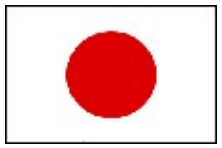
Identification of Risks to enable Preventive Investment

- the Japanese Experience -

February 2022 @ SPP4

NAGOYA UNIVERSITY



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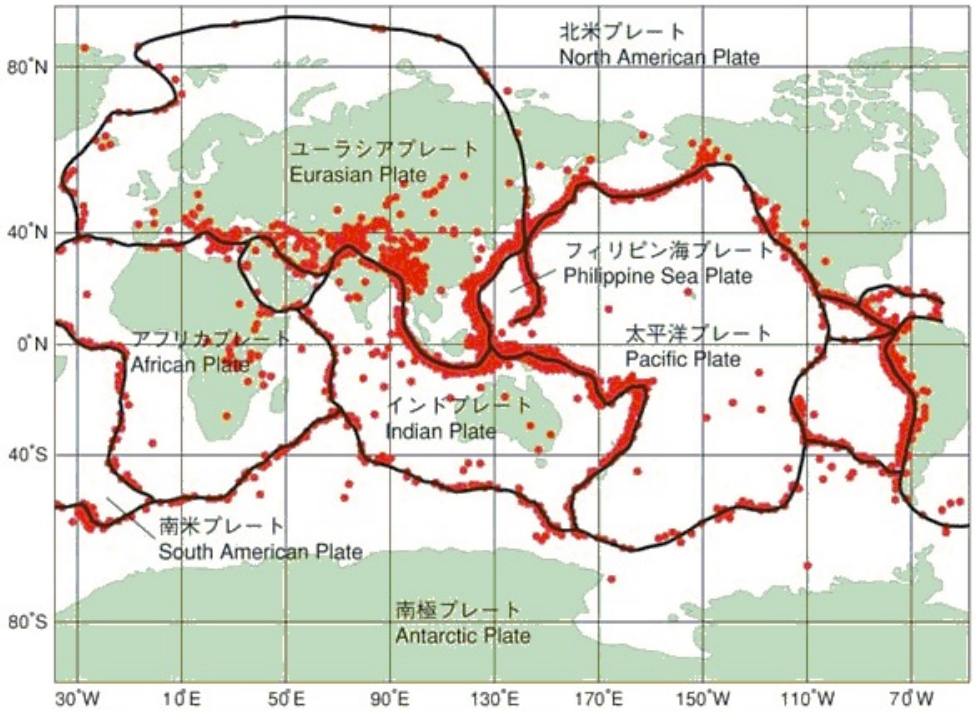
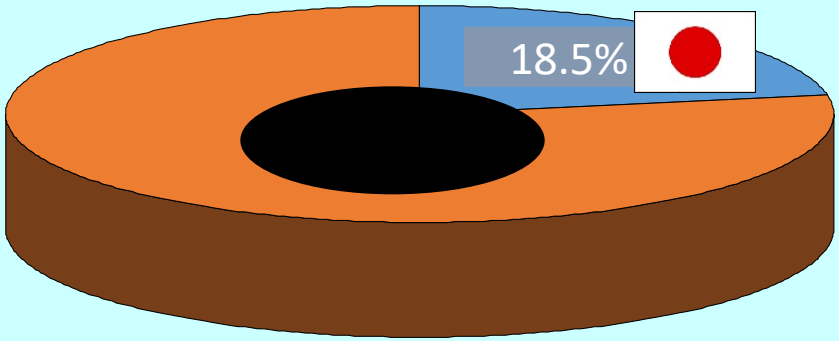
Board of Trustees, Asian Disaster Reduction Center

Mother Nature is not Gentle in Japan !

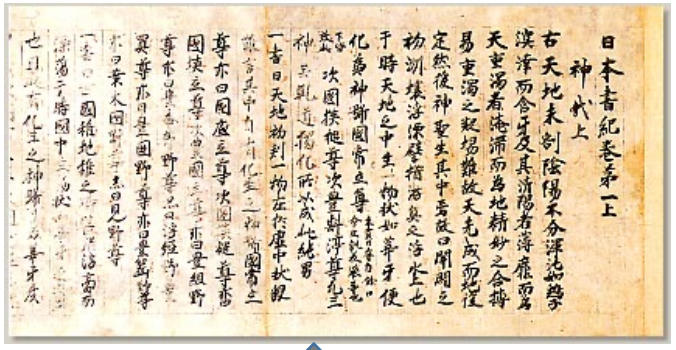
- **Earthquakes**
- **Tsunamis**
- **Volcanic Eruptions**
- **Typhoons**
  (July – October)
- **Heavy Monsoon Rains**
  (May – July)
- **Floods**
- **Landslides**
- **Snow Avalanches**



Number of earthquakes with magnitude of 6.0 or larger (2003-2013) Japan's Unfair Share



Japan's long tradition of coping with natural disasters



- 416A.D. August, Yamato-Kochi Earthquake

The first written record of Earthquake in Japan within "Nihonshoki" the first official history book of Japan, edited in 8th century.

- 684A.D. November, Hakuho-Nankai Tonankai Earthquake (Estimate Magnitude: 8.2-3) & Tsunami

The first written record of Earthquake Tsunami in Japan within "Nihonshoki".

