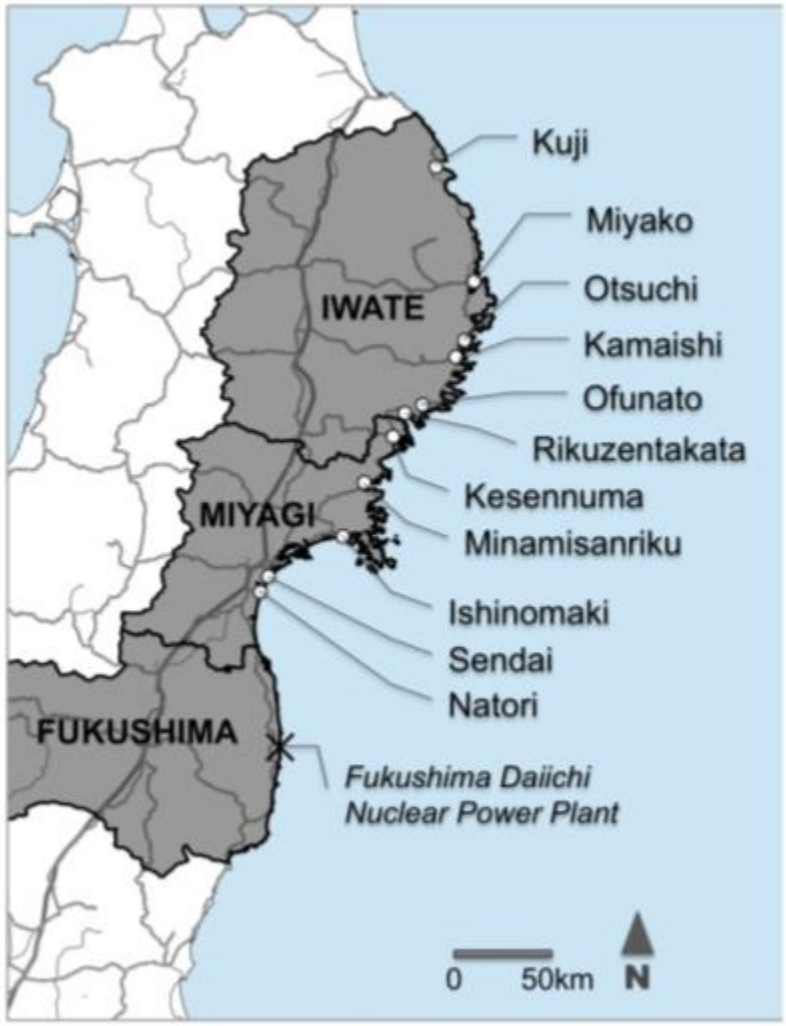
Recovery from M9 Great Eastern Japan Earthquake + Tsunami, March 11, 2011, 2:58 pm

Source: AFP/Getty Images; www.cnn.com)

Great East Japan Disaster Impacts



- Deaths: 15,788; Missing: 4,057
  (National Police Agency, Sept 16, 2011)
  - 90% of deaths due to drowning
  - 56% of deaths ≥ 65 years old
- Injuries: 5,314
  (Major Disaster Management Headquarters 04/25/11)
- Collapsed buildings: 107,000
  Partial-collapsed buildings: 111,000
  (National Police Agency, July 5, 2011)
- Fires: 345
  Totally & half- burned buildings: 260
  (Major Disaster Management Headquarters 04/25/11)
- Heaviest damage in 3 prefectures: Iwate, Miyagi, Fukushima
  - 14 other prefectures with damages

Great East Japan Disaster Impacts

(Cabinet Office, Government of Japan, 6/28/11)

