Architecture for the Displaced:
Exploring Interventions for Sustainable and Resilient Communities

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@Department of Architecture, BUET, DHAKA

Integrated Resilience by the Built-Environment

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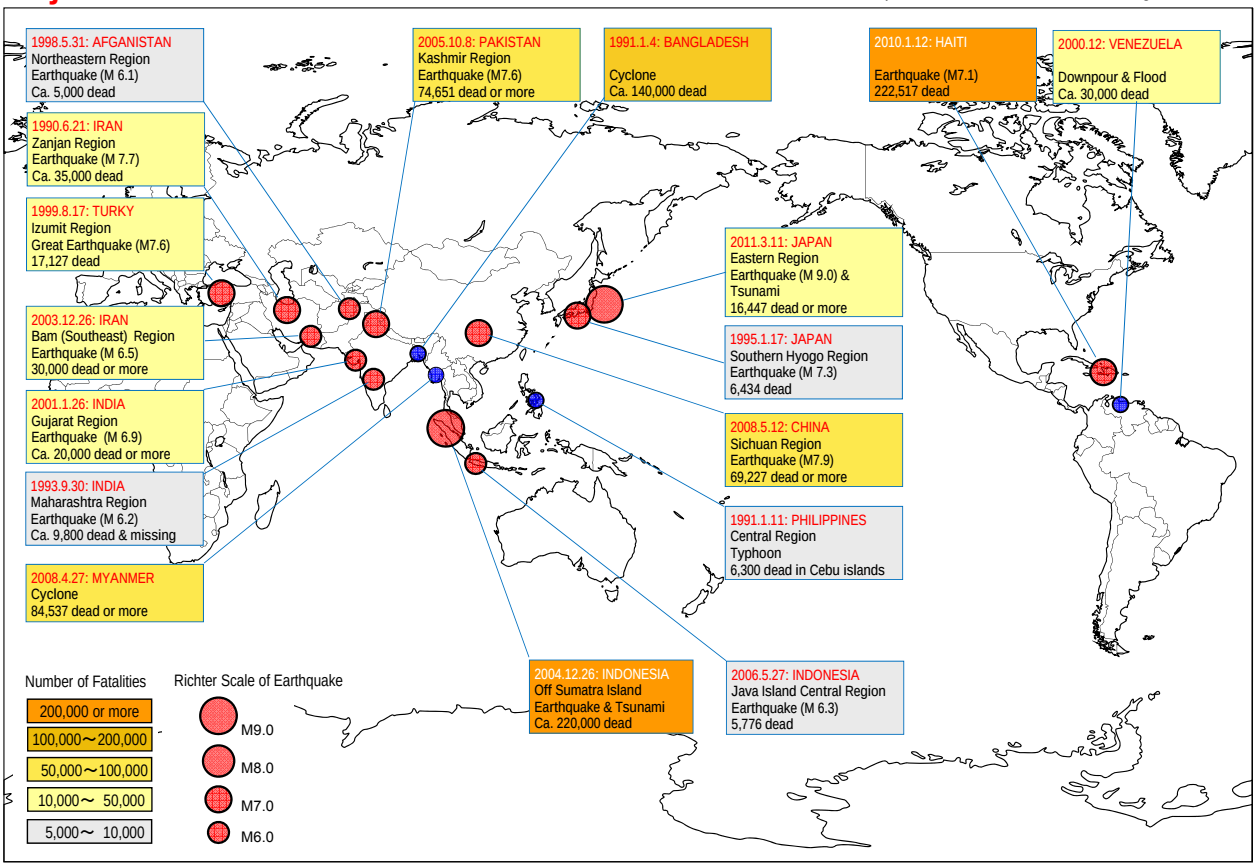
1. Disasters

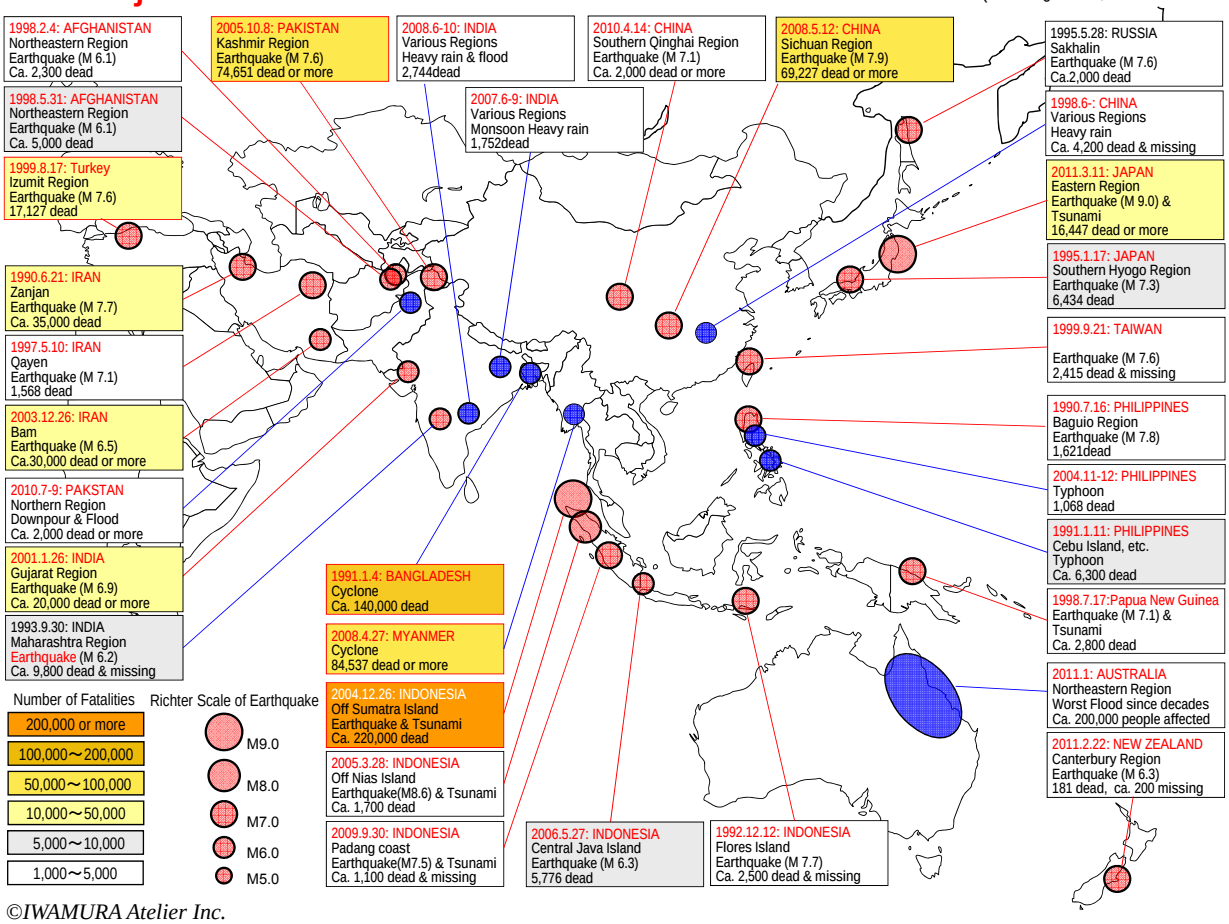
1.1 Occasional Disasters

Japan, like many other Asian counties, has been experiencing the frequent difficulties physically, environmentally, economically and socially, due to a variety of temporary & natural disasters including typhoons, floods, earthquakes, tsunamis, volcanic eruptions and the like.