- Most dreadful things historically in Japan for children

1. Earthquakes, 2. Lightning/Thunder, 3. Fire, 4. father

Jishin Kaminari Kaji Oyaji

Not anymore

Traditional “UKIYOE” drawing after 1855 October Ansei-Edo Earthquake

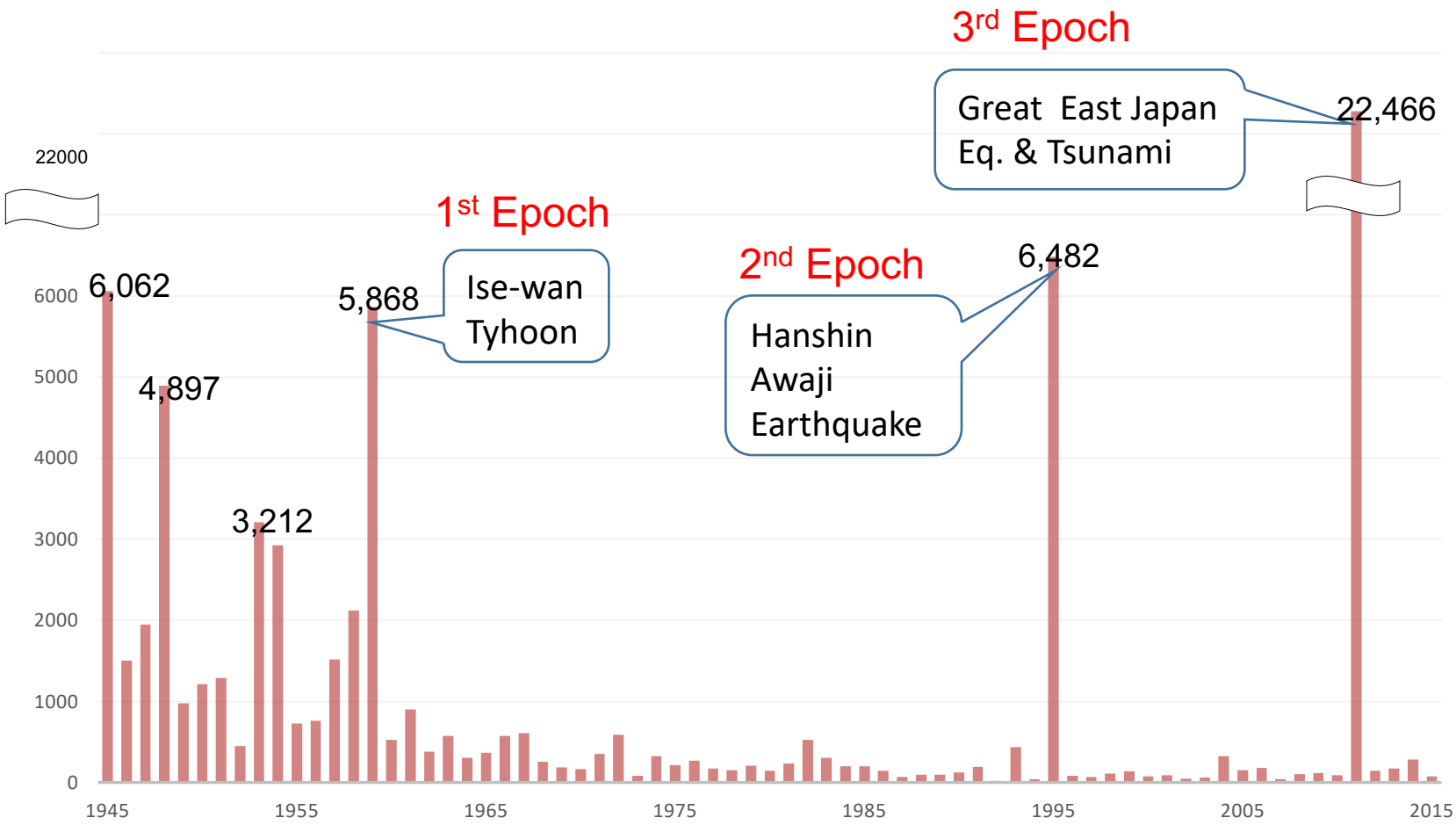
Edo (Old name of Tokyo) citizens beating the legendary Catfish Monster which was believed to cause earthquake