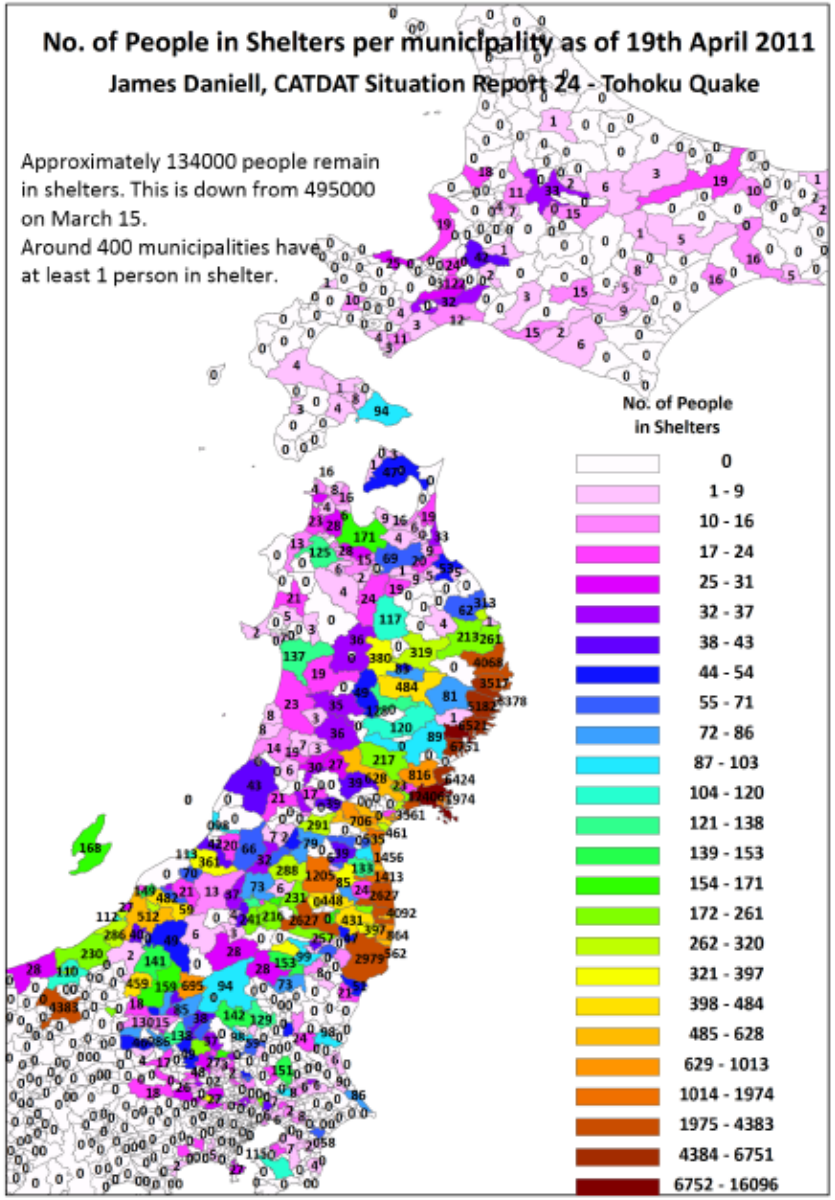
Item	Amount of Damage (approximate)	
	In JPY	In USD (1)
Buildings (housing, commercial, industrial, machinery, etc.)	10.4 trillion	129 billion
Lifeline facilities (water, gas, electricity, communications/broadcasting)	1.3 trillion	16 billion
Infrastructure (rivers, roads, ports, wastewater, airports, etc.)	2.2 trillion	27 billion
Agriculture, forestry, and fisheries-related (farmland, farming facilities, forests, fisheries-related facilities, etc.)	1.9 trillion	24 billion
Other (educational facilities, health and welfare-related facilities, solid waste disposal, other public facilities, etc.)	1.1 trillion	14 billion
Total	16.9 trillion	210 billion