Major Natural Disasters around the World since 1990 (more than 5,000 dead, as of Aug. 31st, 2011)



05 Major Natural Disasters in Asia & Oceania since 1990 (as of August 30th, 2011)



06 Record of Major Natural Disasters in Japan since 2011

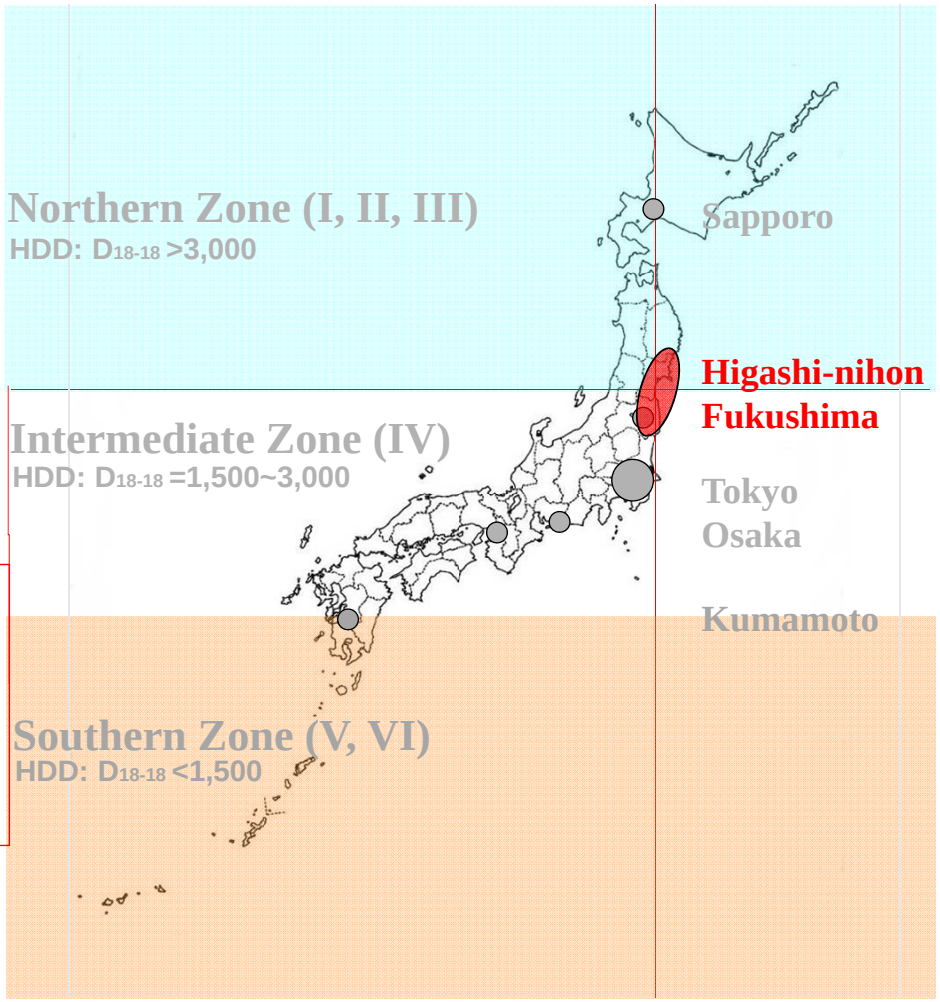
Date	Location	Category	Note
2011			
Jan.-	Kyushu	E. Eruptions	Since 0.5 century
Mar.9	Miyagi	EQ:M7.3	
Mar.11	East Japan	EQ:M9.0 & Tsunami	15,900D, 2,500M
Mar.12	Nagano	EQ:M6.7	
Mar.15	Shizuoka	EQ:M6.4	
Apr.11	Fukushima	EQ:M7.1	
May.-	West J.apan	Typhoon & Floods	Heavy rain
Jun.-	All Japan	Intense Heat	Heatstroke Deaths
Jul.-	Shikoku + α	Typhoon & Floods	Heavy rain
Jul.28-	Hokuriku	Floods	Heavy rain
Aug.30-	East to Kyushu	Typhoon & Floods	20,000-Flooded Houses
Sep.-	All Japan	Typhoon & Floods	7,800-Flooded Houses
Nov.-	Amami	Tornado	
Dec.3	Okinawa	EQ:M7.0	
Dec.3	All Japan	Cold Wave	Heavy snow
2012			
Jan.	Torishima	EQ:M7.0	
Apr.3	All Japan	Windstorm	
May.6	Ibaragi	Tornado:F3	1,000-Collapsed Houses
Jun.	All Japan	Typhoon & Floods	
Jul.-	West Japan	Heavy rains & Floods	12,000-Flooded Houses
Aug.	Kinki + α	Heavy rains & Floods	
Aug.25	Hokkaido	EQ:6.1	
Sep.-	All Japan	Typhoon & Floods	
Dec.-	All Japan	Cold wave	Snow storm & Snowfalls
2013			
Feb.2	Tokachi	EQ:M6.5	
Feb.25	Tochigi	EQ:M6.2	2,000-Collapsed Houses
Apr.14	South Hyogo	EQ:M6.3	2,000-Collapsed Houses
Apr.17	Miyake Isl.	EQ:M6.2	
May.18	Fukushima	EQ:M6.0	Offshore
Jul.-	Chugoku Region	Heavy rains & Floods	+Tornado
Aug-	West Japan	Intense heat	Heatstroke Deaths
Aug.4	Miyagi	EQ:M6.0	Offshore
Sep.-	All Japan	Typhoon & Floods	10,000-Flooded Houses
Oct.-	East Japan	Typhoon & Floods	
Oct.26	Fukushima	EQ:M7.1	Offshore

Date	Location	Category	Note
Nov.-	Ogasawara	E. Eruptions	New island
2014			
Jan.-	All Japan	Influenza epidemic	1.5mil. Affected people
Feb.-	East of Kinki	Heavy snow +storm	Snowfall records
Mar.14	Iyo-nada	EQ:M6.2	Offshore
May.5	Izu-oshima	EQ:M6.0	Offshore
Jun.-	West Japan	Torrential rain	Record rains
Jul.-	All Japan	Typhoon & Floods	Heavy rain & Landslide
Aug.-	All Japan	Typhoon & Floods	Heavy rain
Aug.10	Aomori	EQ:MM6.1	Offshore
Aug.-	West Japan	Torrential rains	Thousands of Flooded Hs.
Sep.-	E & N Japan	Torrential rains	Recorded 120mm & more
Sep.27	Gifu & Nagano	E. Eruptions	Postwar worst E. disaster
Oct.-	Mid Honshu	Typhoons & Floods	Heavy rains & Landslides
Nov.22	North Nagano	EQ:M6.7	
Dec.16	All Japan	Snow storms	Heavy snow & Cold wave
2015			
Feb.6	South Tokushima	EQ:M6.0	
Feb.17	Iwate	EQ:M6.9	Offshore
May.13	Miyagi & Iwate	EQ:M6.8	Offshore
May.29-	Kuchinoerabu	E. Eruptions	Pyroclastic flow
May.30	Ogasawara	EQ:M8.1	Offshore
Jun.29-	Hakone	Phreatic eruptions	Since few centuries
Jul.15-	West Japan	Typhoon & Floods	Heavy rains
Aug.-	S & W Japan	Typhoon & Floods	Windstorm & Heavy rains
Sep.-	Shikoku & East	Typhoon & Floods	Torrential rains
Sep.14	Mt. Aso	Phreatic eruptions	
2016			
Jan.14	South Hokkaido	EQ:M6.7	
Jan-	All Japan	Record cold wave	Heavy snow & Storm
Feb.-	Sakurajima	E. Eruptions	Volcanic smoke: 4,000m
Apr.14-	Mid Kumamoto	EQ:M6.5	Thousands of DH Frequent aftershocks
Jun.-	Kinki & East	Torrential rains	Floods & landslides
Aug.-	Chubu & East	4 Typhoons	Windstorms & heavy rains
	West Japan	Record hot days	Heatstroke sufferers
Sep.-	West Japan	Typhoon & Floods	Windstorms & heavy rains
Oct.-	South Japan	Typhoon & Floods	Windstorms & heavy rains

