The Great East Japan Earthquake, Tsunami and Nuclear Meltdown

An Assessment One Year On

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Japan Quake Map
The Great East Japan Earthquake, Tsunami and Nuclear Meltdown
An Assessment One Year On

• Introduction
• Japan and Tōhoku Prior to 11 March 2011
• What Happened on 11 March 2011?
• After the Disaster
• Can Japan Recover?
• Conclusion: Transformation or Status Quo?
Ageing, Low-fertility and Depopulation

2000 - 2010 - Iwate, Miyagi and Fukushima Prefectures shrank by 3.5 percent, from 5.908 to 5.708 million people.

Prior to 11 March 2011, the Japanese government had forecast shrinkage of a further 791,000 to 4.917 million (13.9%) by 2030; making a total decline of 16.8%.

A total fall of 20 per cent (1.181 million) (2010-30) now seems plausible.

- Japan’s Net Reproduction Rate fell below 1.0 for the first time around 1955/60.
- The Total Fertility Rate fell below 2.1 in 1974.
- Japan began to shrink in around 2005/10.

Japan and Tōhoku Prior to 11 March 2012

Ageing, Low-fertility and Depopulation

What happened on 11 March 2011? A Compound Event

### Earthquake
- **Time:** 14:46 a M9.0 reverse megathrust earthquake.
- **Location:** NW Pacific Ocean (38.297°N, 142.372°E).
  
  Subduction zone between Pacific-N. American Plates.
- **Distance:** 129 km (80 miles) E of Sendai. 373 km (231 miles) NE of Tokyo.
- **Aftershocks:** 702 of M5.0 or greater.

### Tsunami
- **Time:** Approx. 15:00-15:45 in Iwate, Miyagi and Fukushima Prefectures.
- **Height:** 5-20 metres in Iwate, Miyagi and Fukushima.
- **Max. Run-up:** 38.9 m (127.6 ft). Miyako, Iwate Prefecture (Shogakukan Creative et al, 2011: 21).
- **Area Flooded:** 507 km².

### Casualties and Damage (11 April 2012 – National Police Agency Website)
- **Dead:** 15,856  
  **Missing:** 3,070  
  **Injured:** 6,027

129,404 buildings totally destroyed, 255,737 buildings partially destroyed.

26.7 million tons of debris (Asahi Shimbunsha, 2011).

### Fukushima Daiichi Nuclear Power Plant
- Cooling systems flooded and failed.
- Hydrogen explosions at Units 1, 3, and 4.
- Units 1, 2, and 3 experienced full meltdown.
- Evacuation within 20km radius, plus other areas (Iitate Town). 20-30km remain indoors.
What happened on 11 March 2011?
Rikuzentakata, Iwate Prefecture and Ishinomaki, Miyagi Prefecture

Rikuzentakata City (1 March 2012)
Population (2005/10): 24,709 and 23,302 (-5.7%) (National Census data).
Confirmed dead: 1,691 (41 missing) (Post-disaster population est.= 21,570)
Buildings destroyed: 3,368 (3,159 [totally], 97 [mostly], 85 [half-destroyed], 27 [partially])

Ishinomaki City (11 March 2012)
Population (2005/10): 167,324 and 160,826 (-3.9%)
Confirmed dead: 3,280 (539 missing) (Post-disaster population est.= 157,007)

