



APRU Multi-Hazard (MH) Summer School 2020

**Urban Disaster Risk Reduction:
Japan as a disaster-prone country and
learning from past disasters**

**International Strategy for Disaster Mitigation Lab.
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1. How do you evaluate urban disaster risk?
2. Disaster Life Cycle
3. Japan as a Disaster-prone Country and Learning from the Past Disasters

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A blue triangle graphic pointing towards the top-left corner, located to the left of the main text.

**How do you evaluate urban
disaster risk?**

The mechanism of disaster occurrence




The mechanism of disaster occurrence



Definition of Urban Disaster Risk

$$\text{Urban Disaster Risk} \\ = \text{Hazard} * \text{Vulnerability} * \text{Exposed Value}$$

Hazard

A satellite view of a large hurricane over the Earth's surface. The hurricane is a massive, swirling cloud system with a distinct eye. In the foreground, a satellite arm and solar panels are visible, indicating the image was taken from space. The Earth's curvature and blue oceans are also visible.

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Vulnerability



The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Exposure

People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.



Photo: O. Murao

What we ask citizens to do to prevent the spread of the new coronavirus



To prevent COVID-19 outbreaks, every single citizen must take action to avoid “infecting others” and “getting infected”.



Avoid the “Three Cs”

1. Closed spaces
with poor ventilation



2. Crowded places
with many people nearby



3. Close-contact
settings
Such as close-range
conversations



出典：大阪府/Global Risk Solutions Center(塚本研究室、大阪大学)

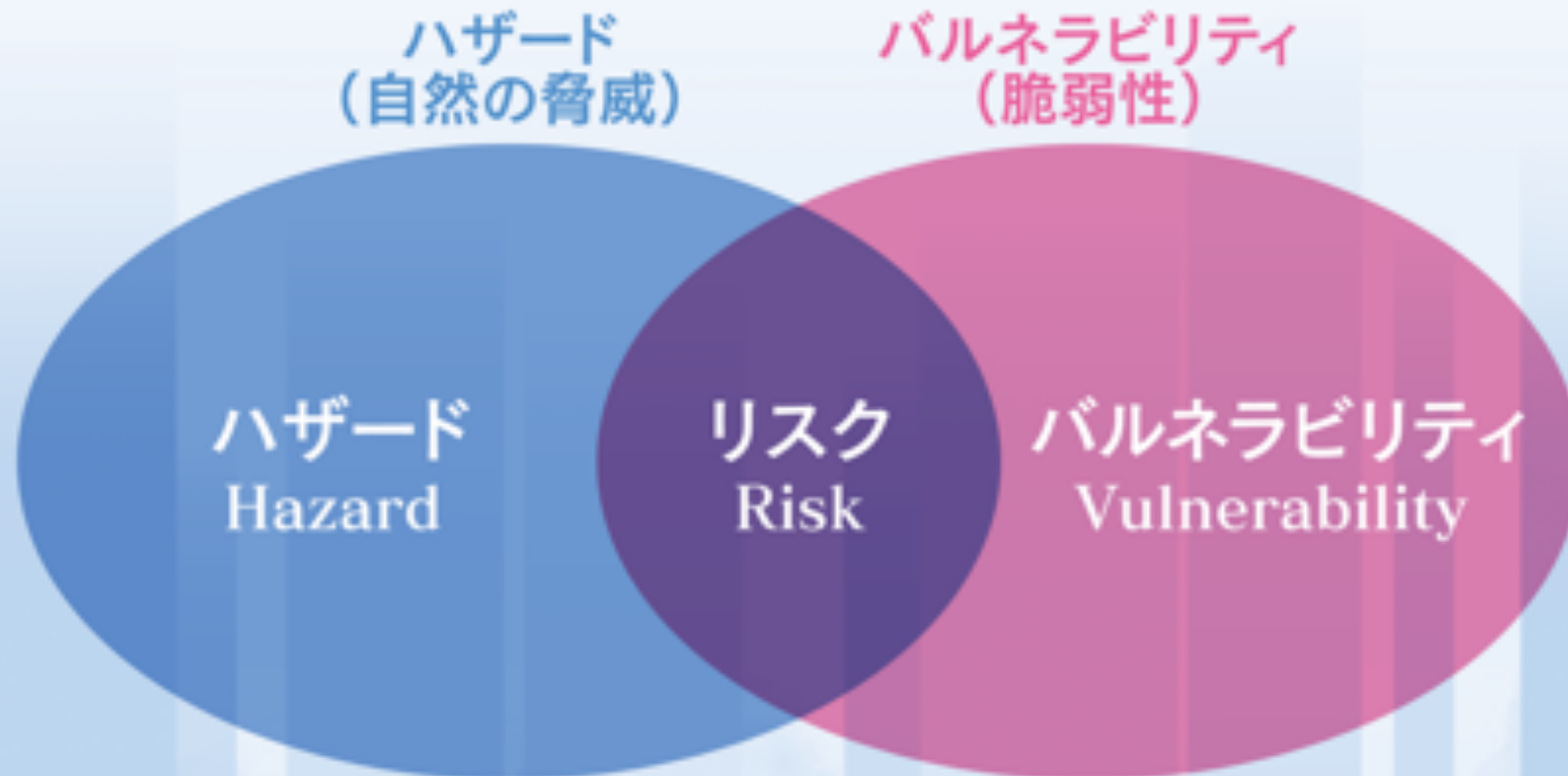
<https://www.ih-osaka.or.jp/english/2020/04/01/coronavirus/>

Definition of Urban Disaster Risk

$$\text{Urban Disaster Risk} = \text{Hazard} * \text{Vulnerability} * \text{Exposed Value}$$

Hazard and Vulnerability

ハザードとバルネラビリティ



Meguro and Murao: Comprehensive Disaster Management of Regions and Cities (2016)

Hazard and Vulnerability

ハザードとバルネラビリティ

ハザード
(自然の脅威)

バルネラビリティ
(脆弱性)