Note) EQ: Earth Quake (only M=6.0 or more), E. Eruptions: Explosive Eruptions

The Great Japan East Earthquake & Tsunami

March 11, 2011



Casualties:
（as of Mar. 10, 2016）

Deaths ： 15,894p
Missing ： 2,561p
Injured ： 6,152p

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Tsunami attacking the Sendai Airport and its vicinity after the 3.11 Earthquake

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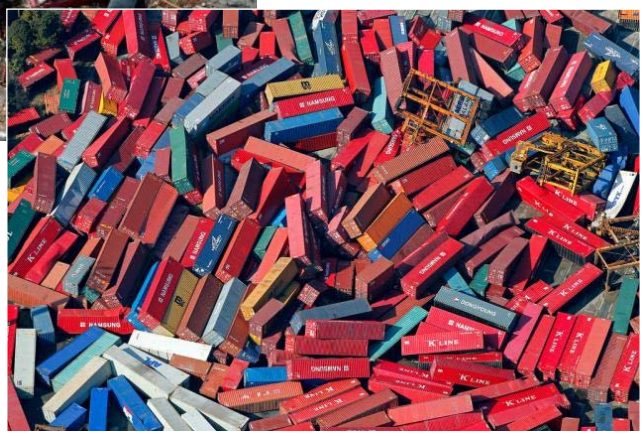
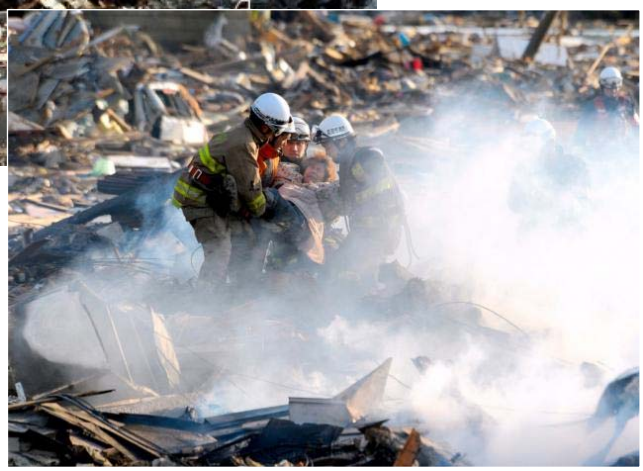
After the Tsunami at the Sendai Airport



09 After the Tsunami at the Port of Sendai

Unexpected fire from the devastating debris caused by the Tsunami



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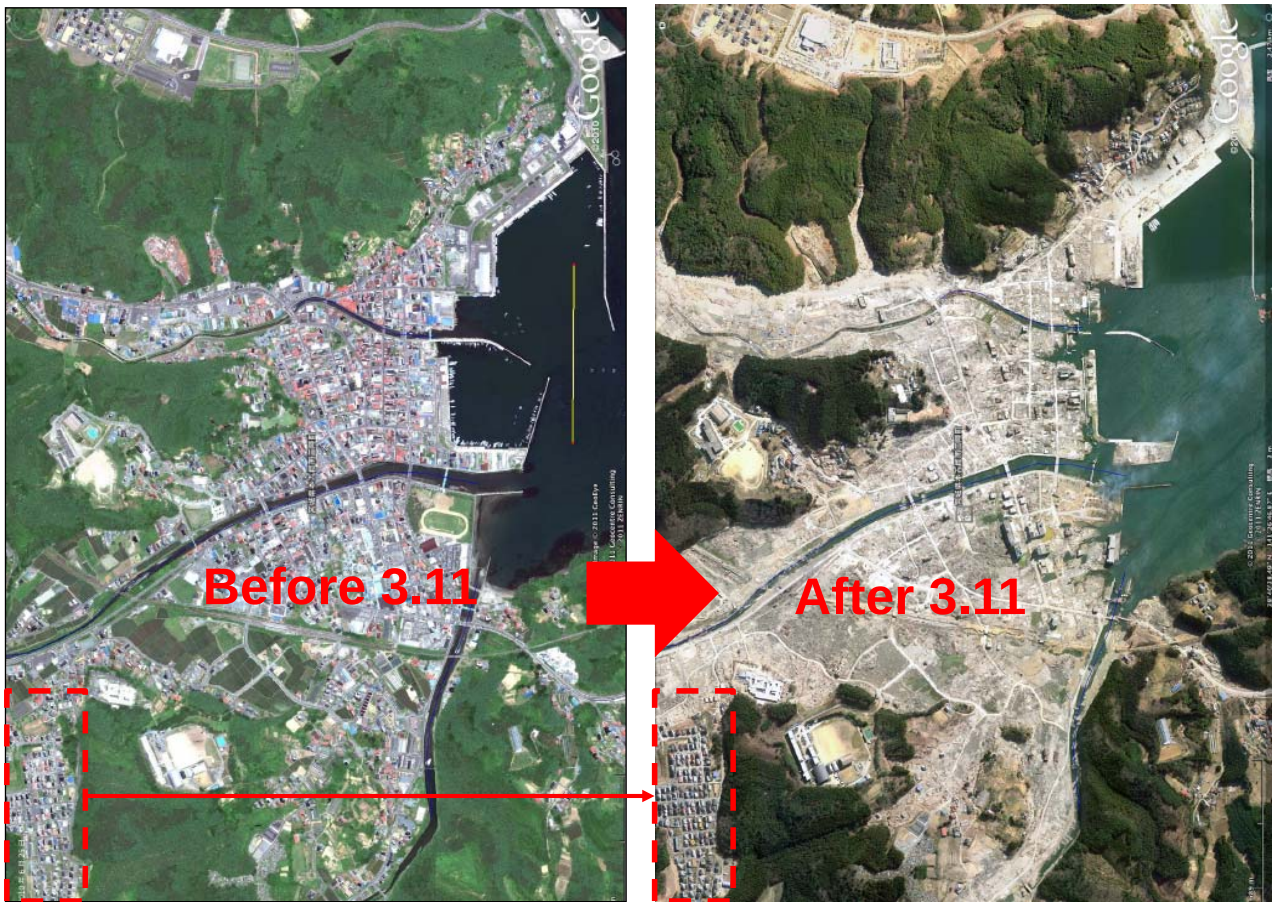
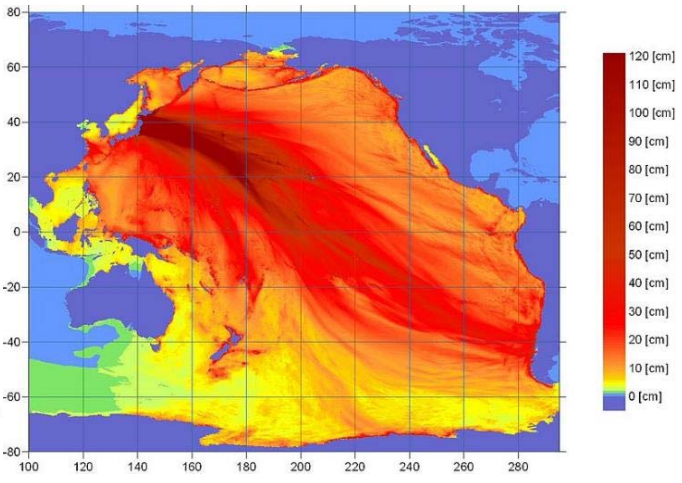
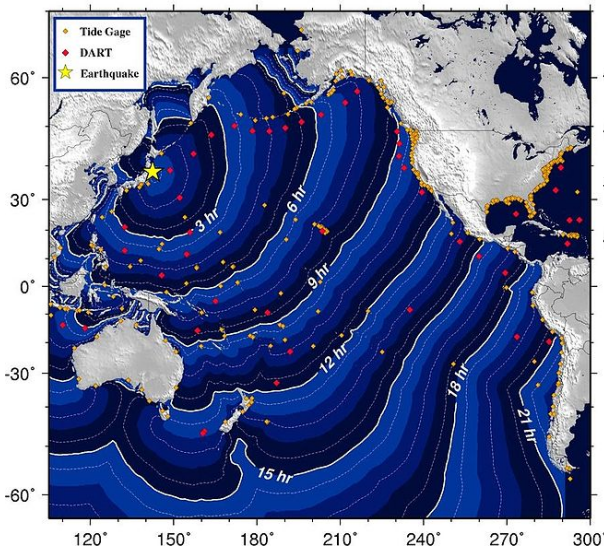
Minami-Sanrikucho totally devastated by the 3.11 Tsunami



