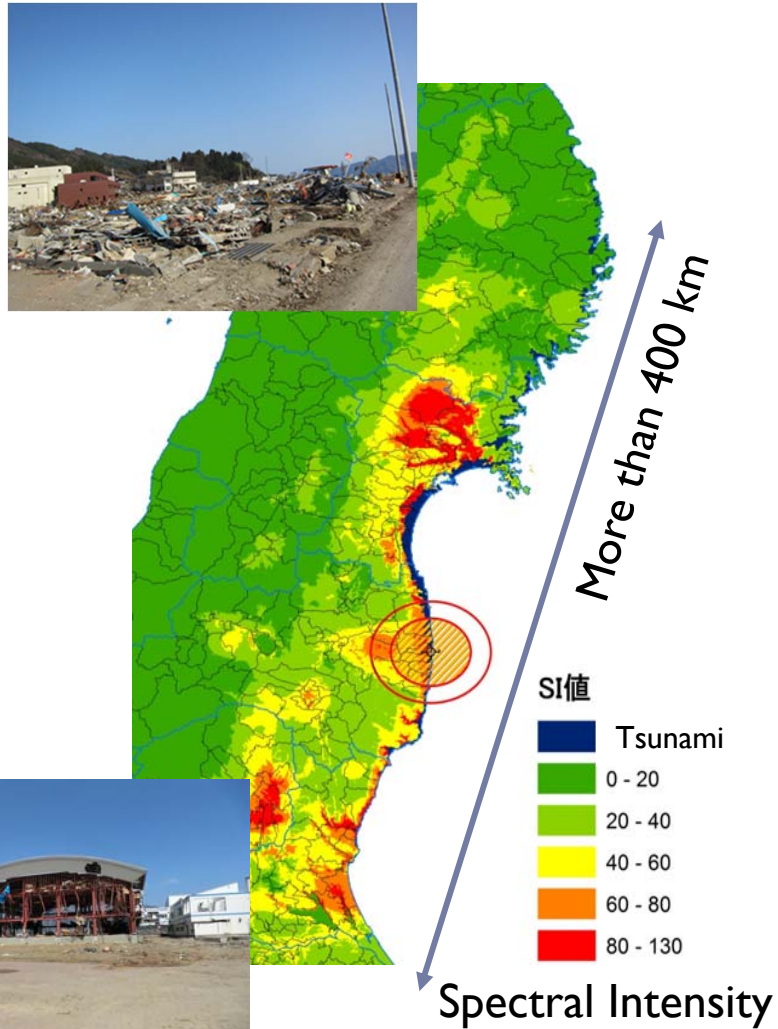




## Lessons from Japan Earthquake and Tsunami 2011: Specific Implications for Financing Relief and Reconstruction

Yoshio Kajitani (Central Research Institute of Electric Power Industry)  
Hirokazu Tatano (Kyoto University)

# The Great East Japan Earthquake and Tsunami

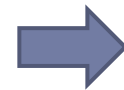


## -Different types of Hazards

- Earthquake
- Tsunami
- Nuclear Accident

-Power Shortages (Rolling Blackout, Persistent shortages)

- gasoline and oil shortages



Large-scale socio-economic impacts

# Direct Damage

**Table 1.** Estimated direct damage ([Government of Japan 2012](#))

| Category              | Scope                                                                          | Damaged Stocks <sup>(1)</sup> (¥) | Damaged Stocks (US\$) <sup>(2)</sup> |
|-----------------------|--------------------------------------------------------------------------------|-----------------------------------|--------------------------------------|
| Buildings, etc.       | Housing, offices, plants, machinery, etc.                                      | 10.4 trillion                     | 130 billion                          |
| Lifeline utilities    | Water service, gas, electricity, and communication and broadcasting facilities | 1.3 trillion                      | 16.3 billion                         |
| Social infrastructure | River, road, harbors, drainage, and airport, etc.                              | 2.2 trillion                      | 27.5 billion                         |
| Others                | Including agriculture, forestry, and fisheries                                 | 3.0 trillion                      | 37.5 billion                         |
| TOTAL <sup>(3)</sup>  |                                                                                | 16.9 trillion                     | 211.3 billion                        |