Modern Japan is still full of Tragedies & Lessons Learnt

1896 Meiji-Sanriku
Tsunami killed 22,000

1923 Great Kanto Earthquake
destroyed Tokyo and killed 105,000

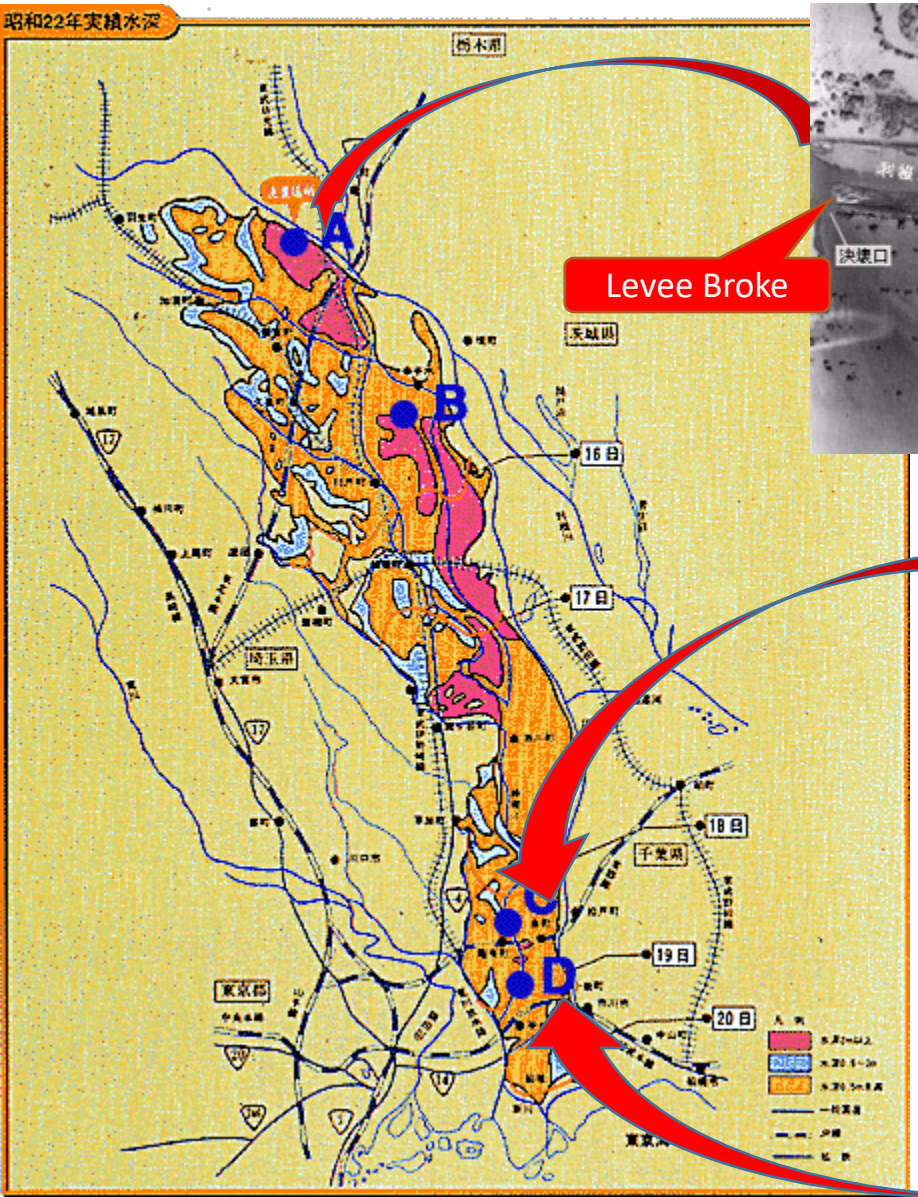
Statistics on Casualties by Natural Disasters in Japan 1945-2015



Severe Damage by Series of Typhoons right after the end of WW Ⅱ

Year	Typhoon	Death Toll
1945	Makurazaki Typhoon	3,756
1947	Kathleen Typhoon	1,930
1948	Ion Typhoon	838
1950	Jane Typhoon	539
1951	Ruth Typhoon	943
1954	Toyamaru Typhoon (with big ferry shipwreck)	1,761
1958	Kanogawa Typhoon	1,269
1959	**Ise-wan Typhoon**	**5,098**

Kathleen Typhoon, inundated Tokyo 19 Sep.1947
440km^2 inundated, 1,930 casualties



Levee Broke

Right levee of Tone River broke 16 Sept. at Ootone-town in Saitama, Floodwaters inundated downstream.

Photos by MLIT

Flooding in Adachi-ku, Tokyo 19 Sept.

Totally inundated Katsushika-ku Tokyo, 19 Sept.

Kathleen Typhoon was a wake-up call for flood protection of urban areas in post WW II in Japan

- 1949 Flood Control Council in Ministry of Construction decided "River Improvement Plan" for 10 major river systems. It called for programed flood control by dams.
- 1949 Flood Control Council proposed "Tone River Improvement Plan" which included construction of 10 dams in upstream and construction of anti-flood pond along Watarase river.