Local disaster ⇒ Global disaster

Energy Transmission
of the Tsunami,
triggered by 3.11 Earthquake





Arrival Time of the Tsunami to the
Pacific Coasts after 3.11 Earthquake

(Source: 2011Sendai-NOAA-Energylhvpd9-05.jpg
NOAA: National Oceanic and Atmospheric Administration, US Department of Commerce)

SHIGERU BAN ARCHITECTS

Voluntary Architects Network (VAN)

Paper Partition System designed and provided by Shigeru BAN for human dignity at Ohtsuchi High-School's gymnasium as an aftermath refuge, set up by the refugees themselves

(2015 Pritzker Prize-Winner)

Before

After

TOYO ITO

(Winner of 2013 Pritzker Prize and 2017 UIA Gold Medal)

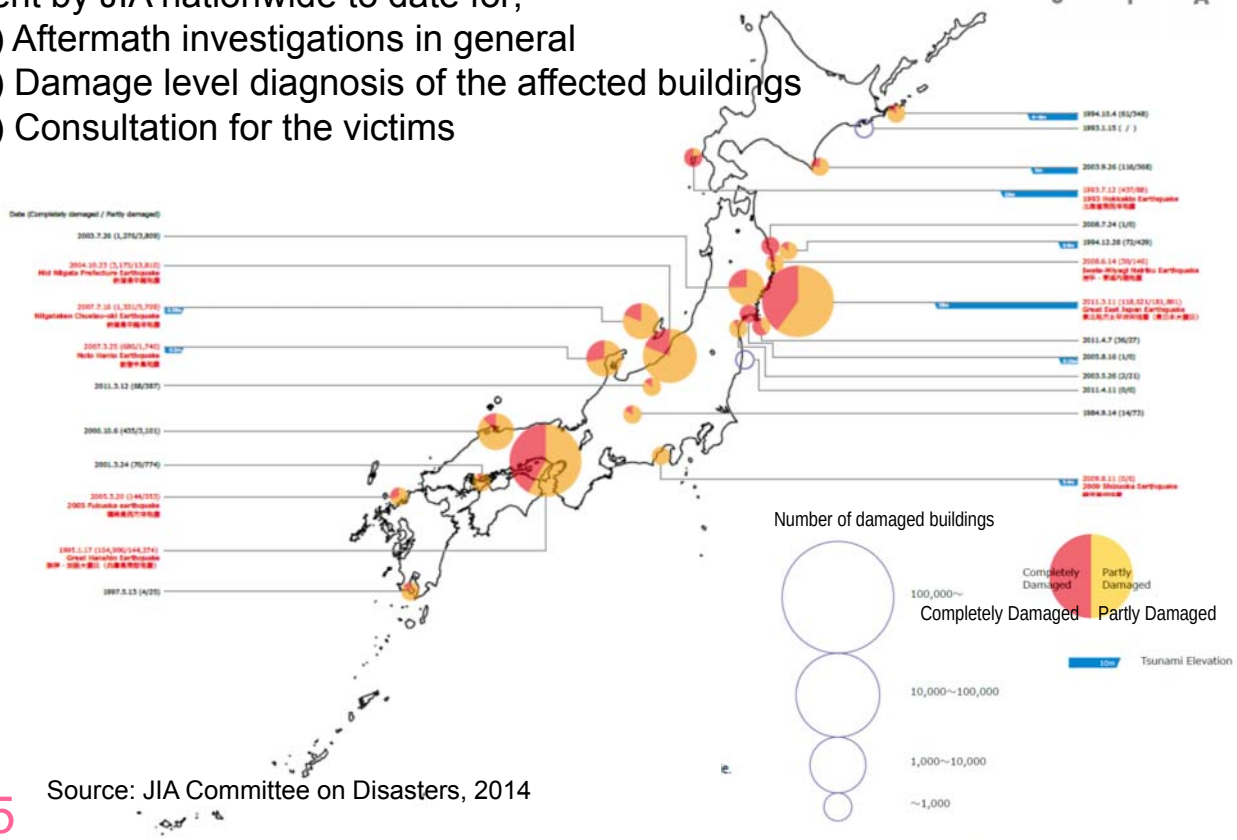
& ASSOCIATES, ARCHITECTS

Initiatives of "Home-for-All" Networking

The 1st Home-for-All (Oct. 2011), built within a temporary housing site in Sendai

Emergency Architects for disaster relief

sent by JIA nationwide to date for;
1) Aftermath investigations in general
2) Damage level diagnosis of the affected buildings
3) Consultation for the victims



Source: JIA Committee on Disasters, 2014

International Workshops about seismic-proof design

February 2016: The Earthquake Resistance Design Workshop in Tokyo for Thai architects.

March 2016: The first Iran-Japan International Workshop in Tokyo on Architectural and Urban Design for erthquaque.

Organized and moderated by Kazuo IWAMURA, FJIA

1.2 Daily Disasters

In Japan, domestic accidental death toll amounts more than three times as much of traffic accident.

↓

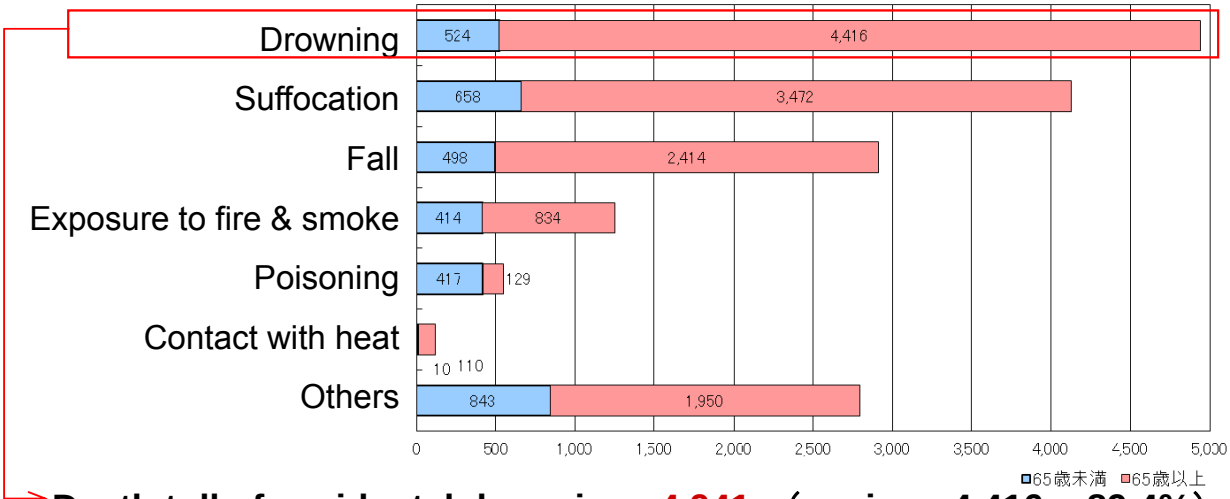
This should be called “Daily Disaster.”