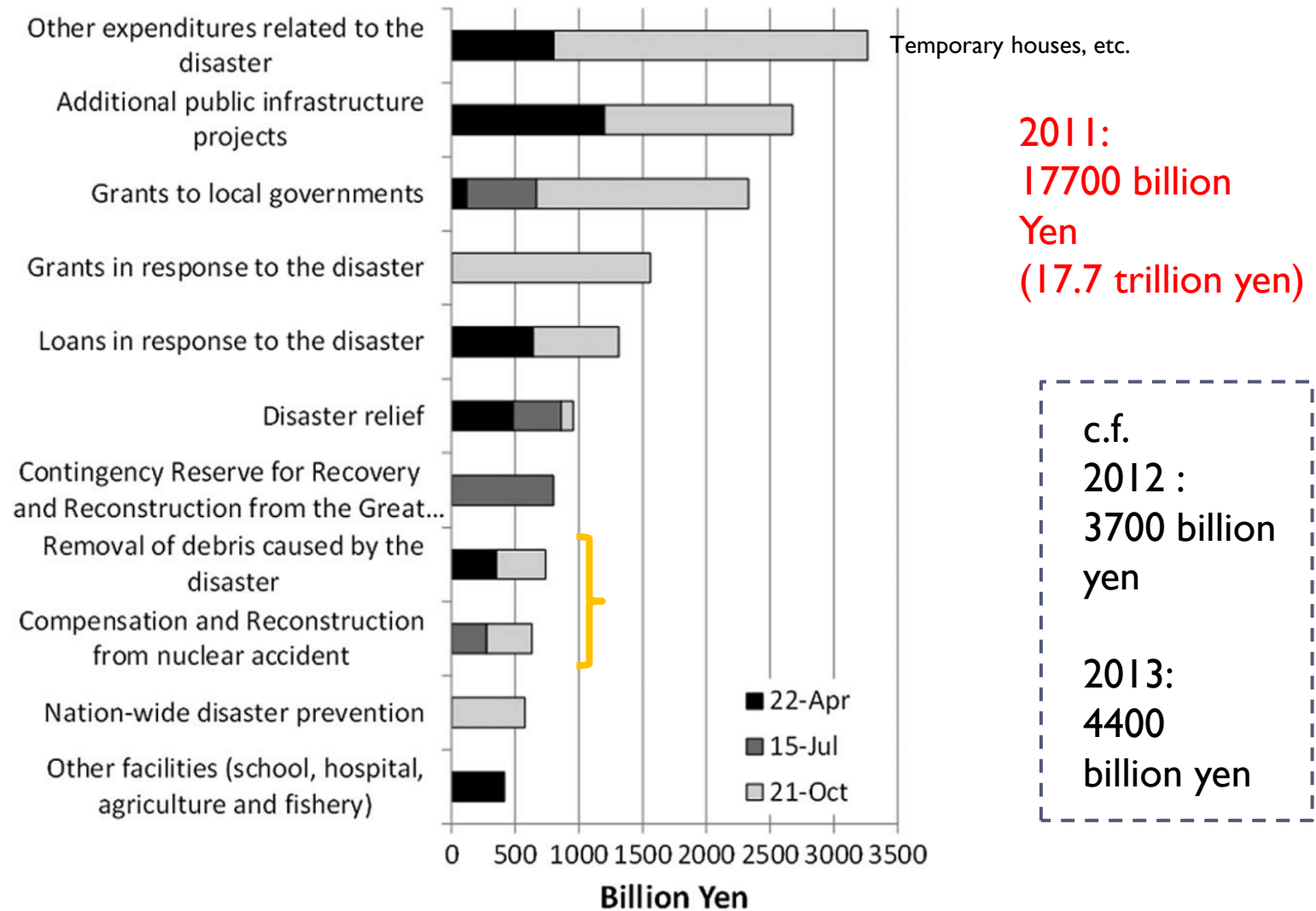
Notes:

<sup>(1)</sup>Estimated by Cabinet Office of Japan, 24 June 2011

<sup>(2)</sup>Converted at US\$1 = ¥80.