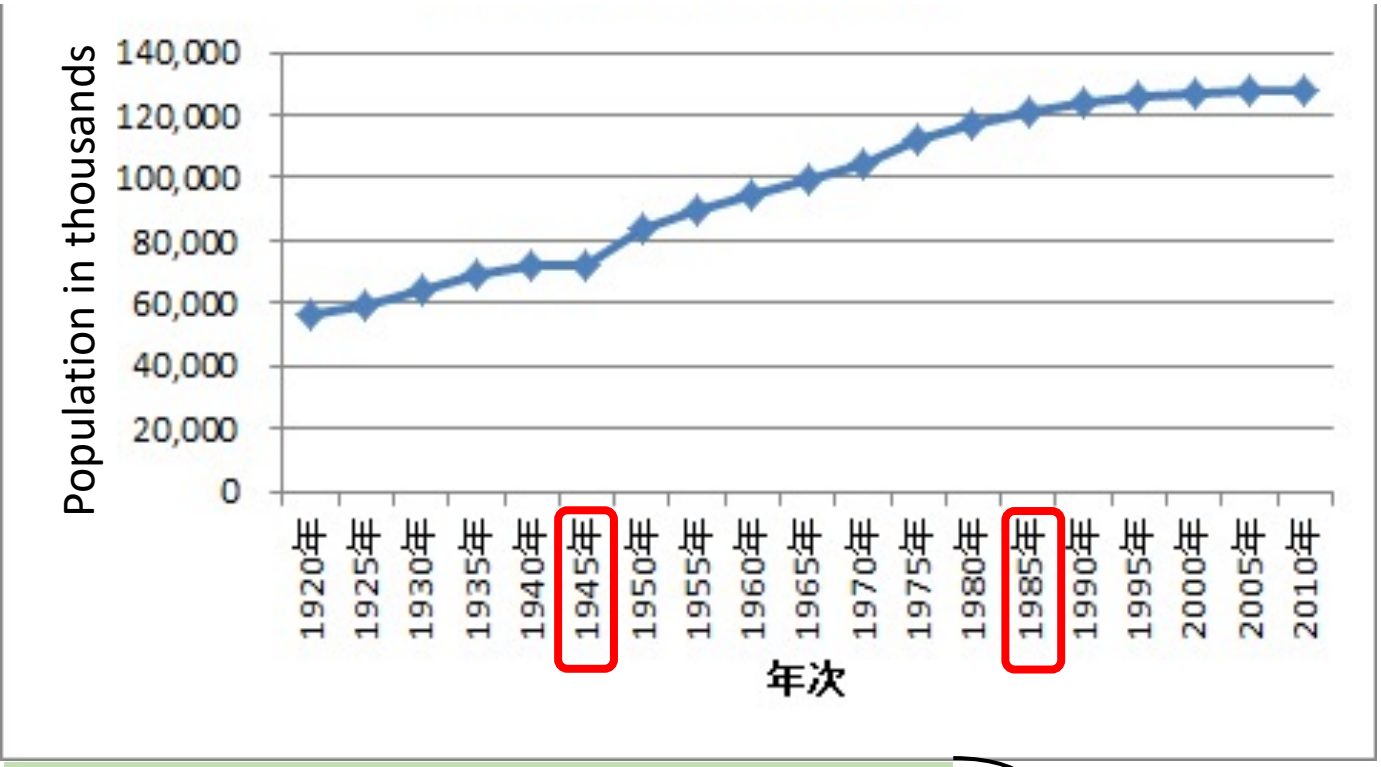
Multi-purpose Yagisawa Dam upstream in Tone River
started construction in 1959 completed in 1967
131m high concrete arch dam, Japan Water Agency

- Flood control
- Agricultural water & Urban water supply
- Hydroelectricity

Watarase anti-flood pond

Photo by MLIT

Population Growth 1945 – 1985 brought numerous social issues



Population Growth

demand for

- Housing
- Water
- Food (farmland & water)
- Electricity
- Transportation

& more

- Flood control,
- Water resource development,
- Hydroelectricity

were the keys to social stability and economic development of Japan in post WW II era

- Housing demand
- Industrial development
- Farmland development

Land deformation in urban areas & suburbs,
Land development in coastal areas & mild hill areas

Population Growth & Land Deformation may induce Disasters

Ise-wan Typhoon, hit Nagoya 26 Sep.1959
Lowest pressure 894 hPa , Max Wind Speed 75m/s

Photo by Takahama

Ise-wan Typhoon landed midnight. Flooding from upstream and high tide & storm surge from the sea sandwiched the low-lying areas of Nagoya, resulted in huge casualties.

1959 Ise-Wan Typhoon was the 1st Epoch-Making Turning Point

Ise-wan Typhoon hit Nagoya, the 3rd largest metropolitan area in Japan. 5098 killed.

- Response oriented approach to **preventive approach**
- Individual approach to **comprehensive multi-sectoral approach**
- **Investment** for disaster reduction
- National, Prefecture and Municipal Gov'ts were given **responsibilities**

Disaster Countermeasures Basic Act 1961

Enabled Investment for Disaster Prevention

- **Flood Control & Land Conservation, Forest Conservation**
- **Meteorological Observation** Mt. Fuji Rader Site, Meteo-Sats
- **Emergency Telecommunication Systems**

⋮

Institutionalization of Disaster Reduction Investments

Designation of "Disaster Prevention Day"

Public Awareness Programs, Disaster Drills & Exercises

1 September (Annual Nationwide Event)

Great Success in decreasing Typhoon & Flood Casualties

Investing in Science and Technology for Disaster Reduction

Meteorological Radar

On top of Mt. FUJI 3776m high

10 March 1965,
The first high mountain meteorological radar started observation.

Mt. FUJI radar was awarded “IEEE Milestone in Electrical Engineering & Computing” in 2000

Severe Damage by Earthquakes(1945-1995)

Year	Earthquake (Magnitude)	Death Toll
1945	Mikawa Earthquake (M6.8)	2,306
1946	Nankai Earthquake (M8.0)	1,330
1948	Fukui Earthquake (M7.1)	3,769
1952	Tokachi-oki Earthquake (M8.2)	33
1960	Chile Earthquake & Tsunami (M8.5)	139
1964	Niigata Earthquake (M7.5)	26
1968	Tokachi-oki Earthquake (M7.9)	52
1974	Izu-hanto-oki Earthquake (M6.9)	30
1978	Izu-Oshima Kinkai Earthquake (M7.0)	25
1978	Miyagi-ken-oki Earthquake (M7.4)	28
1983	Nihonkai Chubu Earthquake & Tsunami (M7.7)	104
1984	Nagano-ken Seibu Earthquake (M6.8)	29
1993	Hokkaido Nansei-oki Earthquake & Tsunami (M7.8)	230
1995	**Hanshin-Awaji <Kobe> Earthquake (M7.3)**	**6,437**

1995 Hanshin-Awaji (Kobe) Earthquake (M7.3)

was the 2nd Epoch-Making Turning Point

Fire in a city center

Collapsed houses

Damaged office building

Damaged railway track

Collapsed viaducts of an expressway

6,437 Casualties

Lesson1: Collapse of old houses built before 1981 standard was the main cause of death

5,520 direct deaths (+917 relevant deaths)

total 6,437 victims

83% immediately killed by building collapse

surgeon general's autopsy report

Prevention & Mitigation

Preparedness

Ensure Building Safety !