Great East Japan Disaster Impacts

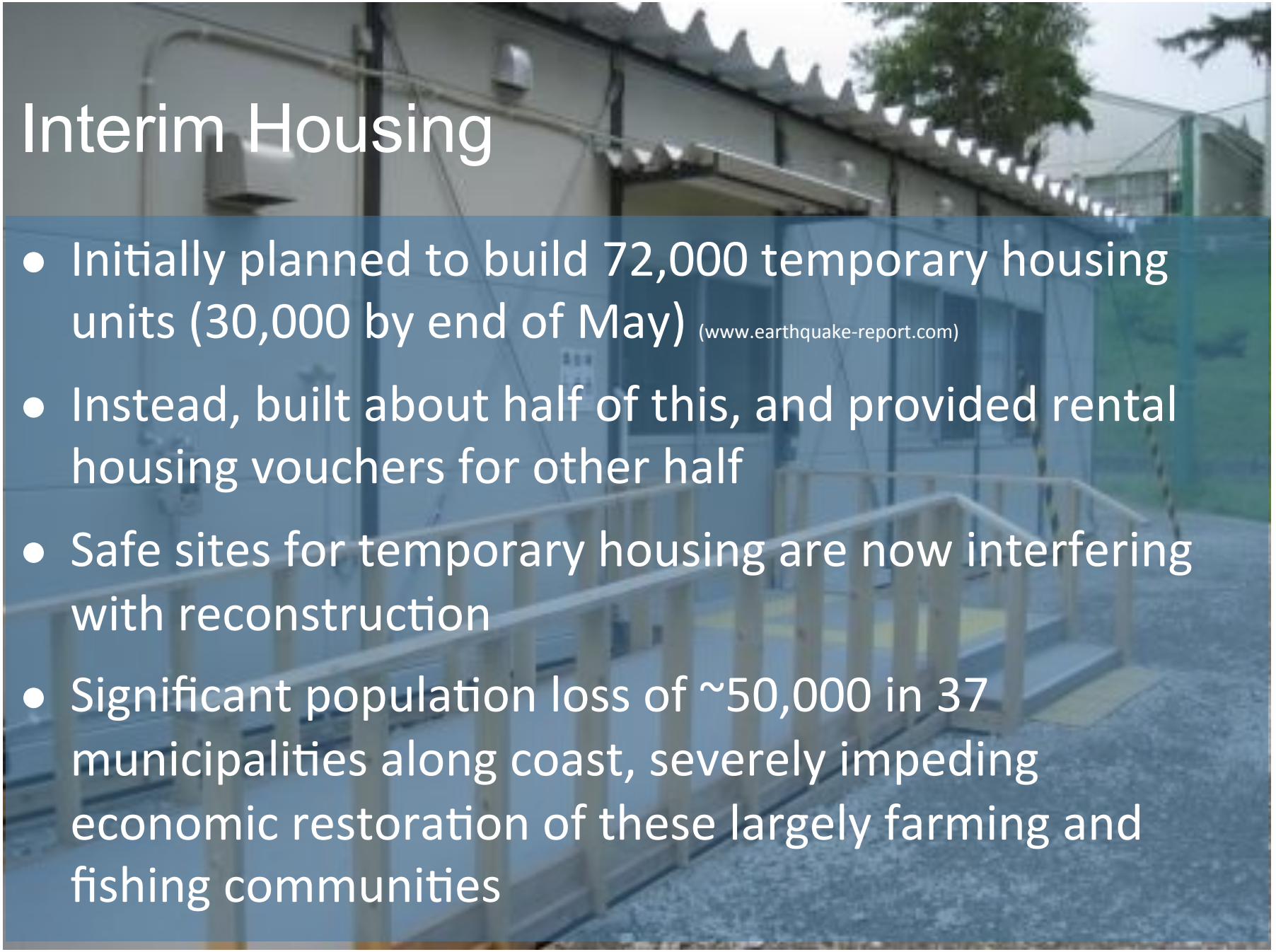
- Total Economic Loss may exceed US$500 billion (4% of GDP and 4x 1995 Kobe Earthquake disaster)
  (Tokyo Tech CUEE, 04/11/11)
  - Includes earthquake shaking, tsunami inundation, and secondary consequences
  - Does not fully account for economic consequences of nuclear incident, electric power reductions, and supply chain impacts
- National government estimated ~ US$200 billion reconstruction cost over 5 years
  - 1st supplementary budget of US$51.3 billion, approved in May
  - 2nd supplementary budget of US$24.7 billion approved in July
  - 3rd supplementary budget of US$150 billion submitted to Diet on October 28; approval expected mid-November
- Insured (Property and Life) Loss Estimates: US$15 to $50 billion
  (www.reuters.com 03/25/11; www.rms.com)

Sheltering

- Initially, 450,000 of 5.75 mn residents in evacuation shelters
- Sheltered population: 130,927 in ~2,950 shelters (mid-April 2011)
  (Major Disaster Management Headquarters 04/25/11)
  - Additionally ~50,000 impacted by Fukushima nuclear plant evacuation
- Last shelter closed in Sept. 2011



Interim Housing



- Initially planned to build 72,000 temporary housing units (30,000 by end of May) (www.earthquake-report.com)
- Instead, built about half of this, and provided rental housing vouchers for other half
- Safe sites for temporary housing are now interfering with reconstruction
- Significant population loss of ~50,000 in 37 municipalities along coast, severely impeding economic restoration of these largely farming and fishing communities

Debris Removal

- Estimated > 25 million tons of building debris NOT including collapsed ports, cars, and ships
  (Ministry of Environment; Tokyo Tech CUEE)
- Self Defense Forces initially assisted with debris removal as part of search and rescue
- Prefectures and local municipalities have primary responsibility for debris removal, sorting, recycling, and disposal, with national funding
  - Most debris management plans have a 3 year timeline
  - Temporary disposal sites near affected communities
  - Only Tokyo prefecture responded to national request for permanent disposal which began in October 2011