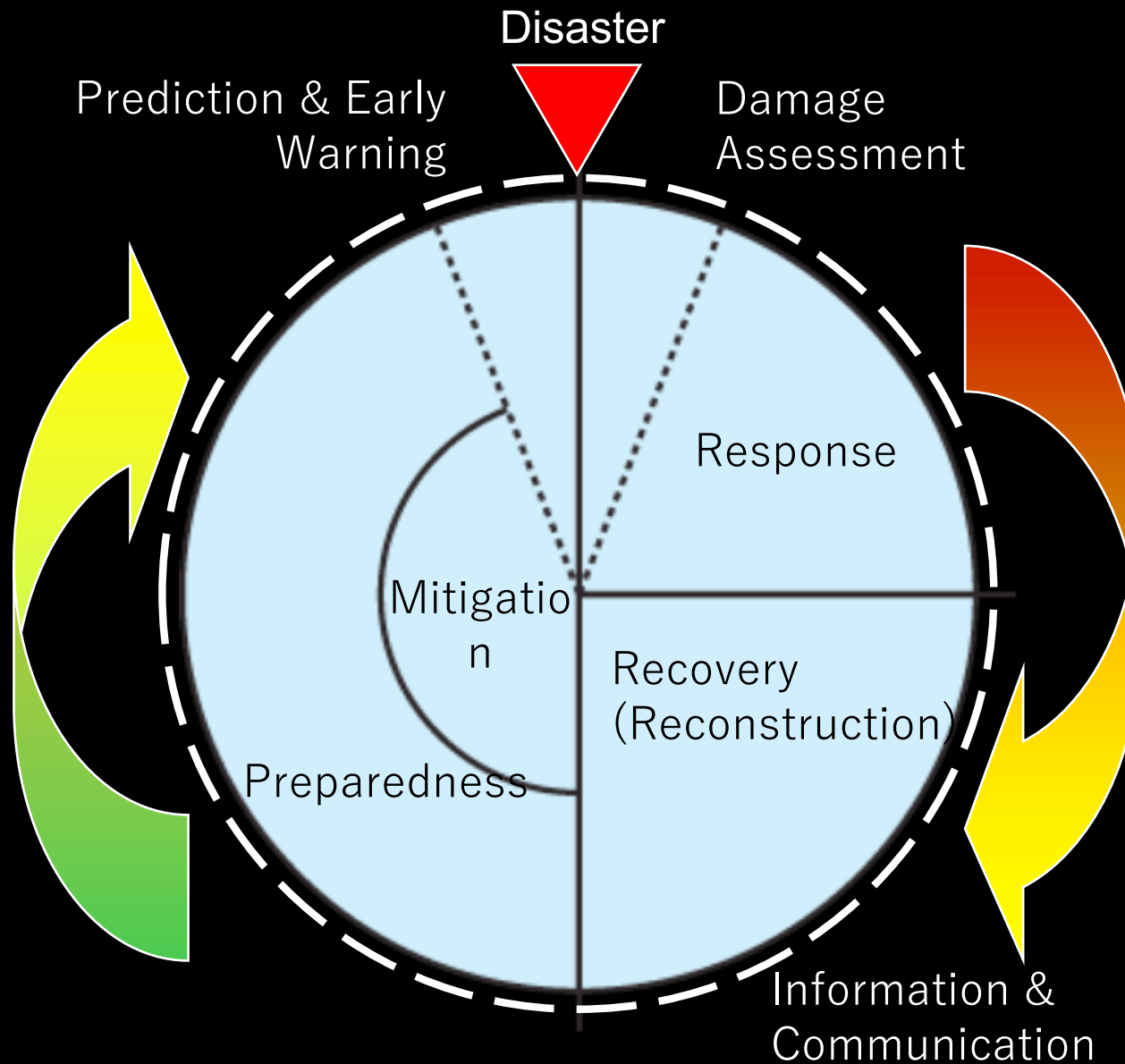


Meguro and Murao: Comprehensive Disaster Management of Regions and Cities (2016)