Public Awareness

Disaster Manager's Proper Action

1995 new Act on Seismic Retrofitting of Existing Buildings

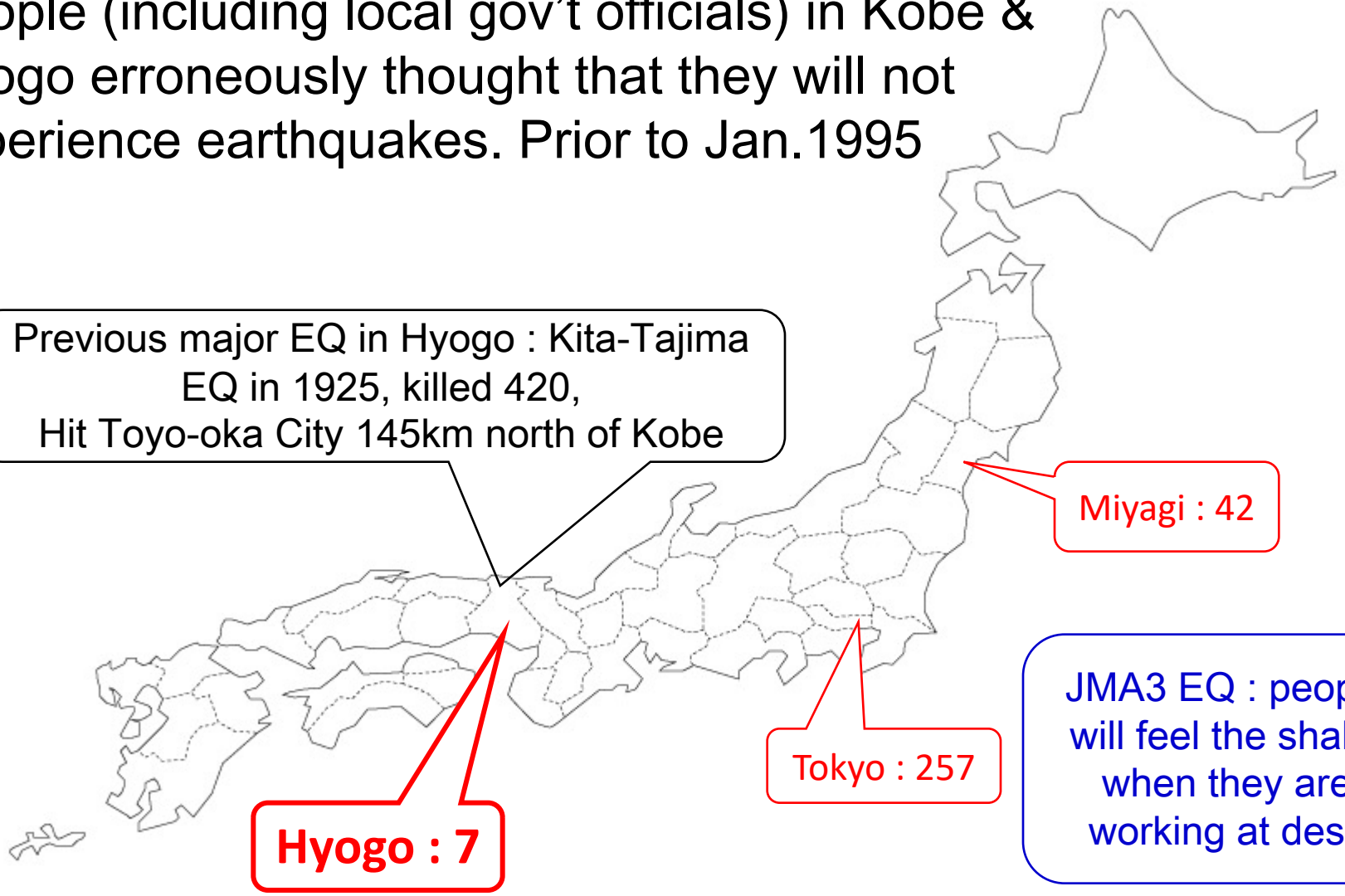
Public awareness campaign on housing seismic safety