Natori


Ishinomaki


Source: Kyodo/AP


Otsuchi

National-level Response

National Earthquake Response Headquarters, Executive Meeting, 03/21/11

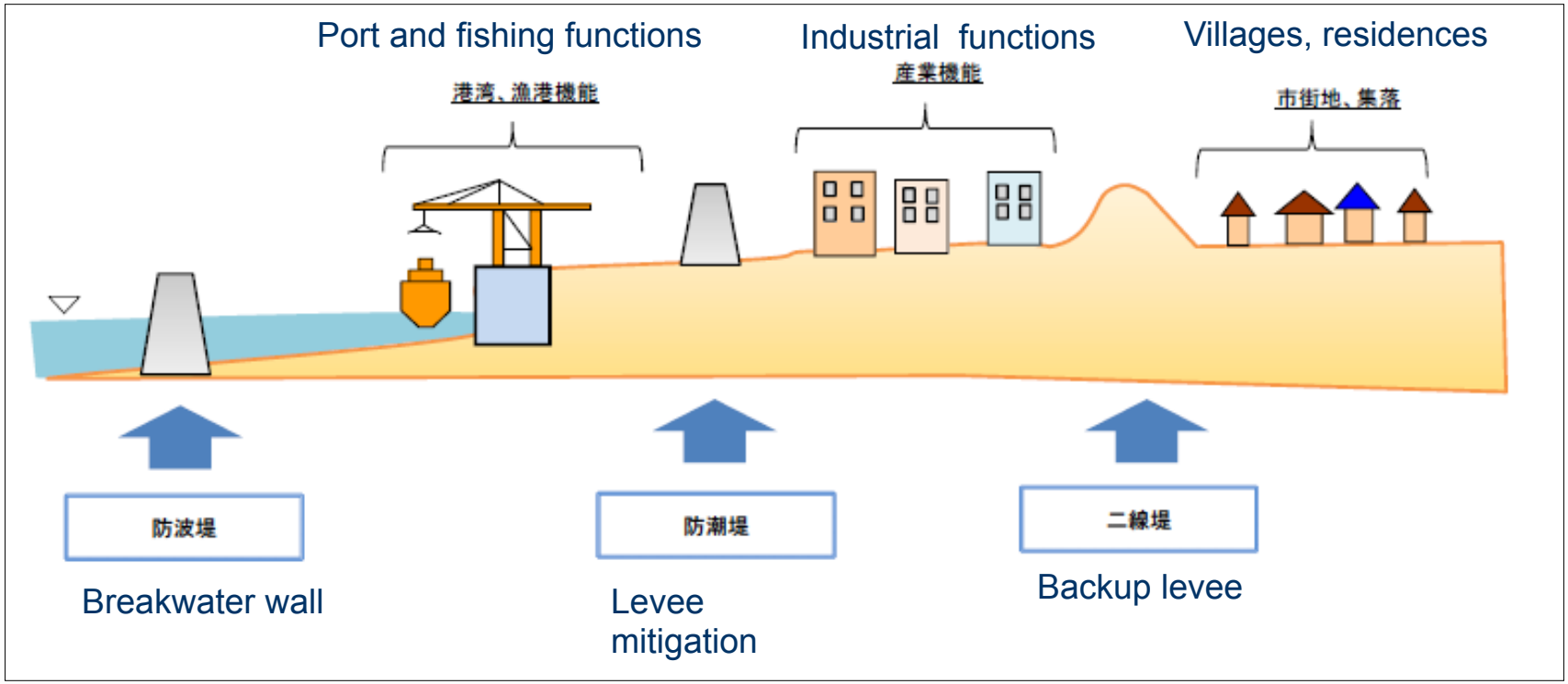
- National Headquarters for Emergency Management established March 11, 3:14 pm (Earthquake occurred at 2:46 pm local time)
- Disaster designated as a "Disaster of Extreme Severity" on March 13
- On April 11, 2011, Japan's Prime Minister established the East Japan Earthquake Recovery Framework Committee
  - 1st national-level planning committee for a natural disaster since Great Kanto earthquake (1927)
  - 15-member committee represents academia, business, and religious group, together with the governors of Miyagi, Iwate, and Fukushima prefectures.