↓

The key architectural solution is providing a whole house with high thermal insulation to relax the Indoor Heat Shock in existing old houses.

Annual death toll of domestic accidents in Japan (2011)

Total：16,722p, of which 13,325p（79.7%）are seniors (>65)



Death toll of accidental drowning：4,941p（seniors：4,416p, 89.4%）

＜Reference＞ Annual death toll of traffic accidents in 2011: 4,664p (seniors: 2,291p, 49.1%) >3,904p in 2016

Death toll of drowning in bathtub has been rapidly increasing in existing old houses, while that of traffic accident became a half during 1995～2012.

The major cause of this accident is considered:

Indoor Heat Shock,

due to the intense temperature difference between

①living room (24℃),

②undressing room (14℃) and

③bathtub (42℃),

which causes sudden change of blood pressure, and consequently stroke or cardiac failure.

High thermal insulation of the whole house is proved very effective to prevent such accidents.

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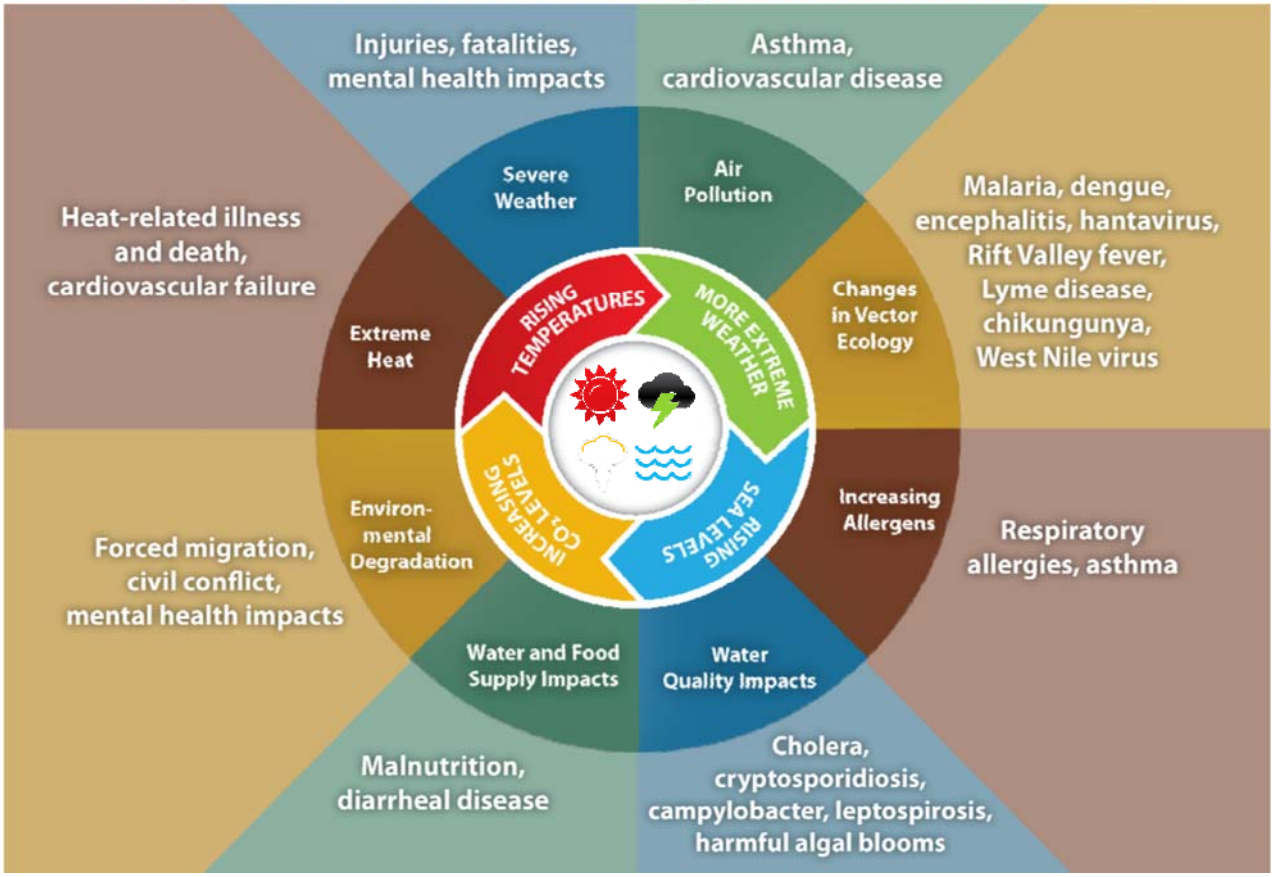
Impact of Climate Change on Human Health



Source: https://www.cdc.gov/climateandhealth/effects

2. Methodological Approach towards Resilient Built-Environment

2.1 Trigger

Iwamura et al. started developing so entitled "Environmentally Symbiotic Housing" as a national initiative of Japan in collaboration with governments, academia and industry in the year of 1990. The trigger was the Japanese cabinet's project in view of coping with the Global Warming (1990). Since then as ever, Japan has experienced a number of tragic natural disasters.

Learning from those experiences, it should be recognized that the sustainability of housing and community be holistically elaborated along a cyclic sequence of time,

1) In ordinary time,
2) At the disaster and
3) In the aftermath.

2.2 Life Continuity Plan (LCP)

Given the above, it must be recognized that we are always confronted with disasters both “Occasional” and “Daily.” Taking this into consideration, how should we plan and design sustainable housing and community?

Related to this query, Business Continuity Plan (BCP) gives us a hint, which means as follows;

“When business is disrupted, it can cost money. Lost revenues plus extra expenses means reduced profits. Insurance does not cover all costs and cannot replace customers that defect to the competition. A business continuity plan to continue business is essential”.

The author proposed a similar initiative, replacing “Business” by “Life,” namely “Life Continuity Plan (LCP)” to take care of the holistic planning and design of resiliently sustainable housing and community.

Life Continuity Plan (LCP)

Basic Frame of Housing for Human Security

Phase	Items	Housing Level		Community Level	
		Detached	Collective	Neighborhood	Region
1. Ordinary Time	Physical Health				
	Physical Security				
	Mental Health				
	Peace of mind				
	Crime Prevention				
	Maintenance				
	Periodic Inspection				
2. At the Disaster	Place of Refuge				
	Energy Sources				
	Energy Supply				
	Tap Water				
	Sewerage System				
	Toilet				
	Traffic				
3. In the Aftermath	Place of Refuge				
	Energy Sources				
	Energy Supply				
	Tap Water				
	Sewerage System				
	Toilet				
	Traffic				
	ICT				
	Provisions				

First, a basic frame has been developed to grasp at a glance overall relevant engagements in terms of the time-line and scale.