*2015 population estimates do not include projections for out-migration.
Rikuzentakata, August 2011: Apartment blocks facing the ocean.
(Photo: Peter Matanle).
Rikuzentakata, August 2011. Debris clearance is progressing. But the town has been destroyed. (Photo: Peter Matanle). [Tsunami footage at Rikuzentakata](http://www.tsunamifootage.com/).
(Photo: Peter Matanle).
Rikuzentakata, August 2011. Temporary housing for tsunami refugees. (Photo: Peter Matanle).
(Photo: Peter Matanle).
Ishinomaki, August 2011. Debris mountain.
(Photo: Peter Matanle).
がんばろう！石巻 (Tough it out! Ishinomaki). 復興するぞ！(We will rebuild!)
Minamisanriku town, Miyagi Prefecture before the tsunami (2001).
Source: Sankei Shimbunsha (2011: 31); see also SankeiPhoto (2011).
Reproduced by kind permission of Sankei Books.
Minamisanriku town, Miyagi Prefecture after the tsunami (27 March 2011). Source: Sankei Shimbunsha (2011: 31); see also SankeiPhoto (2011). Reproduced by kind permission of Sankei Books.
The Unosumai district of Kamaishi City, Iwate Prefecture before the tsunami (2007). Source: Sankei Shimbunsha (2011, p. 31); see also SankeiPhoto (2011). Reproduced by kind permission of Sankei Books.
The Unosumai district of Kamaishi City, Iwate Prefecture after the tsunami (29 March 2011). Source: Sankei Shimbunsha (2011, p. 31); see also SankeiPhoto (2011). Reproduced by kind permission of Sankei Books.
What happened on 11 March 2011?
Exposing Problems of Governance

The disaster exposes difficult issues in 21st century Japanese society

- A society of gaps (kakusa shakai):
  65.2% of dead were aged 60+; 92.5% of deaths by drowning (Japan Times, 2011).

- Post-traumatic psychological and emotional impacts.
  Relocation damage tsunami and radiation affected areas: Anxiety, depression, hypertension.

- Government/bureaucracy/industry relations:
  ‘The Iron Triangle’ and the role of electricity providers: Regulatory capture; exploitation of vulnerable rural locales.

- Problems of nuclear management:
  Erosion of public trust in government and expert systems; design, siting, construction, and management all flawed; belief in fail-safe systems.

Can Japan overcome these problems?
Japan's Nuclear Power Stations in March 2012 (JAIF Website)

Tomari (Hokkaido EPCO)
Tomari Village, Hokkaido, Pop.: 1,882 (2,185)
3 X PWR: 2 X 579MW; 1 X 912MW MOX.
1XPWR operating.

Higashidōri (Tōhoku EPCO/Tokyo EPCO)
Higashidōri Village, Aomori Pref. Pop.: 7,253 (8,042)
1 X BWR: 110MW (Tōhoku EPCO)
(1 X ABWR Planned - 2021; 138.5MW) (Tōhoku EPCO),
(2 X ABWR Planned – 2017/19, 2 X 1,385MW) (Tokyo EPCO)

Kashiwazaki-Kariwa (Tokyo EPCO)
Kashiwazaki City and Kariwa Village, Niigata Pref. Pops. 91,463/4,802 (94,648/4,806)
5 X BWR (5 X 1100MW) 2 X ABWR (1356MW)
1XABWR Operating.

Shika (Hokuriku EPCO)
Shika Town, Ishikawa Pref. Pop.: 22,228 (23,790)
1 X BWR (540MW) 1 X ABWR (1206MW)
None operating.

Onagawa (Tōhoku EPCO)
Onagawa Town, Miyagi Pref. Pop.: 10,051 (10,723)
3 X BWR (1 X 524 MW; 2 X 825MW)
None operating. Emergency shutdown, 11 March 2011.

Ōma (J-Power)
Ōma Town, Aomori Pref. Pop.: 6,340 (6,212)
(1 X ABWR Planned - 2014; 1,383MW MOX)

Hamaoka (Chubu EPCO)
Omaezaki City, Shizuoka Pref. Pop.: 34,700 (35,272)
4 X BWR (1 X 540MW; 1 X 840MW; 1 X 1100MW; 1 X 1137MW)
1 X ABWR (1267MW)
All shut down. Prime Minister's request, May 2011.
(1 X ABWR Planned – 2020; 1400MW).

Fugen (Japan Atomic Energy Agency)
Tsuruga City, Fukui Pref. 67,765 (68,402)
1 X Advanced Thermal Reactor (165MW)
Shut down and awaiting decommissioning.

Mihama (Chugoku EPCO)
Mihama Town, Fukui Pref. Pop.: 8,077 (8,462)
3 X PWR (340MW, 500MW, 826MW)
None operating.

