration and  
Livelihood Rehabilitation

2nd Discussion Paper

Fukushima Action Research on Disaster  
Reconstruction Questions (FAIRDO)



[http://pub.iges.or.jp/modules/  
envirolib/upload/4718/attach/  
web\\_FAIRDO\\_2nd\\_Discussion\\_Paper  
\\_E\\_130906.pdf](http://pub.iges.or.jp/modules/envirolib/upload/4718/attach/web_FAIRDO_2nd_Discussion_Paper_E_130906.pdf)



<http://fukushimalessons.jp/en-booklet.html>

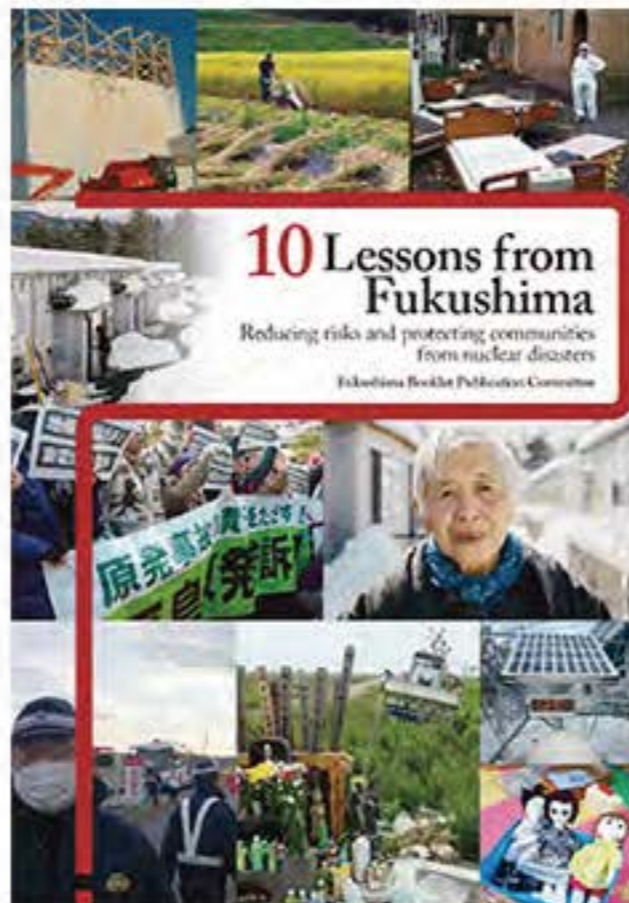


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**Even as Evacuation Orders are Lifted,  
Recovery Remains Distant Prospect for  
Many Fukushima Residents**

Suzuki Hiroshi (Profile)

[http://www.nippon.com/  
en/currents/d00319/](http://www.nippon.com/en/currents/d00319/)



United Nations University  
Institute for the Advanced Study of Sustainability

Fukushima Global Communication Programme  
Final Report



[https://collections.unu.edu/eserv/  
UNU:5758/FGC\\_Final\\_Report\\_EN.pdf](https://collections.unu.edu/eserv/UNU:5758/FGC_Final_Report_EN.pdf)



<http://fukushimaontheglobe.com/>

# Characteristics and Challenges for Tohoku Recovery

- Disaster area is not uniform, made up of
  - large cities and small towns,
  - areas that have merged with other municipalities: creating political power imbalance; center/periphery recovery gaps
- Aging population in an area where population was already declining (disaster is speeding up the process)
- In the disaster area, most households lived in large single family detached homes--especially for elderly, difficult to rebuild similar on their own.
- Livelihood is connected to the sea—relocation is difficult
  - relocation must involve not just housing, but also shops, etc.
- Relocation also involves the provision of new land in the target relocation area, not just zoning/buybacks
- Infrastructure investment in relocation (mountaintop cutting, land preparation) disproportionate to future residential population (infrastructure is EXTREME in Japan)
- Nuclear contamination means long-term relocation (unprecedented—unique case in the world, we have no good plan for this)