National-level Response

- June 25, 2011, National Recovery Framework Committee released 39-page national recovery vision, *"Toward Reconstruction: Hope Beyond the Disaster"*
  - General concepts and strategies for physical recovery in the damaged areas, emphasizing the mitigation of future disaster impacts
  - Ideas for job creation and regional economic recovery
  - Needs for resolving the Fukushima nuclear crisis
  - General concepts and approaches for repositioning Japan in global economy, and opportunity to promote a better understanding of recovery processes globally.
- Most sections underscore local government primacy for recovery
  - 1 exception: national government in the lead on nuclear incident and associated recovery
- Acknowledges that implementation will require special land use, economic, and disaster management measures

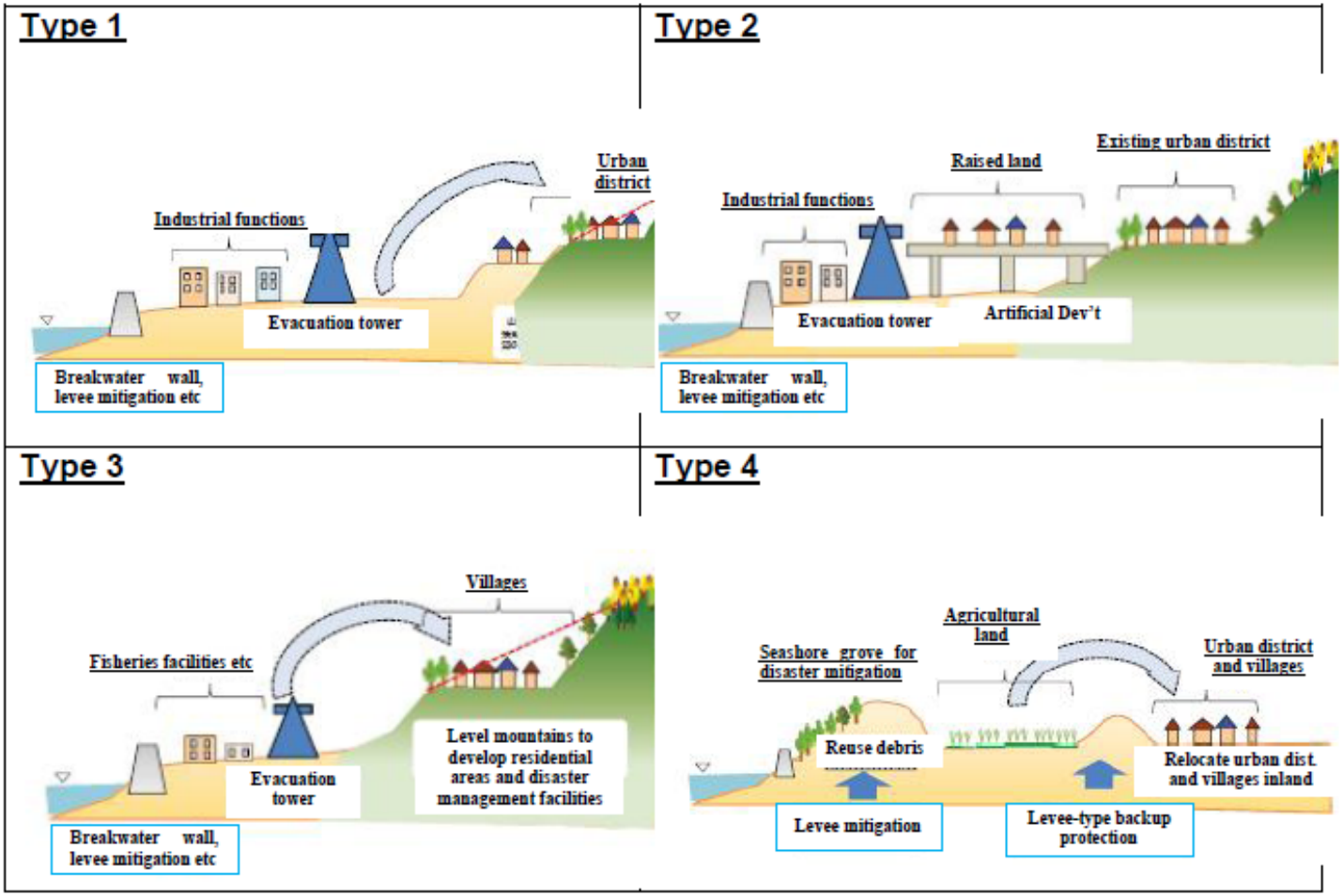
Reconstruction Concept for Tsunami-Resilient Communities

(Reconstruction Design Council in Response to the Great East Japan Earthquake, 2011; translation by K. Iuchi)