Sendai (Kyūshū EPCO)
Sendai City, Miyagi Pref. Pop.: 99,558 (102,370)
4 X PWR (2 X 890MW)
None operating. (Planned 1 X APWR - 2019, 1590MW)

Ikata (Shikoku EPCO)
Ikata Town, Ehime Pref. Pop.: 10,880 (12,095)
3 X PWR (2 X 566MW; 1 X 890MW)
None operating.

Takama (Kansai EPCO)
Takama Town, Fukui Pref. Pop. 11,064 (11,630)
4 X PWR (2 X 826MW; 2 X 870MW)
None operating.

Ōi (Kansai EPCO)
Ōi Town, Fukui Pref. Pop.: 8,582 (9,217)
4 X PWR (2 X 1175MW; 2 X 1180MW)
None operating.

Mihama (Kansai EPCO)
Mihama Town, Fukui Pref. Pop.: 8,077 (8,462)
3 X PWR (340MW, 500MW, 826MW)
None operating.

Tsugura (Japan Atomic Power Company)
Tsugura City, Fukui Pref. 67,765 (68,402)
1 X BWR (357MW); 1 X PWR (1160MW)
None operating. (2 X ABWR; Under construction – 2016/17; 2 X 1538MW)

Monju (Japan Atomic Energy Agency)
Tsuruga City, Fukui Pref. 67,765 (68,402)

Fugen (Japan Atomic Energy Agency)
Tsuruga City, Fukui Pref. 67,765 (68,402)
1 X Advanced Thermal Reactor (165MW)
Shut down and awaiting decommissioning.

Shikata (Chugoku EPCO)
Shikata Town, Hyogo Pref. Pop.: 193,331 (196,603)
2 X PWR (1 X 460MW; 1 X 820MW)
(1 X PWR Planned – 2011; 1373MW)
None operating.

Genkai (Kyūshū EPCO)
Genkai Town, Saga Pref. Pop.: 6,379 (6,738)
4 X PWR (2 X 559; 2 X 1180MW)
None operating.

Jōyō (Japan Atomic Energy Agency)
Ōarai Town, Ibaraki Pref. Pop.: 18,331 (19,205)
Experimental FBR X 1 (140MW)
Current Status unknown. Not commercially operating.

Kaminoseki (Chugoku EPCO)
Kaminoseki Town, Yamaguchi Pref. Pop.: 3,332 (3,706)
2 X ABWR (1373MW)
None operating.

Mihama (Kansai EPCO)
Mihama Town, Fukui Pref. Pop.: 6,340 (6,212)
1 X ABWR (1400MW)

Sendai (Kyūshū EPCO)
Sendai City, Miyagi Pref. Pop.: 99,558 (102,370)
4 X PWR (2 X 890MW)
None operating. (Planned 1 X APWR - 2019, 1590MW)

Ikata (Shikoku EPCO)
Ikata Town, Ehime Pref. Pop.: 10,880 (12,095)
3 X PWR (2 X 566MW; 1 X 890MW)
None operating.

Hamaoka (Chubu EPCO)
Omaezaki City, Shizuoka Pref. Pop.: 34,700 (35,272)
4 X BWR (1 X 540MW; 1 X 840MW; 1 X 1100MW; 1 X 1137MW)
1 X ABWR (1267MW)
All shut down. Prime Minister's request, May 2011.
(1 X ABWR Planned – 2020; 1400MW).

Tōkai and Tōkai Daini (Japan Atomic Power Co.)
Tōkai Village, Ibaraki Pref. Pop.: 37,430 (35,450)
Tōkai: Magnox (159MW), Decommissioned.

Jōyō (Japan Atomic Energy Agency)
Jōyō Town, Ibaraki Pref. Pop.: 18,331 (19,205)
Experimental FBR X 1 (140MW)
Current Status unknown. Not commercially operating.
The Government’s Immediate Response
11 April 2011 PM Naoto Kan established three principles for recovery.

(1) to create a regional society that is highly resistant to natural disasters [SAFE],
(2) to establish a social system that allows people to live in harmony with the global Environment [SUSTAINABLE], and
(3) to build a compassionate society that cares about people, in particular, the Vulnerable [COMPASSIONATE].