2

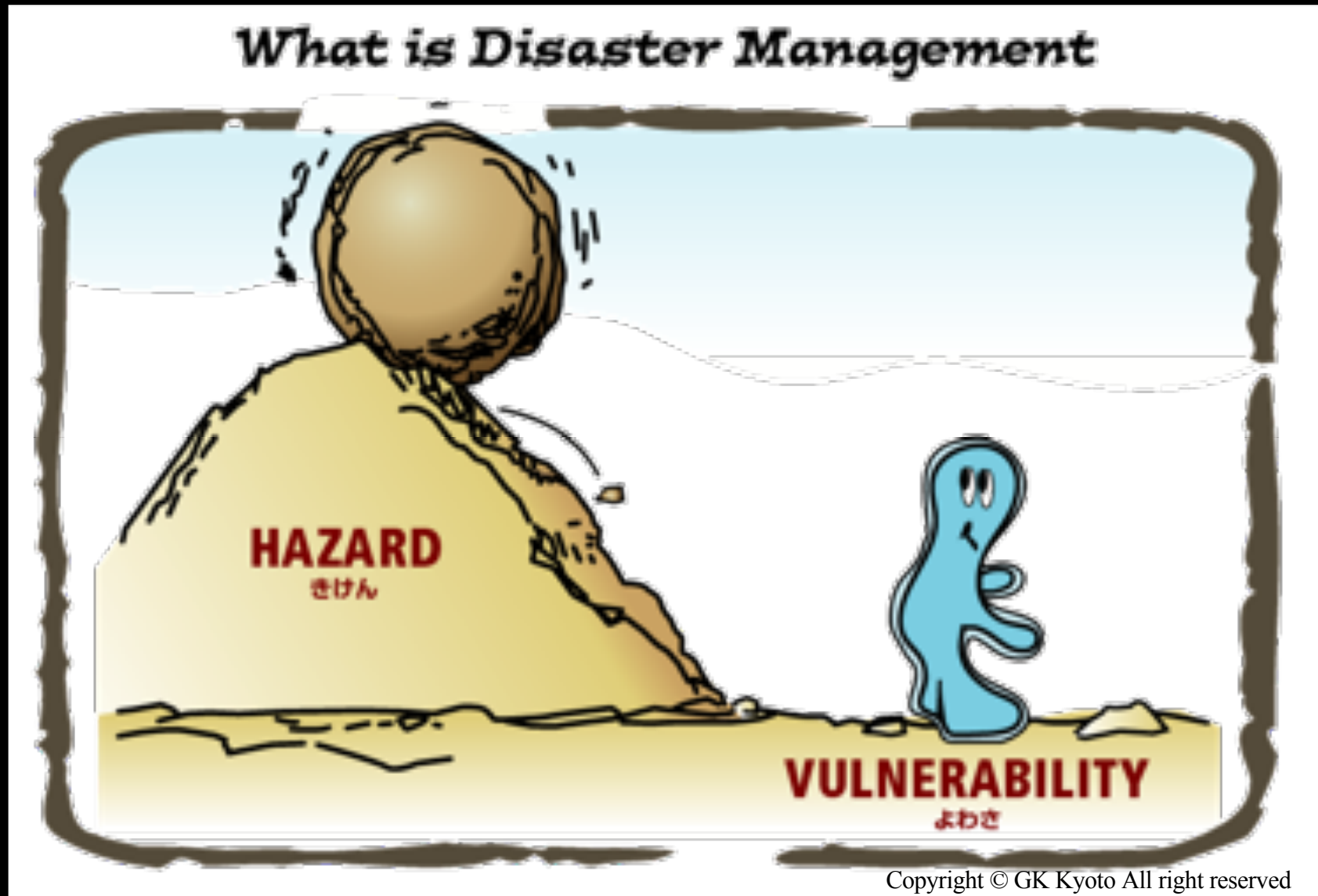
Disaster Life Cycle

Disaster Life Cycle

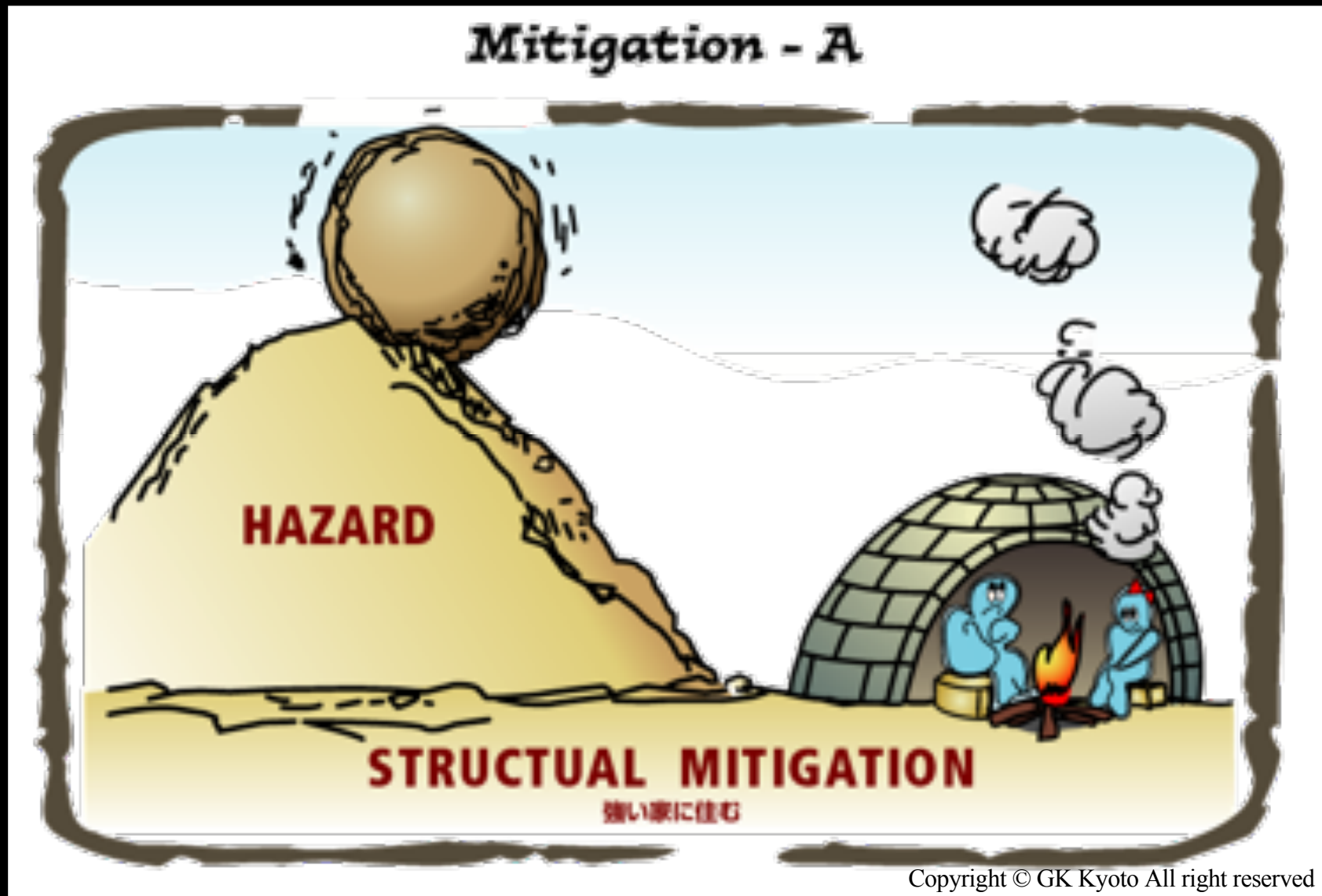


Q: What is mitigation and preparedness?