The objects of measures are sorted horizontally according to the scale (from a detached-house, an apartment, a neighborhood, to a region), and vertically to the time-line (from ordinary time, at the disaster, and in the aftermath, which are always cyclically repeated).

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3. Implemented Practice

Yakushima Symbiotic Housing

designed for
passive & indigenous resilience

by
IWAMURA Atelier Inc.
2001-2006

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Yakushima Symbiotic Housing

- **Public Leasehold Housing**
  - 50 Dwelling Units
  - Public Facilities
  - Commons + Parking
- **Site area: 19,750 m²**

EARTH SWEET HOME
環境共生住宅

Zones

Northern Zone (1, 2, 3, 4)
HDD: $D_{18\text{-}18}$ >3,000

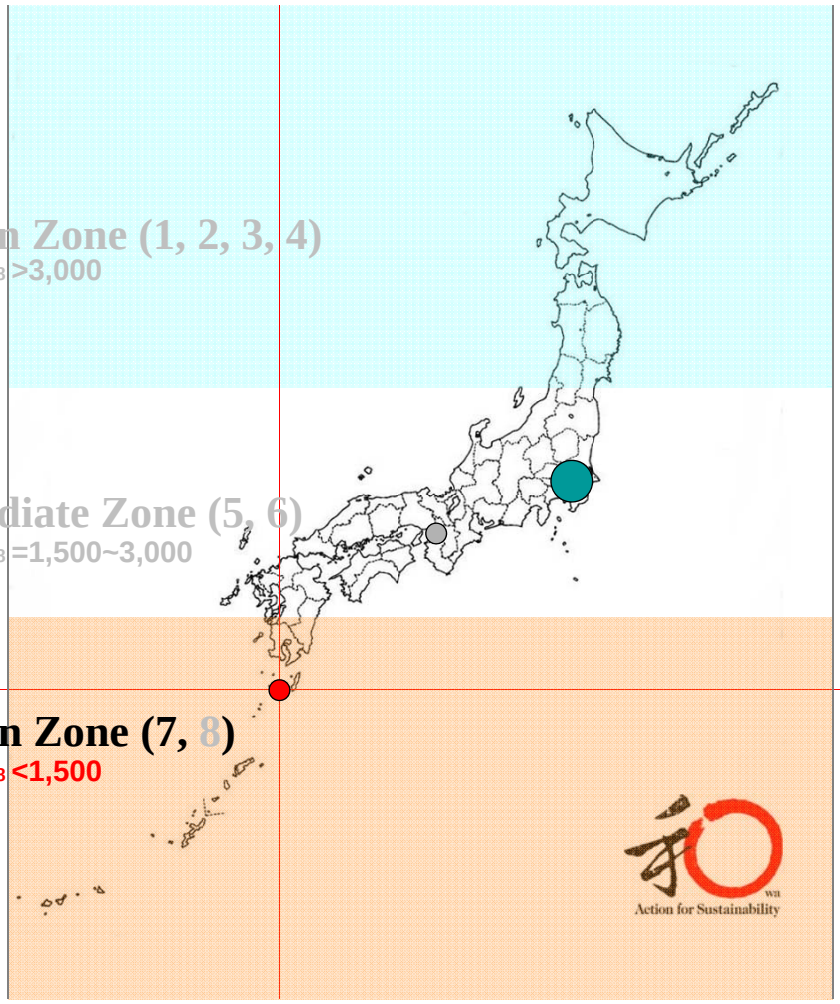
Intermediate Zone (5, 6)
HDD: $D_{18\text{-}18}$ =1,500~3,000

Southern Zone (7, 8)
HDD: $D_{18\text{-}18}$ <1,500

Cities

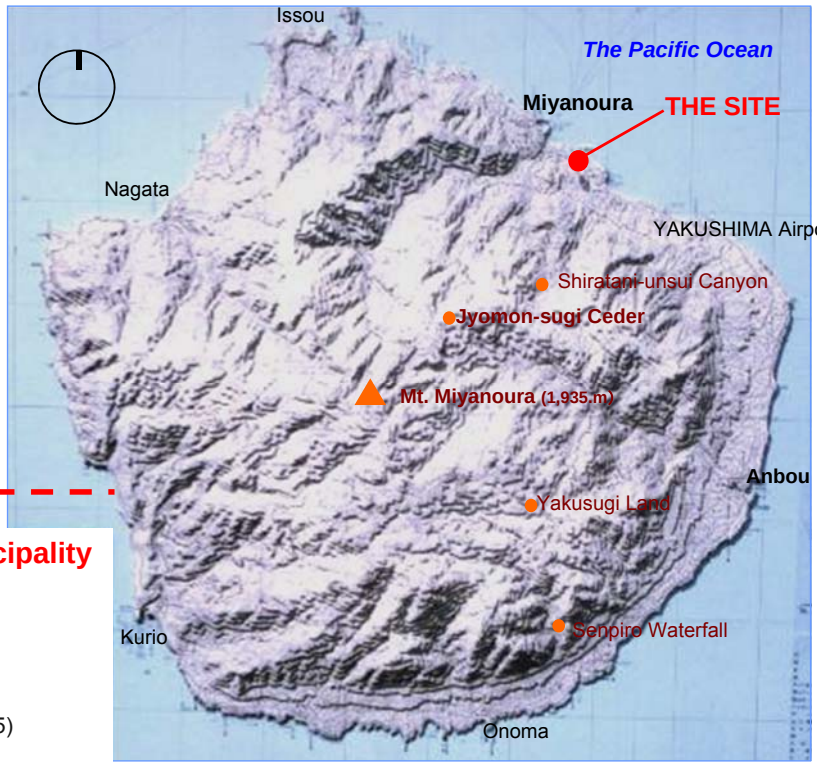
Tokyo

Yakushima Island



Action for Sustainability

Location



Yakushima Island Municipality

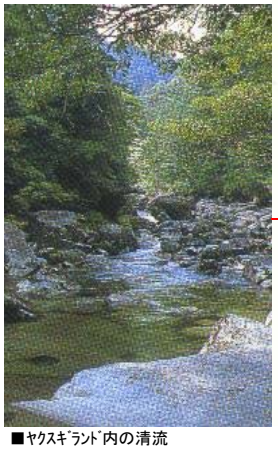
Location:
Long. 130° 34'E
Lat. 30° 25'N

Area: ca. 503km^2

Population: 13,761 (as of 2005)

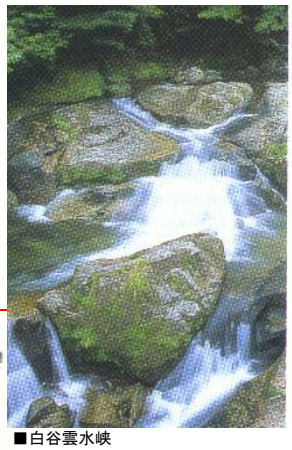
Nature of Yakushima: *World Natural Heritage*