• Government efforts to restore systems mired in political in-fighting over management of the Fukushima crisis, then intentions and status of PM Kan, and now over how to pay for recovery.
• Reconstruction Agency took 11 months to establish (Kobe took 4 months, and that was criticised as a slow response).
After the Disaster: One Year On

Government Reconstruction Response

24 June Basic Act on Reconstruction in response to the Great East Japan Earthquake
25 June 2011 Reconstruction Design Council produced its report: Towards Reconstruction: Hope beyond the Disaster
10 February 2012 Reconstruction Agency inaugurated.

Basic Principles of Report Recommendations
1. Focus on Local Communities and human linkages (絆 - kizuna).
2. Accept that disasters occur, and base survival on ‘self-aid’.
3. Develop conditions for mutual aid and public aid.

Basic Principles of Reconstruction
1. Reconstruct under concept of ‘Disaster Reduction’. There are some disasters so huge as to be impossible to defend against. Self-help essential, but mutual and public help important too.
2. Reconstruction plans must incorporate a future vision for the region which takes account of structural changes in society and economy (principally ageing and depopulation).
After the Disaster: One Year On

Main points from: Towards Reconstruction: Hope beyond the Disaster

1. Relocate onto higher ground – Compact Cities. [SAFE/SUSTAINABLE]
2. Integrated land use regulations for building on low-lying land. [SAFE]
3. Huge-scale coastal levees to protect coastal plains where community relocation to higher ground impossible. [SAFE]
4. Municipality led consultation with citizen groups. [SUSTAINABLE]
5. New government led disaster response structure. [SAFE]
6. Restore community life and livelihood. [SUSTAINABLE/COMPASSIONATE]
7. Provide comprehensive community care facilities. [COMPASSIONATE]
8. Ensure education and restore culture. [SUSTAINABLE/COMPASSIONATE]
9. From emergency employment to employment restoration. [SUSTAINABLE]
10. Recovery of agriculture, forestry and fisheries. [SUSTAINABLE]
11. Strengthening of infrastructure. [SAFE]
12. Improved energy efficiency and promotion of renewable energy. [SUSTAINABLE]
13. Utilisation of ICT involving local citizens. [SAFE/SUSTAINABLE/COMPASSIONATE]
14. Creation of special zones and use of municipal independence. [SUSTAINABLE]
15. Open Reconstruction; promotion of a New Public Commons. [COMPASSIONATE]
After the Disaster: One Year On

Obstacles to Recovery

1. Securing **financial stability** and providing funds.
2. Removal and disposal of **irradiated debris** ...
3. To make way for rebuilding.
4. Ensuring adequate **professional planning** capacities at the municipal level.
5. **Topographical difficulties** in constructing new communities on higher ground.
6. **Economic/environmental** conflicts.
7. Securing **labour and resources** needed for reconstruction while ...
8. Maintaining a **high quality of life** elsewhere in Japan.
9. Maintaining a **stable electricity supply** while ...
10. **Reforming** the **energy system**.
11. Planning for **regeneration** while ...
12. Acknowledging **shrinkage**.
14. **Resettlement/use** of the areas around Fukushima Daiichi.
15. **Recovery/return of** lost social, cultural, and **human capital**.
Japan will not collapse tomorrow.
• Tohoku accounts for under 10% of the national economy.
• Was the disaster is too small to enable national transformation?

Can Tōhoku recover?
• A realistic appraisal suggests continued, perhaps accelerated, shrinkage and decline.
• A delicate balance should be struck.
• Must not return to the past, but …
• Need to root recovery in what the region possesses already.

What are the consequence of the nuclear disaster?
• Nuclear power is likely to remain, but will probably be reduced.
• Renewable generation will expand, with locally owned and managed wind, geothermal, tidal etc. Potential for local economic revival (See Fintry, Scotland.)
• Fukushima Daiichi to be decommissioned and the area turned into a marine park or mega-solar array.
Conclusion: Transformation or Status Quo?