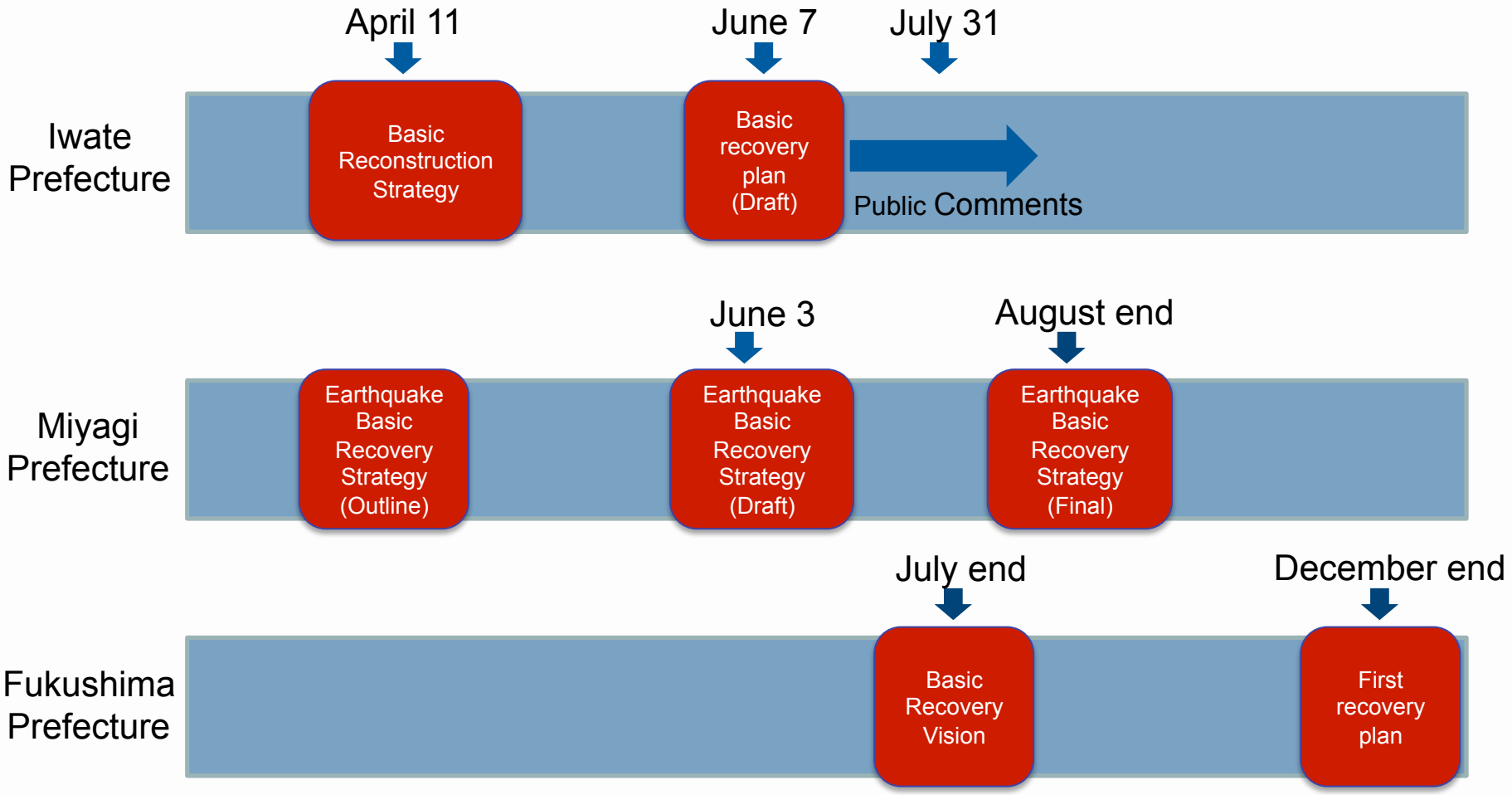


Four Reconstruction Models (based on damage types)

(Reconstruction Design Council in Response to the Great East Japan Earthquake, 2011; translation by K. Iuchi)