Hazard and Vulnerability

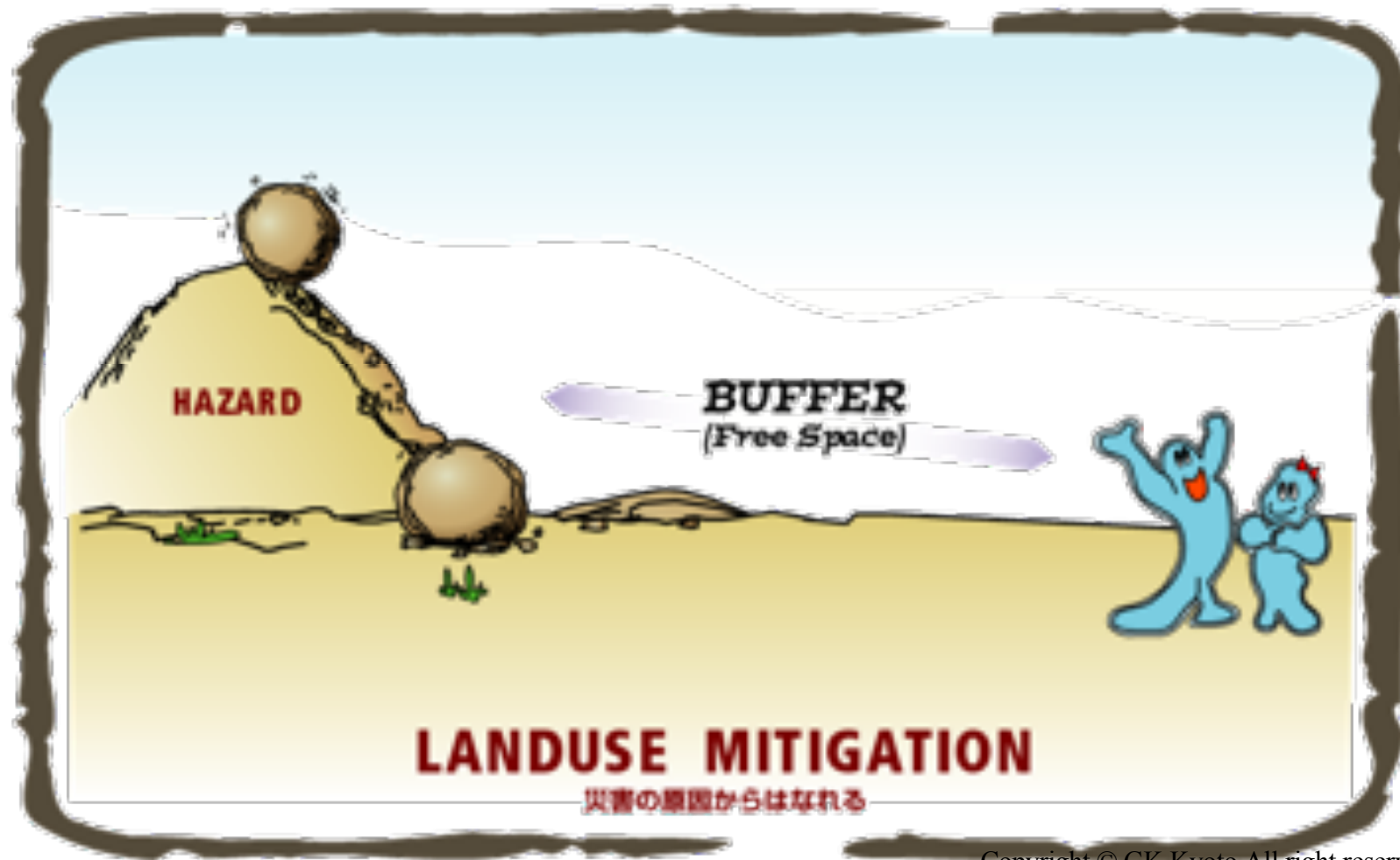


Structural Mitigation

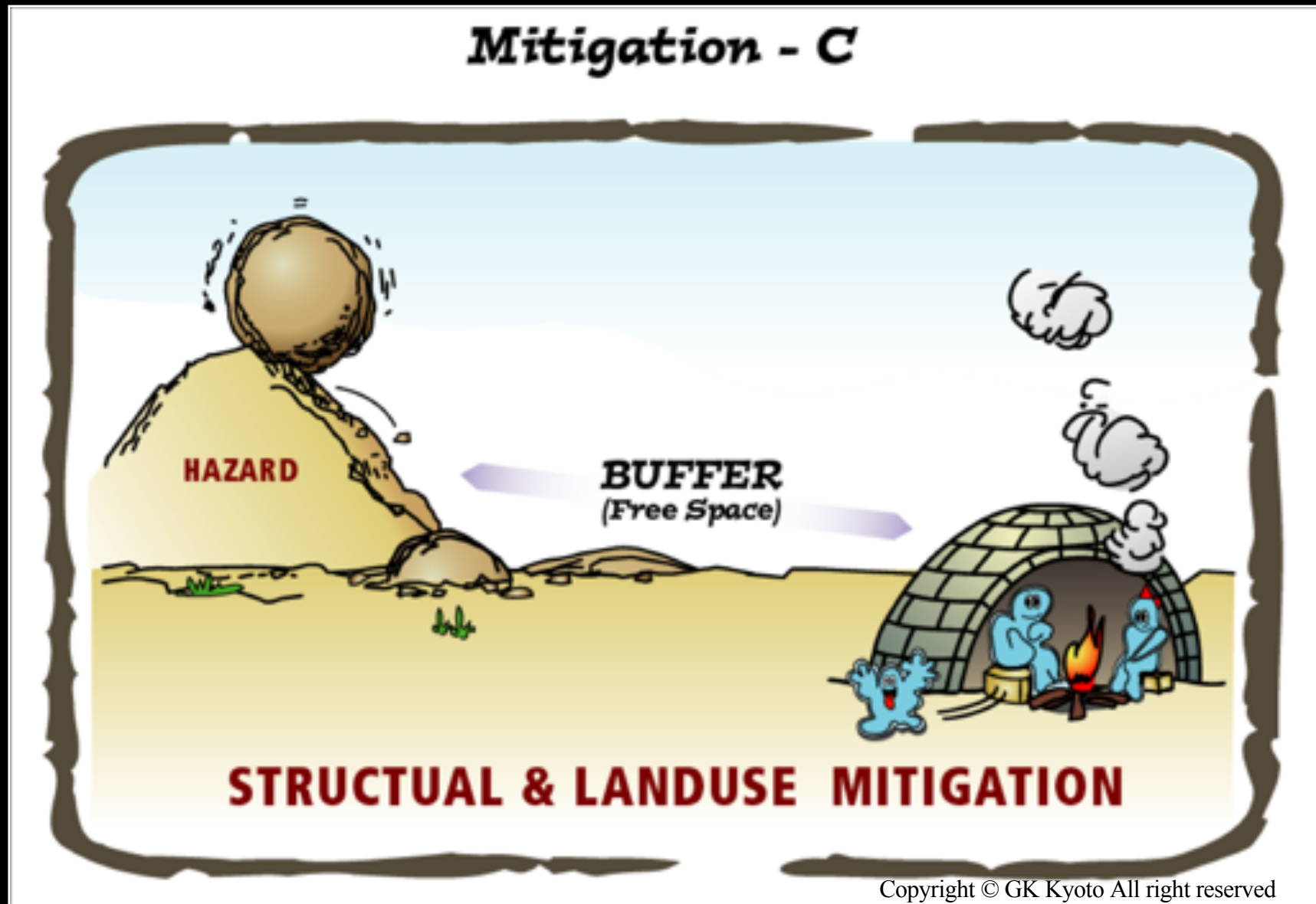


Landuse Mitigation

Mitigation - B



Structural and Landuse Mitigation



Mitigation

- Activities aimed at eliminating or reducing the occurrence of a disaster and reducing the effects of unavoidable disasters.
- Measures that will reduce the potential for damage to a facility or structure from a disaster event.

(FEMA)

Preparedness



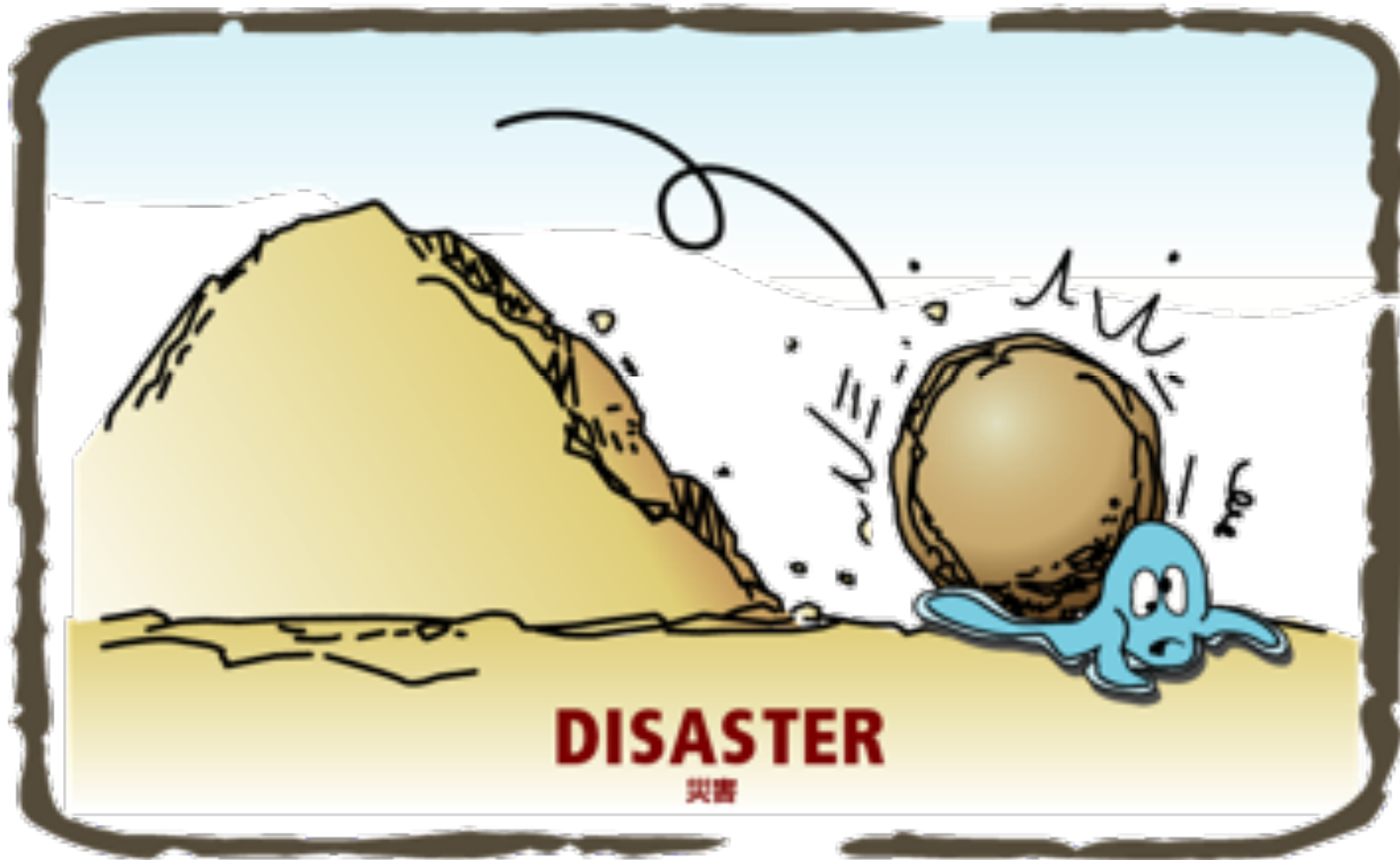
Preparedness

- Activities taken to help save lives and minimize damage by preparing people to respond appropriately when an emergency is imminent. Preparedness includes planning to respond when an emergency or disaster occurs and working to increase resources available to respond effectively.

(FEMA)

Disaster

Disaster = f (Hazard, Vulnerability)