Tohoku will remain a shrinking region
- Ageing, low-fertility, out-migration and depopulation will continue.
- **Danger of false expectations**: Reconstruction will take longer than anticipated.
- This will discourage return and resettlement.
- Reconstruction and recovery complicated by the status of decommissioning works at Fukushima (which may take decades to complete).

Japan overall may not be transformed
- Economic and political systems may be too rigid; too many particularist interests.
- Early signs show a desire for ‘normalisation’ at all levels of politics and society.
- A few strong challenges show some signs of emerging (e.g. Governor Hashimoto of Osaka, but these remain local (for now)).

Japan’s energy system will undergo gradual reform, but it may take a long time.
- Competition from small/local providers.
- **Feed-in tariffs**.
- More renewables and less nuclear (geothermal and wind; biomass etc.).
- Cost and difficulty of decommissioning.
Appendix 1. References


Shogakukan Creative et al. (eds.) (2011) Chizu de yomu higashi nihon daishinsai [Reading the Great East Japan Earthquake Disaster via Maps]. Seibido: Tokyo.

Appendix 2. My experience of the event

My Circumstances in March 2011
Living in Kyoto (521km distance from Fukushima).
1 year research leave to study regional employment and revitalisation in Japan.

On the day in Kyoto
A lovely sunny early spring day.
Visiting the International Manga Museum in Kyoto.
Back to my office by 2.45. Booted computer and opened Facebook to find news of the event.
Cycled home immediately to watch TV.
Watched the disaster unfold live for many hours.

Succeeding Weeks and Months
First Week: Every morning woke up to find the situation even worse than the night before.
First Month: Stayed at home glued to TV and reading press reports.
Welcomed various people (friends, students, colleagues) travelling away from the disaster.
Kept in touch with University of Sheffield and assisted in managing response.
First 6 Months: Wrote a journal article. Gathered research materials.
August 2011 travelled to Sendai, Rikuzentakata, and Ishinomaki to take photos.
Left Japan in late August 2011 to return to Sheffield.
## Appendix 3. Internet Resources

### Geophysics
- Japan Meteorological Agency (JMA)
- Tōhoku Earthquake Portal
- United States Geological Survey (USGS)
- Japan Earthquake Information
- Tōhoku Earthquake Report
- University of Tokyo, Earthquake Research Institute
- Pacific Tsunami Warning Centre (NOAA)

### Great East Japan Earthquake, Tsunami and Nuclear Meltdown
- Japan Quake Map
- Cabinet Office Earthquake Site
- Reconstruction Agency
- *Asia-Pacific Journal: Japan Focus 3.11 Resources*
- *Guardian – Japan Disaster*
- BBC News – Japan Earthquake
- Tōhoku Planning Forum Square
- Japan Atomic Industrial Forum
- Nuclear Industrial Safety Agency
- International Energy Agency (IEA)
- International Atomic Energy Agency (IAEA)
- Fukushima Nuclear Accident Update Log
- Tokyo Electric Power Company (TEPCO)

### General Information on Japan
- Statistics Bureau of Japan
- Statistical Handbook of Japan
- Japan Statistical Yearbook
- National Institute of Population and Social Security Research
- Japan Guide
- *Japan Times*

### Japan in the UK
- The Japan Society
- GB-Sasakawa Foundation
- Daiwa Anglo-Japanese Foundation
- The Japan Foundation UK
- Japan Local Government Centre, London
- Embassy of Japan in the UK
- Japan-UK Events Calendar
- British Association for Japanese Studies
- Hyper Japan

### Teacher and Student Interest
- Discover Japanese Studies
- Japan Exchange and Teaching Programme
- How to Make Sushi at Home
- *electronic journal of contemporary japanese studies*
Recent publications


Matanle, P. (2011) The Great East Japan Earthquake, Tsunami and Nuclear Meltdown: Towards the (Re)Construction of a Safe, Sustainable, and Compassionate Society in Japan’s Shrinking Regions, *Local Environment*, 16 (9): 823-847


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Thank you for your attention!

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