Prefecture Recovery Planning Timelines



Courtesy: Norio Maki, DRS-DPRI, Kyoto University

Minami-sanriku City Office and Emergency Operations Center

Recovery Planning Uncertainties/ Challenges

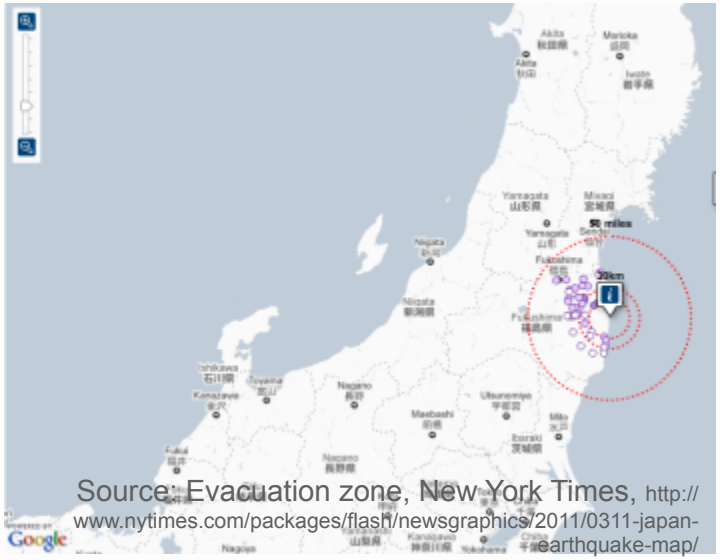
1. *Will there be enough money and community reinvestment?*
   - Even with the national government's allocations, prefectures, cities, residents and businesses will have to invest in rebuilding
   - Tohoku region was already struggling economically before the disaster occurred; population has been aging and declining; and employment prospects have been limited in many communities

Recovery Planning Uncertainties/ Challenges

2. *What to plan for?*
   - Entire towns in Fukushima Prefecture are in the nuclear off-limits zone with no clear end
   - Additional post-disaster population out-migrations across the region are making it difficult for local governments and businesses, in particular, to plan for the future
     - Generally, planners are less familiar, and have fewer examples of plans and approaches for dealing, with non-expanding communities and economies.
   - Substantial costs and design impacts in the affected communities are still not well-understood by residents and will have affect plans and decisions already made.

Fukushima Nuclear Power Plant

Photos: GeoEye/EyeQ
http://www.nytimes.com/interactive/2011/03/13/world/asia/satellite-photos-japan-before-and-after-tsunami.html



Source: Evacuation zone, New York Times, http://www.nytimes.com/packages/flash/newsgraphics/2011/0311-japan-earthquake-map/

Photo: CNN.com

Ishinomaki City

Recovery Planning Uncertainties/ Challenges

3. *How to handle land use issues?*
   - About 561 sq. km (216 sq. miles or 138,380 acres) subsided; most in narrow, 4- to 5-kilometer swath along coast. Relocations of ports and other public uses are needed
   - Plans call for substantial land use changes to:
     - Construct significant tsunami protection systems
     - Relocate damaged residential areas, in particular, to higher lands.
   - Lack of hazard-free space, and conflicting or overlapping hazards
     - Much of region is quite mountainous and faces multiple hazards from flooding, landsliding, coastal storms, tsunamis, and earthquakes.