■小花之江河の眺め

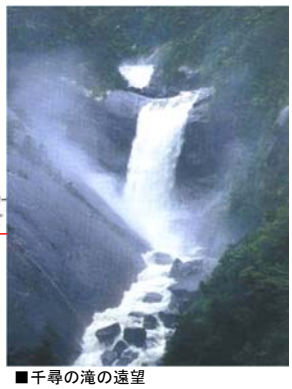


■ﾔｸｽｷﾞﾗﾝﾄﾞ内の清流

■Jomon Cedar Tree: 7,000 years old



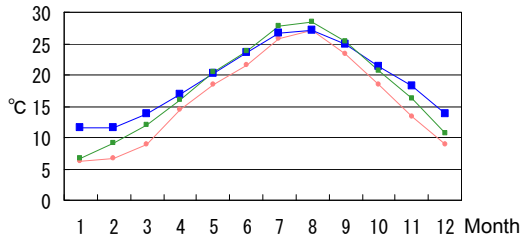
■白谷雲水峡



■千尋の滝の遠望

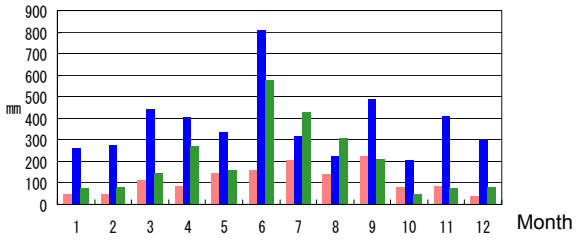
Local climate

TEMPERATURE



Annual Mean Temperature:
19.14℃

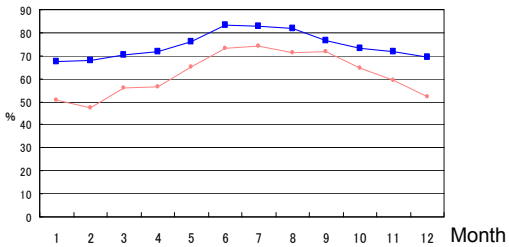
PRECIPITATION



Annual Mean Precipitation:
4,488 mm

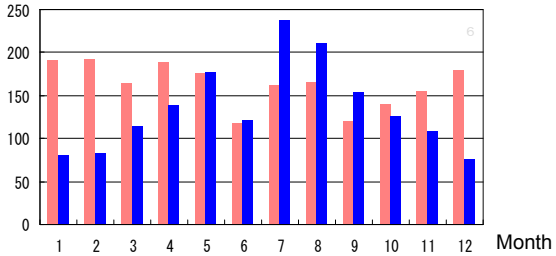
YAKUSHIMA TOKYO KAGOSHIMA

HUMIDITY



Annual Mean Humidity:
74.35%

HOURS OF SUNSHINE



Annual Mean Hours of Sunshine:
1,627 hr

Source : AMEDAS Data by the Meteorological Agency (1993～97)

Existing vernacular settlement in Nagata on the western shore



Integrated measures against disasters, while creating beautiful built environment



Conceptual design guidelines

1. 太陽と暮らす
Live with the sun
- 太陽エネルギーを利用する
- 適切な断熱と日射遮蔽を行う
- 適切な廃熱を行う
- 内外に影をつくる
- 土面を確保し、しつらえを工夫する
- 北側空間を有効利用する

2. 水と暮らす
Live with water
- 排水する
- 雨を避ける
- 雨水を利用する
- 保水力を高める
- 節水・水質浄化に寄与する

3. 風と暮らす
Live with wind
- 空気の流れをつくる
- 風力エネルギーを利用する
- 強風・塩風害に対応する

4. 資源と暮らす
Live with resources
- 省エネルギー設備機器を採用する
- 躯対構造を長持ちさせる
- ライフスタイルの変化に対応する
- リサイクル資材・建材を用いる
- 廃棄物を削減する
- 地場産材を積極的に採用する

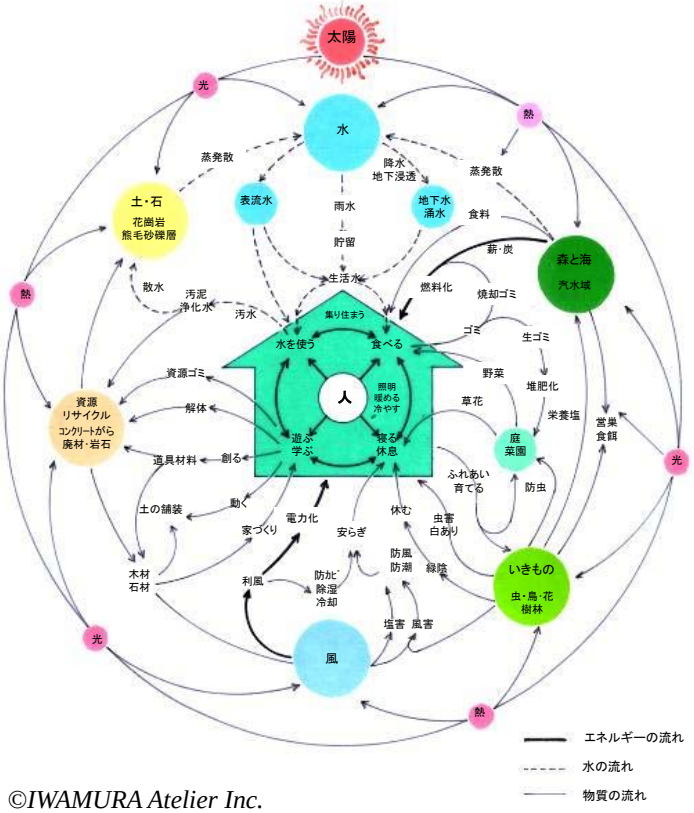
5. 生き物と暮らす
Live with creatures
- 表土の流出を防止する
- 薬剤を過剰に利用しない
- 水と緑の軸をつくる
- 多様性を確保する
- 貴重種・希少種の保護に配慮する
- 多孔質な空間を確保する

6. 地域社会と暮らす
Live with local community
- 界隈を引き継ぐ
- 伝統的住いに学ぶ
- 伝統的暮らしに学ぶ
- 人と人の交流を進める
- 家づくりに参加する
- まちづくりに参加する
- リサイクルマーケットを設置する

7. 自然と暮らす
Live with the nature
- 生き物とふれあう
- 音・香り・感触を楽しむ
- 緑化によって、熱環境の質を向上する
- 原風景を引き継ぐ

8. 安心して暮らす
Live safe
- 利用者の特性に配慮する
- 白ありの被害に対応する
- 安全な材料を用いる
- カビ・結露を防ぐ
- 非常時に備える

■屋久島環境共生住宅の流れと循環モデル図



Major strategies of Yakushima Symbiotic Housing -1

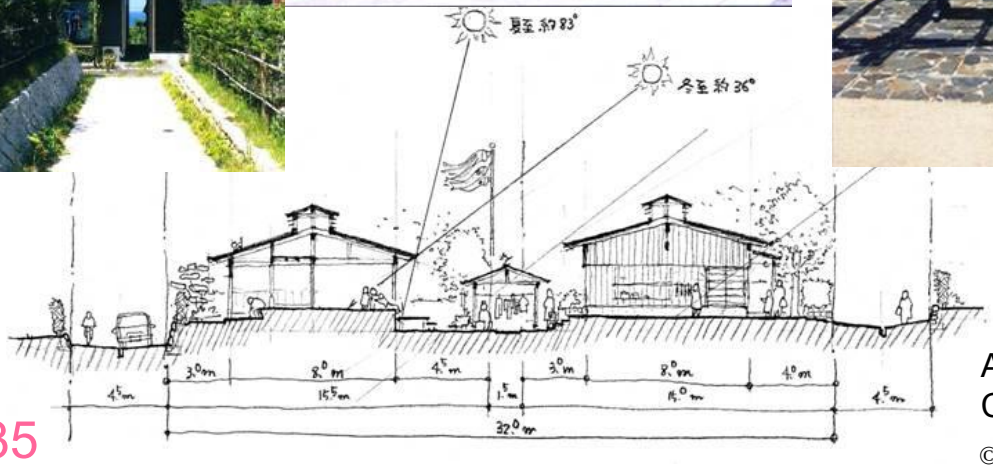
1) Provision of safe and long-life basis and housing, resisting typhoons, heavy rains, salt damage and termites
2) Creation of safe and beautiful town-and land scape, respecting the original topography of the site as well as the local life-style
3) Provision of a greening base to be networked for the restoration of the local forests that disappeared through exploitation to date