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Response

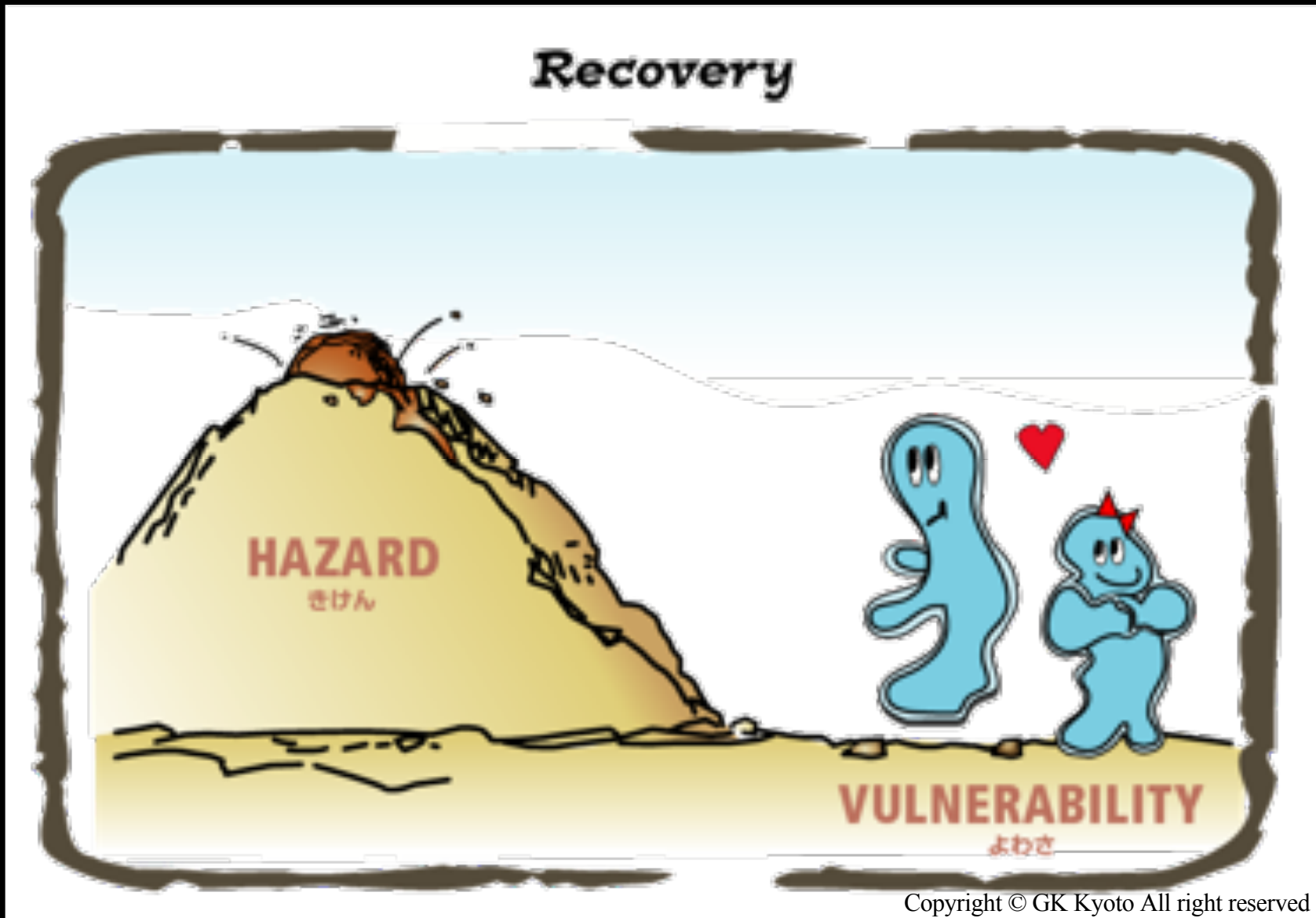


Response

- Activities occurring during or immediately following a disaster designed to provide emergency assistance to the victims of the event, reduce the likelihood of secondary damage and to expedite recovery operations.

(FEMA)

Recovery



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Recovery

- Activities traditionally associated with providing Federal supplemental disaster recovery assistance under a disaster declaration. Recovery includes individual and public assistance programs that provide temporary housing assistance, grants, and loans to eligible individuals and government entities to recover from the effects of a disaster.
- (FEMA)

Build Back Better (より良い復興)