Public campaign on affixing furniture and room safety

更新

Biggest Lesson: Lack of Earthquake Awareness in Kobe & Hyogo

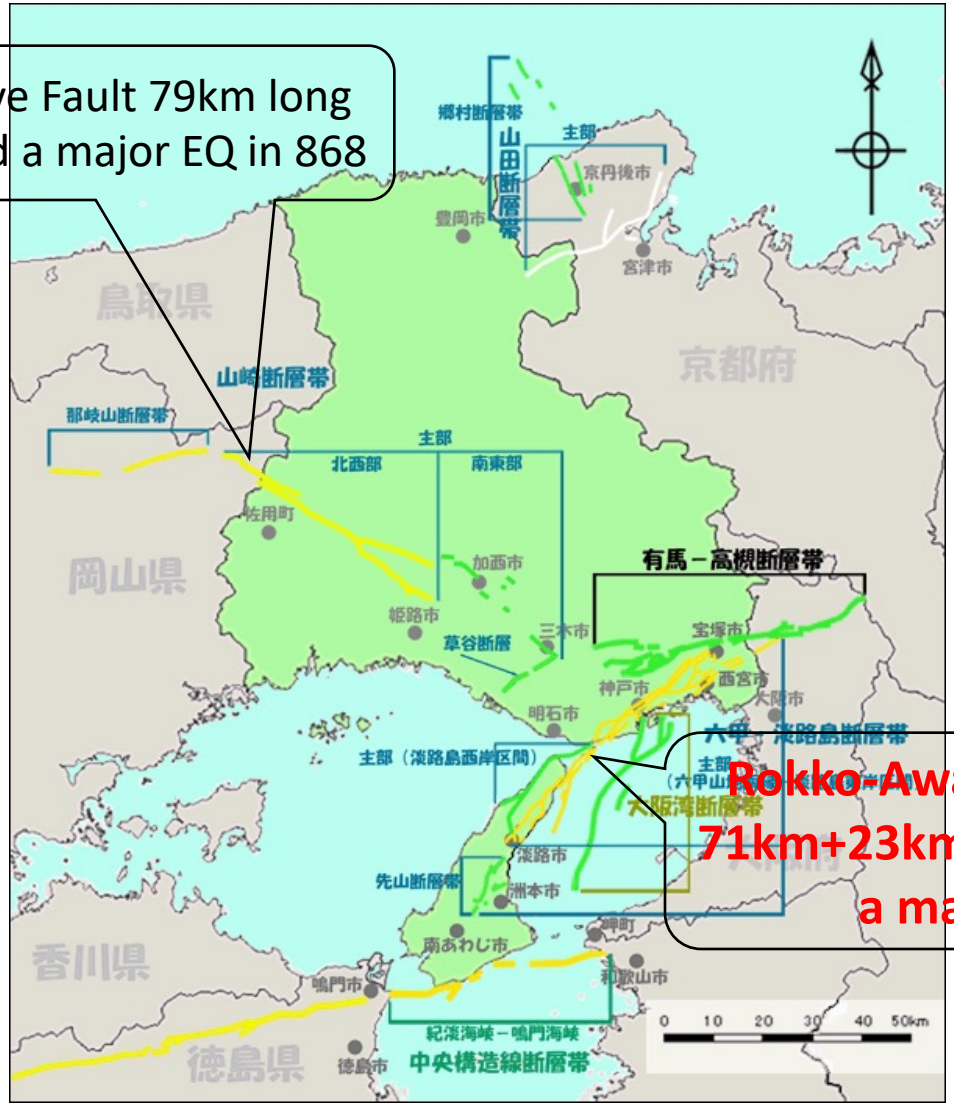
People (including local gov't officials) in Kobe & Hyogo erroneously thought that they will not experience earthquakes. Prior to Jan.1995



Number of EQs greater than JMA3 felt in 1985-1994

Existence of Active Faults in Hyogo were known to only a limited number of scientists