Ishinomaki Port Affected by Subsidence

Ishinomaki Port Affected by Subsidence

Ishinomaki – Temporary Fishing Port

Recovery Planning Uncertainties/ Challenges

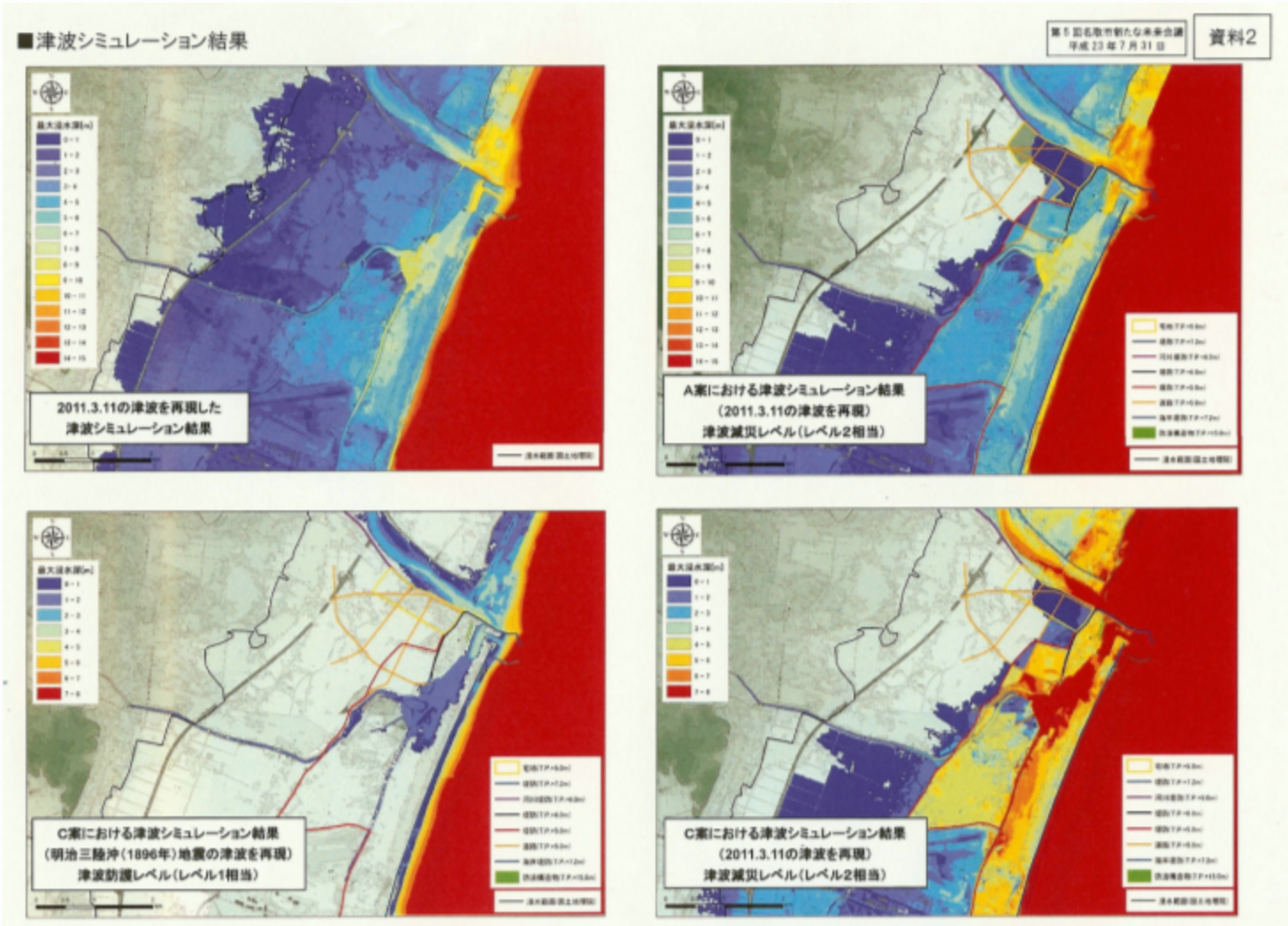
4. What is the future risk?

- March 11 disaster overwhelmed communities' pre-disaster risk reduction efforts.
  - Most coastal communities had high levels of tsunami awareness, pre-disaster mitigation (including protective structures) and preparedness
  - But, many had assumed and planned for a much smaller tsunami, in part because of over-reliance on previous risk estimates and models developed by national disaster management and scientific agencies.
- Substantial study and debate now underway both within scientific community, and impacted localities, to determine the future risk and appropriate kinds of protection:
  - Design heights and numbers of tsunami seawalls and levee structures
  - Reductions of human and residential exposures in potential inundation areas
  - Adequate provisions of evacuation routes, locations, and plans

National Technical Investigation Panel to the Central Disaster Management Council (June 26, 2011 report)

- Recommended "overhauling… Japan's tsunami response measures… to cope with the largest tsunami that can be expected…" (Asahi Shimbun 6/28/11)
- "Countermeasures should focus on how to evacuate residents, instead of relying on seashore protection;" and "evacuation routes should be set so that children and elderly residents can evacuate without difficulty…"
  - Construct structures for vertical evacuation in areas "without high ground"
  - Improve real-time earthquake assessment to speed determination of magnitudes and potential for generation of tsunami
  - Review evacuation training measures

Natori City: Modeling Examples of Future Tsunami Scenarios with Different Protections



Early Insights

- A country with an excellent track record of preparedness, had not anticipated the magnitude of the earthquake and tsunami
- Cascading effects indicative of a “super-catastrophe” leading to a protracted response period, escalating losses and far-field effects, and impeded transition to recovery
- Recovery from the 3.11 Great East Japan earthquake will require sustained commitment for planning, financing, and rebuilding for 10+ years

Early Insights

- Devastation of local governments, and long-distance evacuations will disrupt community-level organizing and implementation of recovery plans
- National leadership, political instability, and financing for recovery will continue to be problematic
  - Protracted economic impacts of nuclear incident
- Significant changes in legislation and policy for disaster management, land use, engineering/construction, and financing will likely follow

Planning for the Next Large Bay Area Earthquake

- Are we planning for the right hazards/risks (i.e. expected vs. extreme, and cascading effects)?
- Is our planning toolkit up-to-date and appropriate to deal with post-disaster recovery issues and demands?
  - General plans/safety elements, zoning, hazard mitigation plans, building repair and retrofit standards, lifeline performance standards
- What resources (human, financial, information) do we need to deal with the likely post-disaster needs (public and private)?
- Are our governing structures and institutional capacities adequate to manage different aspects of recovery?

Thank you!

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