Sendai Framework for Disaster Risk Reduction(仙台防災枠組), 2015

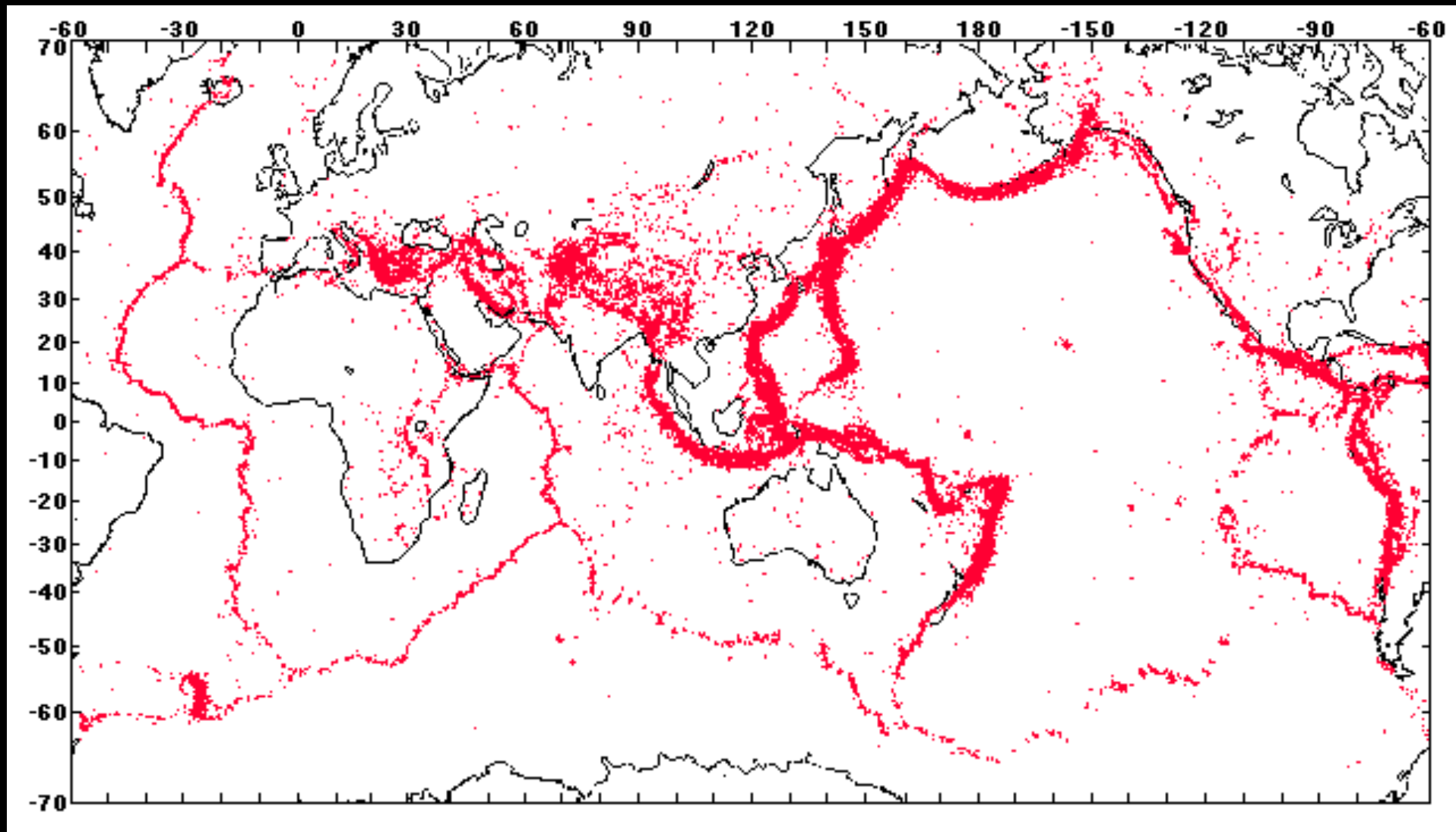


3



Japan as a Disaster-prone Country and Learning from the Past Disasters

Hazard: World Earthquake Map



Vulnerability: Wooden House Congested Districts



Photo: O. Murao

Japanese Traditional House Made of Wood and Paper

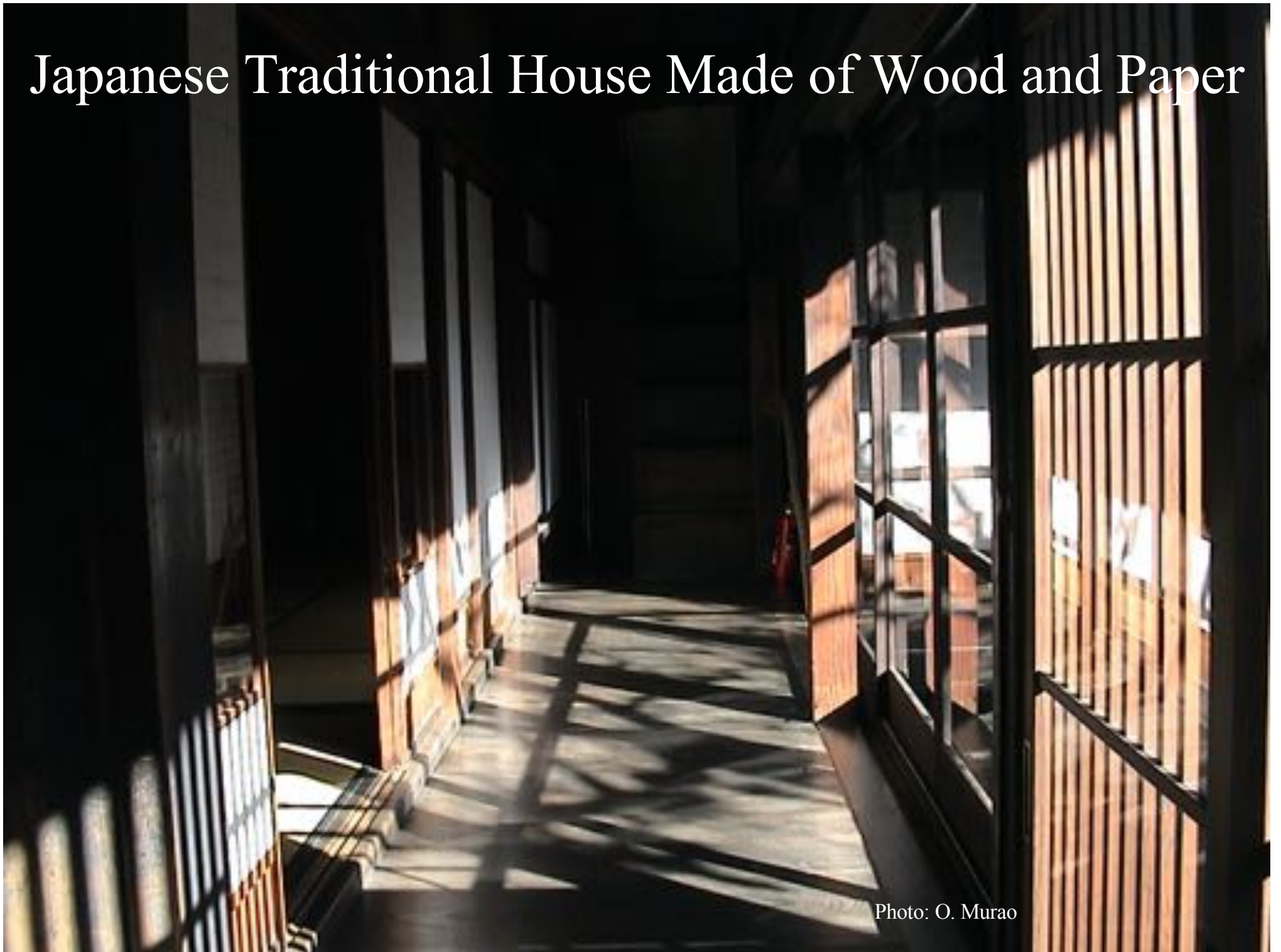


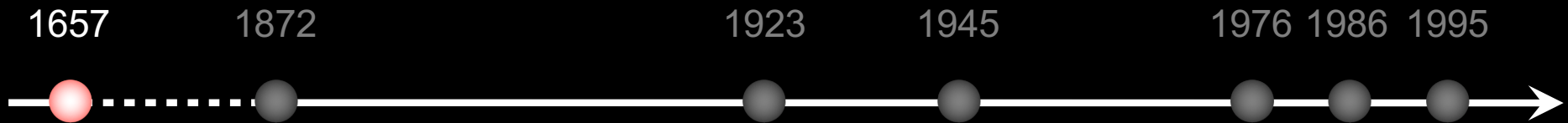
Photo: O. Murao

Exposed Value: High Population Density



Photo: O. Murao

1657 Meireki Great Fire in Edo Period (Old Tokyo)



Public Open Space in Ryogoku to Prevent Fire Spread



Edo Tokyo Museum

Walls to Prevent Fire Spread in Waki, Tokushima

Udatsu
卯建(うだつ)
うだつがあがらない



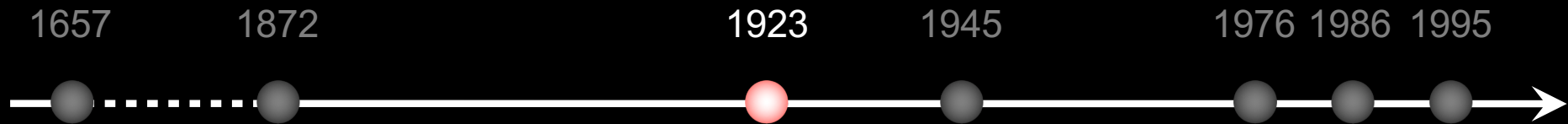
Photo: O. Murao

Warehouses with Tiled Roof in Kawagoe, Saitama



Photo: O. Murao

Great Tokyo Earthquake



難避の君象海の大の近野戦屋花僧二十國公草漢

(二萬執業民衆大京東)



Tokyo Memorial Hall

Master Plan (1921)



Post-Earthquake Recovery Master Plan (1924-30)



1. Urban Structure Readjustment



Showa Avenue



Recovery Parks



Sumida Park (the First Water Front Park)



AFO

Yamashita Waterfront Park (Yokohama)

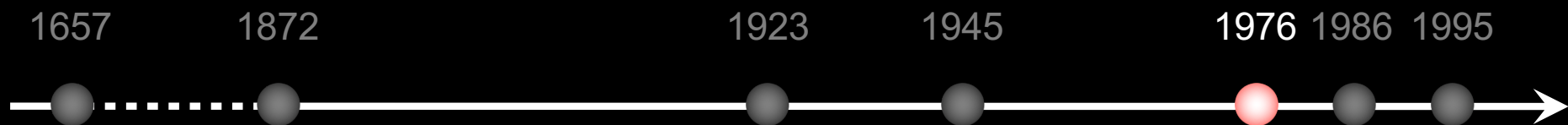


Providing Modern Apartments (Doujunkai)



Photo: O. Murao

Sakata Fire (Yamagata)

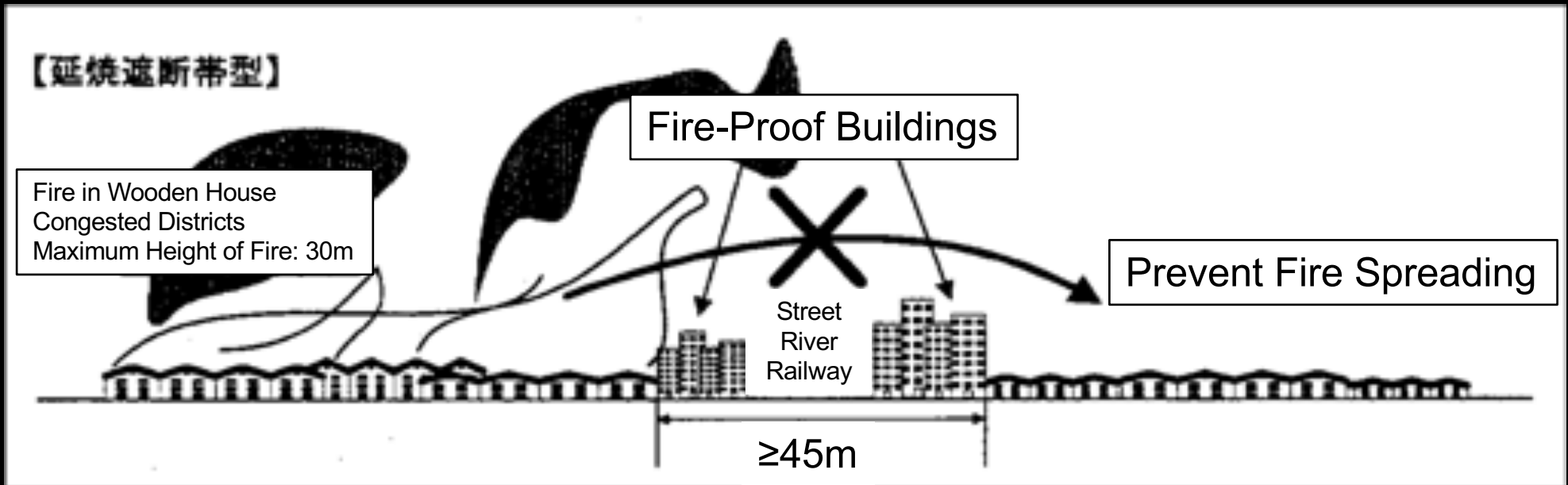


Sakata City

Aftermath of the Fire



Street Design to Prevent Fire Spreading



A wide, paved pedestrian walkway in Hakodate City, Japan, flanked by greenery and modern buildings. The walkway is made of light-colored paving stones and runs straight into the distance. On the left side of the walkway, there is a low, green hedge and a row of young trees supported by wooden stakes. On the right side, there is a grassy area with more trees and a tall, green lamppost. In the background, there are several modern buildings, including a tall one with a 'P' sign and a red logo. The sky is blue with some light clouds.