Major strategies of Yakushima Symbiotic Housing -2

4) Housing development using the indigenous resources of the Yakushima island
5) Provision of a variety of housing types based upon the simple and flexible timber structure
6) Consideration of the property maintenance through participatory initiatives of the residents

for Human Security and Resilient Sustainability

Townscape for the Human Security



A Typical
Cross Section

Common paths for the residents

as of August 2004

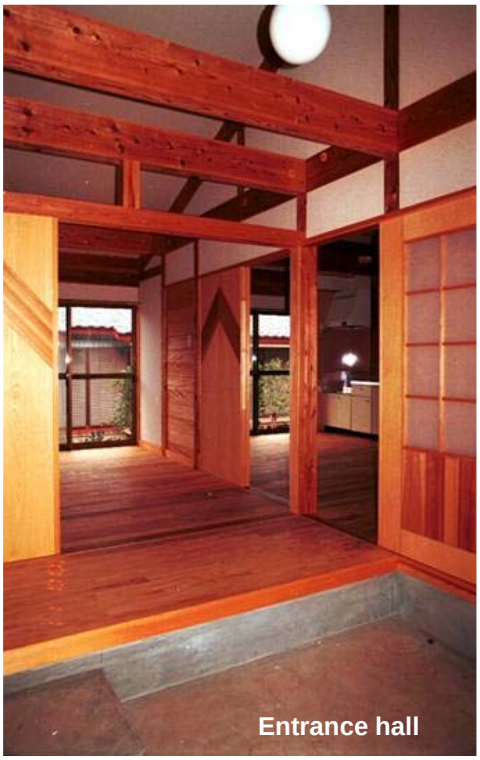
For the neighborhood exchange as well as evacuation route at disasters

Indoor and outdoor relationship

A typical block (model)

-Traditional closed housing layout to protect each other against typhoon's strong wind

-Open interior for providing flexibility and natural ventilation



Entrance hall

Interior solutions of passive design

As of October 2000

■Upward View toward the Upper Roof

■Tatami, Cedar Flooring and Recycled Charcoal for Humidity Control

39

Central Square for provisional refuge

as of August 2004

Neighborhood's Meeting Hall as an indoor refuge

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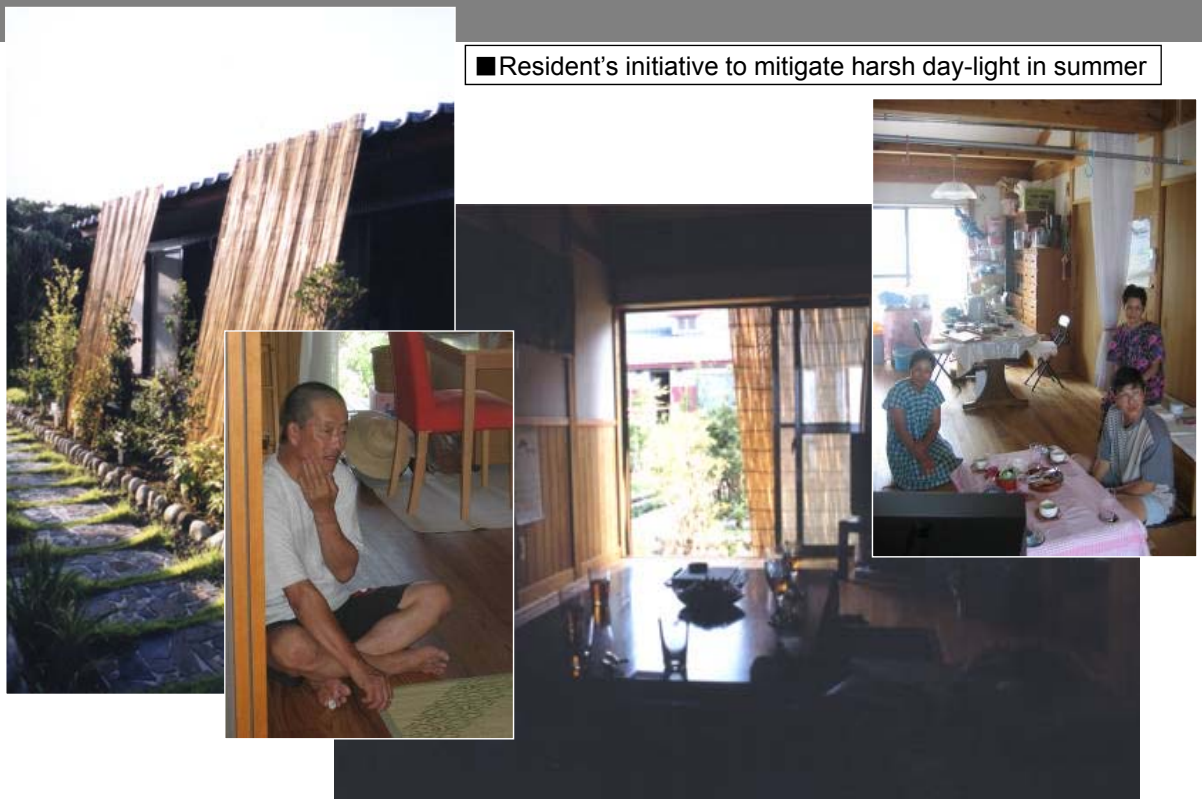
Occupants' intervention

as of August 2004

■Resident's initiative to mitigate harsh day-light in summer



■An indoor scene of post-occupancy in summer

New resilient village, learned from the heritage

<Reference-1>

Well known "Footprint" is metaphorically used to symbolize the negative impacts, while "Handprint" symbolizes positive and innovative management that contributes to the sustainable development.

Current Footprint approach is focused on the negative impacts to individual, organization or states.

Ecological Footprint

On the other hand, Handprint means to identify, measure and evaluate the positive sustainable impacts including social and economic levels.

Handprint

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<Reference-2>

-Wasting resources
-Generate waste
-Emissions
-Social impacts
-Others

Decrease Footprint

-Quality of life
-Recognition of sustainability
-Quality of eco-system
-Social benefits
-Others

Increase Handprint

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4. Conclusions

1) Japan, similar to other Asian countries, has been experiencing the frequent difficulties physically, environmentally, economically and socially, due to a variety of natural and occasional disasters including typhoons & earthquakes, as well as the daily indoor disasters.

2) Accordingly, short-, mid- and long term effective relief measures should be taken to cope with them, especially the relevant preparedness measures for predicted future disasters.

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4. Conclusions (cont'd)

3) In this regard, a cyclical design process for the human security must be taken into consideration as the highest priority involving all the stakeholders beyond simply being "Green" and/or "Smart."

4) To this end, our collective efforts through communal and local solidarity will be the very base towards; Integrated Resilience by the Built Environment for Human Security.

4. Conclusions (cont'd)

5) Consequently, it describes the capacity of those to function, so that the people living and working there, particularly the poor and vulnerable, survive and thrive no matter what stresses or shocks they encounter.

6) Such a goal towards human security must be the top priority that formulates the social responsibility of our profession worldwide;

Beyond Disasters
Through Solidarity
Towards Resilient Sustainability

According to our globally common
"SDGs by Built Environment"

Thanks for your attention..

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