Yamazaki Active Fault 79km long which triggered a major EQ in 868

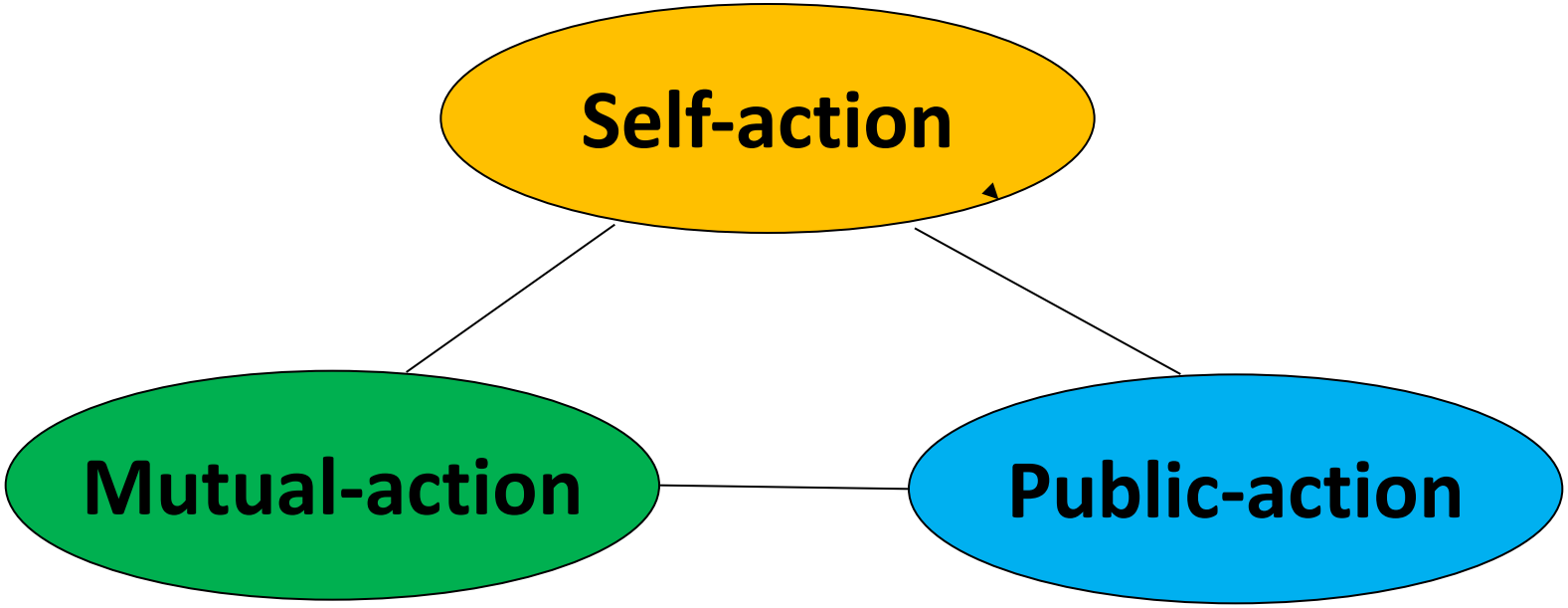


Rokko-Awajishima Active Fault 71km+23km long which triggered a major EQ in 1596

http://www5d.biglobe.ne.jp/~kabataf/katudansou/hyougo/hyougo.htm

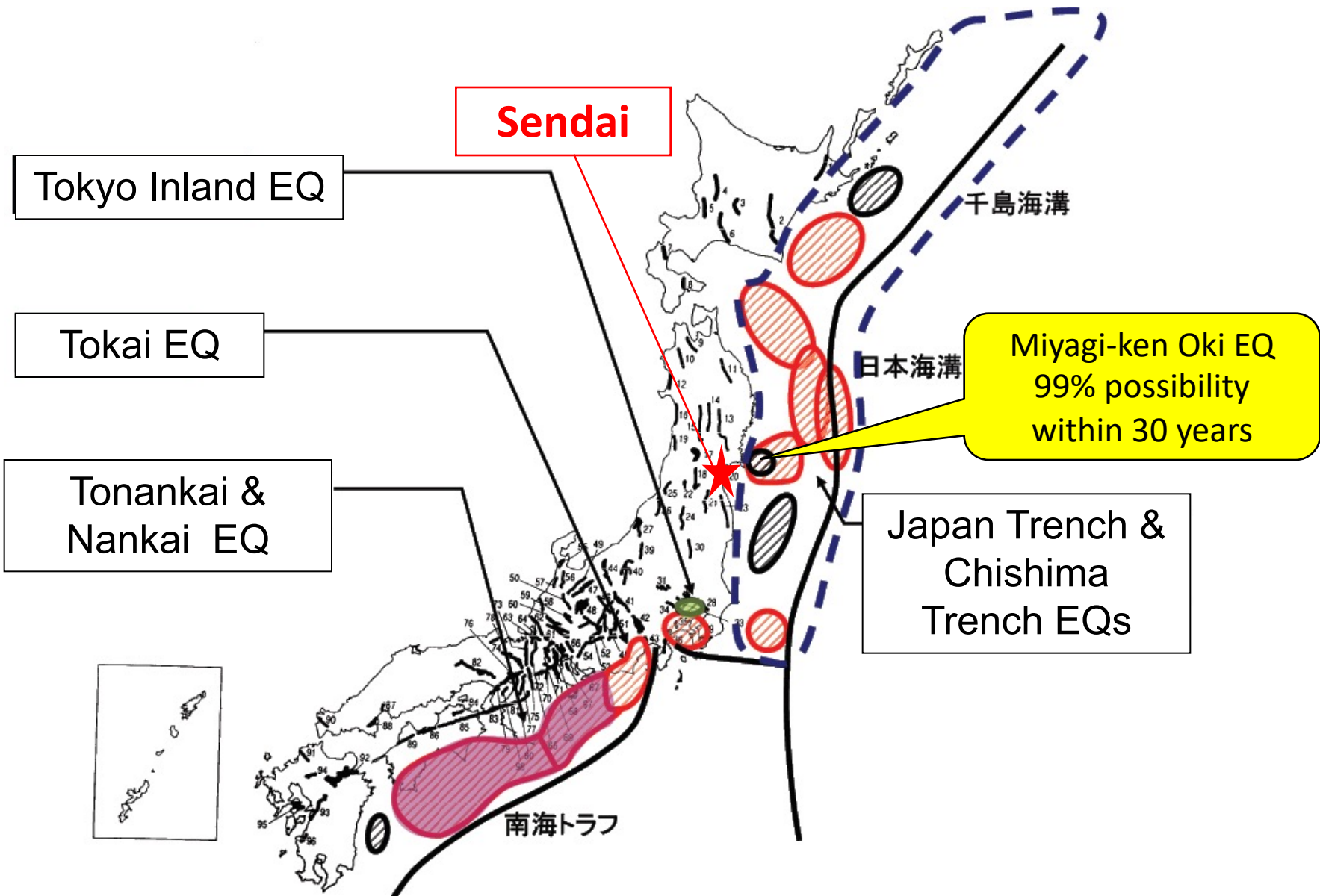
Paradigm shift after 1995 Hanshin-Awaji (Kobe) Earthquake

Call for a Nation-Wide Movement for Disaster Reduction Actions



Self-help action by individuals, families and companies
Mutual-help action at neighborhoods and local communities
Public-action by governments

Recognized Possibilities of large-scale M8 earthquakes and tsunamis in Japan (pre-2011)



M9 Earthquake & Tsunami Came ! 2011

The 3rd Epoch-Making Turning Point

写真出典仙台市復興五年記録誌

Tohoku was prepared for a Miyagi-ken Oki EQ of M7.6-M8.2,
but what came was M9 EQ & Tsunami

Energy of M9 earthquake is 32 times stronger than M8 earthquake

Enormous Destruction by the Tsunami !

Lessons from Disasters

What went wrong with pre-disaster countermeasures ?

What went right with pre-disaster countermeasures ?