Present Hakodate City with Green Belt Network

Photo: C

Designated Evacuation Open Space in Tokyo



Timeline of Critical Disastrous Events



Great Fires in Old Tokyo

17,18C

World War II

1945

Sakata
Fire

1976

Great Kobe
Earthquake

1995

1872

1923

1986

Ginza Fire

Great Tokyo Earthquake

Disaster Prevention Base
In Eastern Tokyo



3. History of Natural Disasters in Japan (1888 - 2010)

Japan is located in one of the most disaster-prone areas in the world, and we Japanese have experienced many disastrous events throughout history. Thus Japanese society and cities are skilled at disaster management. Each disaster has helped develop and strengthen our disaster management system. Although we occasionally experience catastrophic disasters, the number of deaths and missing persons due to disasters has been declining as a result of gradual improvement of the various aspects of our disaster management system.

This map displays the distribution of major disasters in Japan from 1888 to 2010. About sixty disasters are classified into four types: earthquake or tsunami, volcanic disaster, windstorm or flood, and heavy snowfall.

2009 Terrestrial Rains in the Tokai Region : 18
→ 2009 - Specified special disaster Countermeasures Act

1948 Fukuoka Earthquake (M7.6) : 3,769
→ 1949 - Building Standards Law

2010 Heavy Snowfall : 126
1983 Terrestrial Rains : 127

1999 Terrestrial Rains in Shikoku
→ 2000 - Act on Promotion of Disaster Countermeasures for Southern Disaster Prone Areas

1970 Terrestrial Rains : 407
1967 Terrestrial Rains : 236

1946 Tsunami Earthquake (M8.0) : 1,440
→ 1947 - Disaster Relief Act

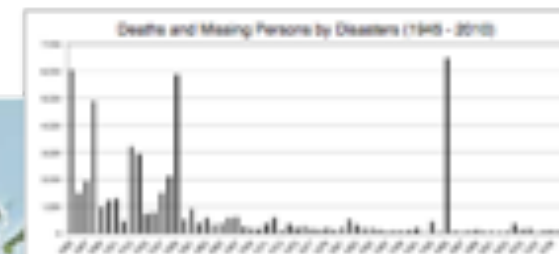
1976 Typhoon 17 and Terrestrial Rains : 175

1904 Mt. Tokaijima Eruption : 36

1975 Mt. Tokaijima Eruption : ...
→ 1975 - Act on Disaster Measures for Active Volcanoes

1993 Terrestrial Rains : 1,440
1987 Terrestrial Rains : 105

1981 Typhoon Ruth : 90
1945 Typhoon Makurazaki : 1,706



Year	Disaster (Magnitude)	Number of Deaths and Missing
1945	Earthquake (epicenter marked), Tsunami	1,000
1945	Volcanic disaster	1,000
1945	Windstorm (epicenter marked), Flood	1,000
1945	Heavy snowfall (peak with higher seasonal total marked)	1,000

1964 Niigata Earthquake (M7.6) : 36
→ 1965 - Act on Earthquake Insurance Insurance

1976 Miyagi Sea-Off Earthquake (M7.6) : 28
→ 1981 - Amendment of Building Standards Law

2004 Niigata Sea-Off Earthquake (M6.8) : 47
→ 2005 - Amendment of Act on Promotion of the Earthquake-proof Renovation of Buildings
→ Amendment of Flood Control Act
→ Amendment of Act on Promotion of Disaster Countermeasures for Southern Disaster Prone Areas

1995 Great Hanshin-Awaji Earthquake (M7.3) : 4,407
→ 1996 - Act on Special Measures for Earthquake Disaster Countermeasures
→ Act on Promotion of the Earthquake-proof Renovation of Buildings
→ Amendment of Disaster Countermeasures Basic Act
→ Amendment of Act on Special Measures for Large-scale Earthquakes

1999 Typhoon 16 : 1,000
→ 1999 - Act on Special Measures for Prevention of Rights and Profits of the Victims of Specified Disasters
→ 1997 - Act on Promotion of Disaster Resilience Improvement in Seismicity-prone Areas
→ 1998 - Act on Budgetary Support and Recovery of Disaster Victims

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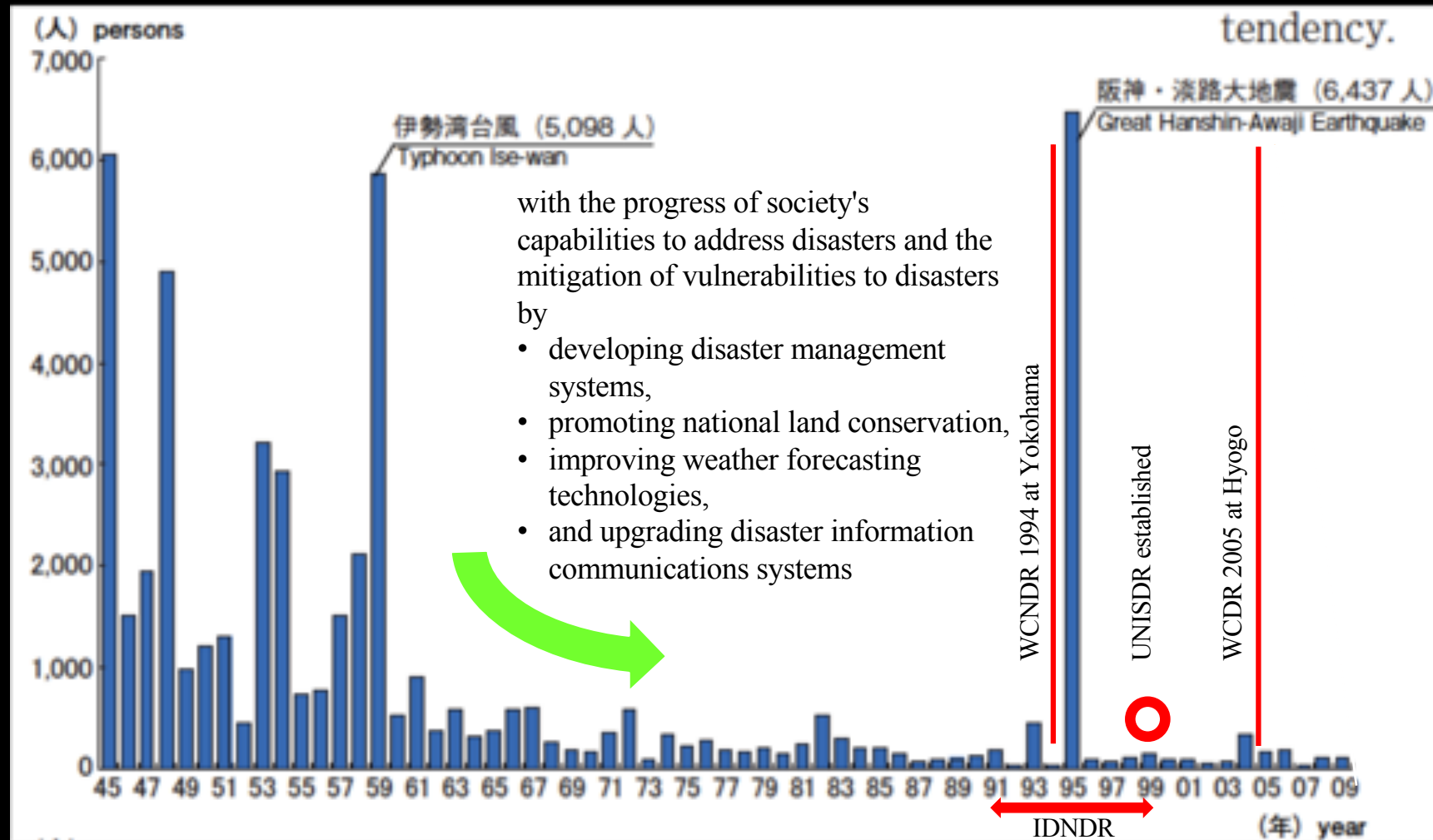
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Data Source: "Disaster Management in Japan" (Cabinet Office, Government of Japan, 2011)

Number of Deaths and Missing Persons in Disasters



An aerial photograph showing a coastal town in Japan. In the foreground, there are several parking lots filled with cars. Behind them, there are residential buildings, some of which appear to be damaged or partially submerged. The background shows a large body of water, likely the ocean, with a line of trees and buildings along the coast. The overall scene depicts the aftermath of a major disaster.