It is no use crying over spilt milk,
but
We must make best of the lessons learnt.

SFDRR priority 3
“Investing in disaster risk reduction for resilience”

How to make effective investment beforehand ?

Hanshin-Awaji (Kobe) Earthquake (M7.3) 1995

Collapsed office building in Kobe

Population of Kobe 1990: 1,477,410

The Great East Japan Earthquake(M9.0) 2011

No collapse of buildings in Sendai.
Business as usual inside.

Population of Sendai 2010: 1,046,000

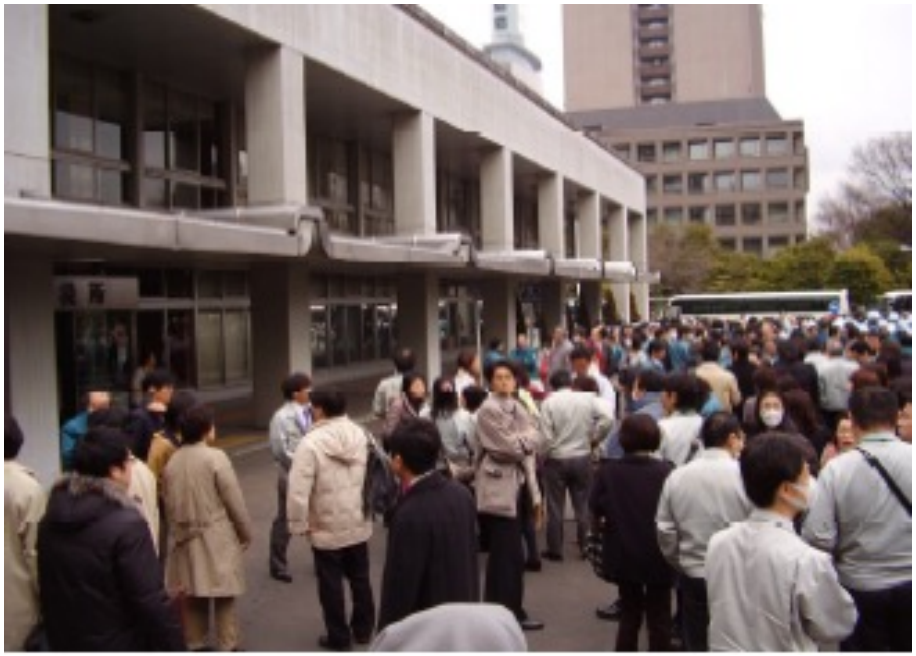
Sendai City carefully examined the lessons learnt of Kobe 1995

Hanshin-Awaji (Kobe) Earthquake (M7.3) 1995

Collapsed Kobe City Hall old building
Kobe water department was in the crushed 4th floor.

The Great East Japan Earthquake(M9.0) 2011

Sendai City Hall temporary evacuated for safety check.
Safety confirmed in 1 hour and resumed functions.



Sendai City carefully examined the lessons learnt of Kobe 1995

Seismic Retrofit of Sendai City Hall

Sendai City Hall built in 1965 (before the 1981 seismic standard)
Earthquake Resistance Analysis done in 1996 ⇒necessity for seismic retrofit
Seismic retrofit work done in 2007 to 2008

Seismic Brace with vibration damper inserted.

Seismic Brace & Seismometer installed on ground floor hall.

M9 Earthquake Came ! 11 March 2011

Structural safety of City Hall confirmed in 1 hour.
City hall served as temporary shelter for stranded commuters & visitors.

Photo by Tobishima Cooperation

Seismic Retrofit of Schools

Seismic retrofit of schools based on Sendai City Earthquake Resilience Policy April 2008

Progress of school seismic retrofitting : 99.6% done by April 2010

M9 Earthquake Came ! 11 March 2011

No structural damage to Sendai schools.
Not a single child killed in Sendai school.

How can we take action before ?

Past Experiences + Appreciation of Risk

Imagination of Future Disaster & Tragedy
What if (your house collapse, school collapse, hospital collapse, bridge fall, road blocked ++) ?

Knowledge of Effective Preventive Methods

Investment & Action !

Culture of Prevention must prevail to encourage investment & action for safety & resilience.

How can you convince the community leaders about disaster risk in their localities ?

1923 Great Kanto Earthquake Monument in Yokotsuna park in Sumida-ku Tokyo where 38,000 people perished by fires.

1933 Tsunami Stone Monument in Miyako City

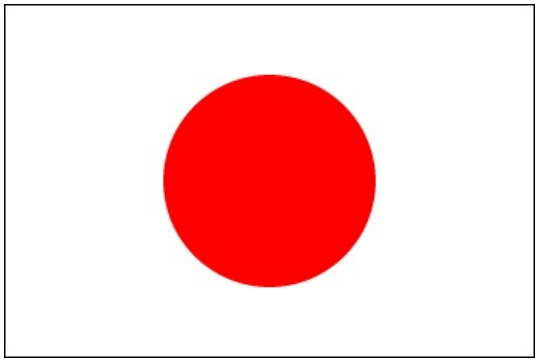
Why did our ancestors leave these historical assets for us ?

Proverb by Japanese Physics Scientist
Dr. Torahiko TERADA (1878-1935)
who investigated the damage by
1923 Great Kanto Earthquake

「天災は忘れた頃にやってくる」

“Natural Disasters will hit us by the Time people have forgotten about it”

How to foster & inherit the Culture of Prevention



Thank you for your attention!