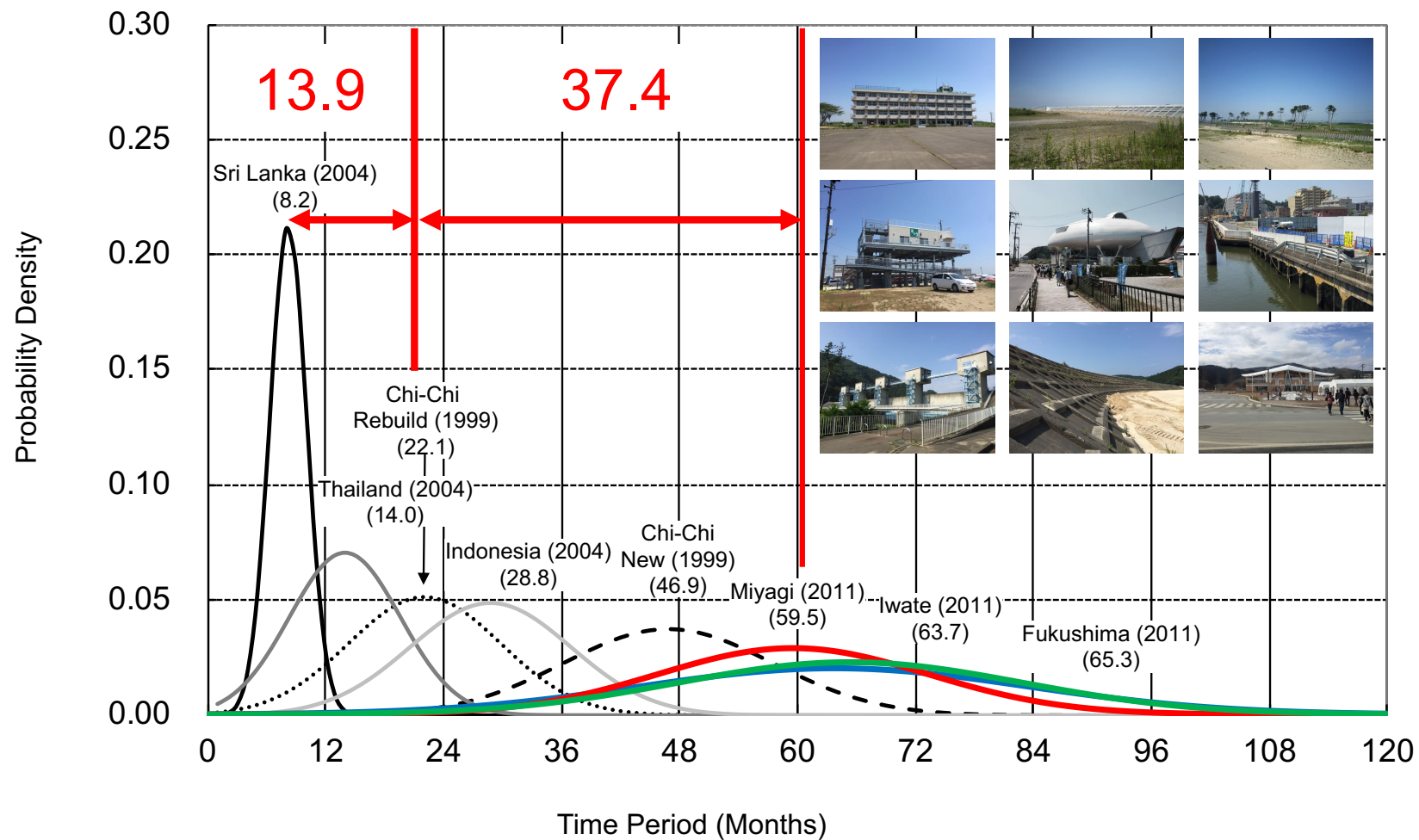
March 11, 2011

The Great East Japan Earthquake and Tsunami

(Death Toll/Missing: 22,010 as of March 2016)

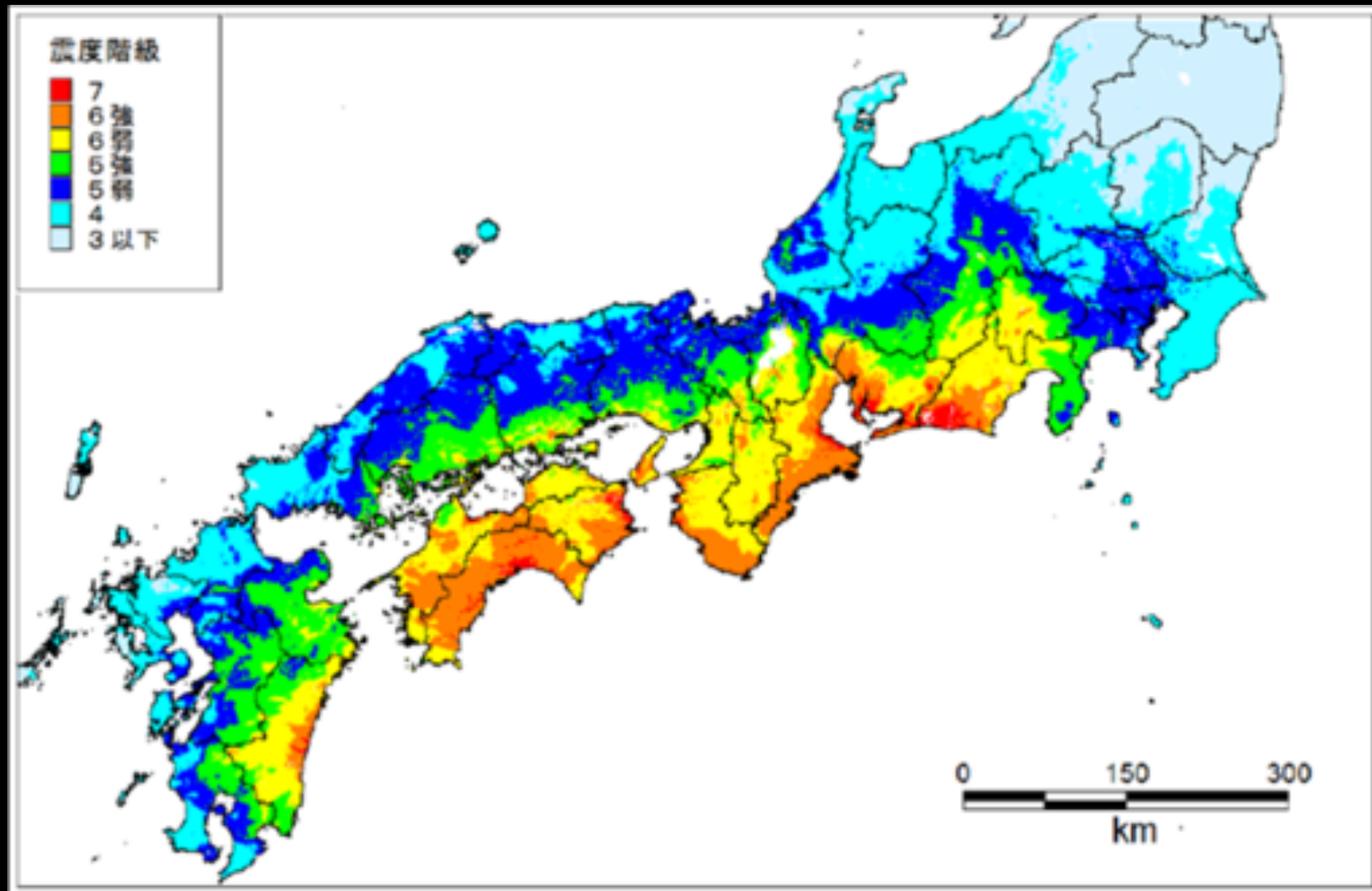


Comparison of post-disaster recovery processes from the 1999 Chi-Chi Earthquake, the 2004 Indian Ocean Tsunami, and the 2011 Great East Japan Earthquake and Tsunami using probability density functions



Importance of Learning from Past Disasters

Anticipated Nankai Megathrust Earthquakes



Japan Meteorological Agency

Urban Disaster Risk Reduction
Japan as a disaster-prone country and learning
from past disasters