<sup>(3)</sup>Excludes land damage.

# Recovery Cost Allocation for 2011 fiscal year



# Insurance payouts (Kajitani, Chang, Tatano, 2013)

| Insurance Type                                                                  | Actual Payouts<br>(billion ¥) | Comments                                                                                                                                              |
|---------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Earthquake insurance                                                            | 1,218.6                       | As of 12 March 2012. <sup>(2)</sup> Includes domestic and foreign insurers. Source: <a href="#">The General Insurance Association of Japan (2012)</a> |
| Japan Agriculture fraternal insurance (JA Kyosai)                               | 883.2                         | As of 8 March 2012. Includes <u>\$3 billion</u> from catastrophe bond (Muteki, Ltd.) Source: JA Kyosai (2012a and 2012b)                              |
| Japan Fishery (JF Kyosai)                                                       | 24.0                          | As of 22 March 2012. Source: <a href="#">JF Kyosai (2012)</a>                                                                                         |
| National Federation of Workers and Consumers Insurance Cooperatives (Zenrousai) | 113.6                         | As of 31 January 2012. Source: <a href="#">National Federation of Workers and Consumer Insurance Cooperatives (2012)</a>                              |
| Japan Federation of Cooperative Mutual Aid (Co-op Kyosai)                       | 93.6                          | As of 27 July 2011. Source: <a href="#">Ministry of Health, Labor, and Welfare (2012)</a>                                                             |
| Other insurance (payouts to firms, etc.)                                        | 600.0                         | As of 20 May 2011. Source: <a href="#">Asahi News (2011b)</a>                                                                                         |
| TOTAL <sup>(1)</sup>                                                            | (>) 2,933.0                   | \$36.7 billion                                                                                                                                        |

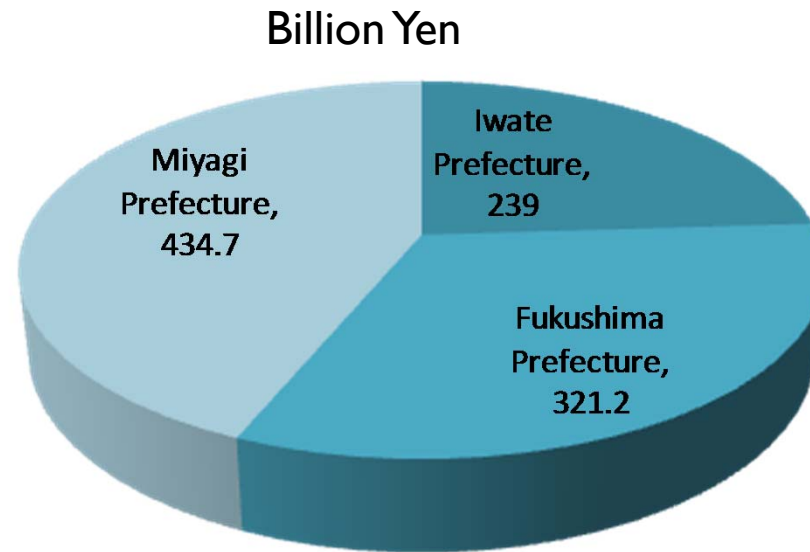
Notes:

<sup>(1)</sup>Excludes mutual aid system for local governments (*Todoufukemin Kyosai*), life insurance (except earthquake insurance), and other types of insurance.

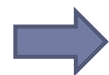
<sup>(2)</sup>Nearly all claims have already been inspected (870,341 out of 878,898).

# Remaining Budgets for 2012 fiscal year in the severely damaged prefectures

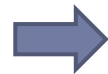
---



Reasons: Over capacity of construction sector  
Price increase of materials and rigidity of price bidding  
Mismatch of Job opportunities and specialties of unemployment,  
etc.



Delay of recoveries (debris removal, reconstruction, etc.)



Local government tries to modify the bidding system (simpler)



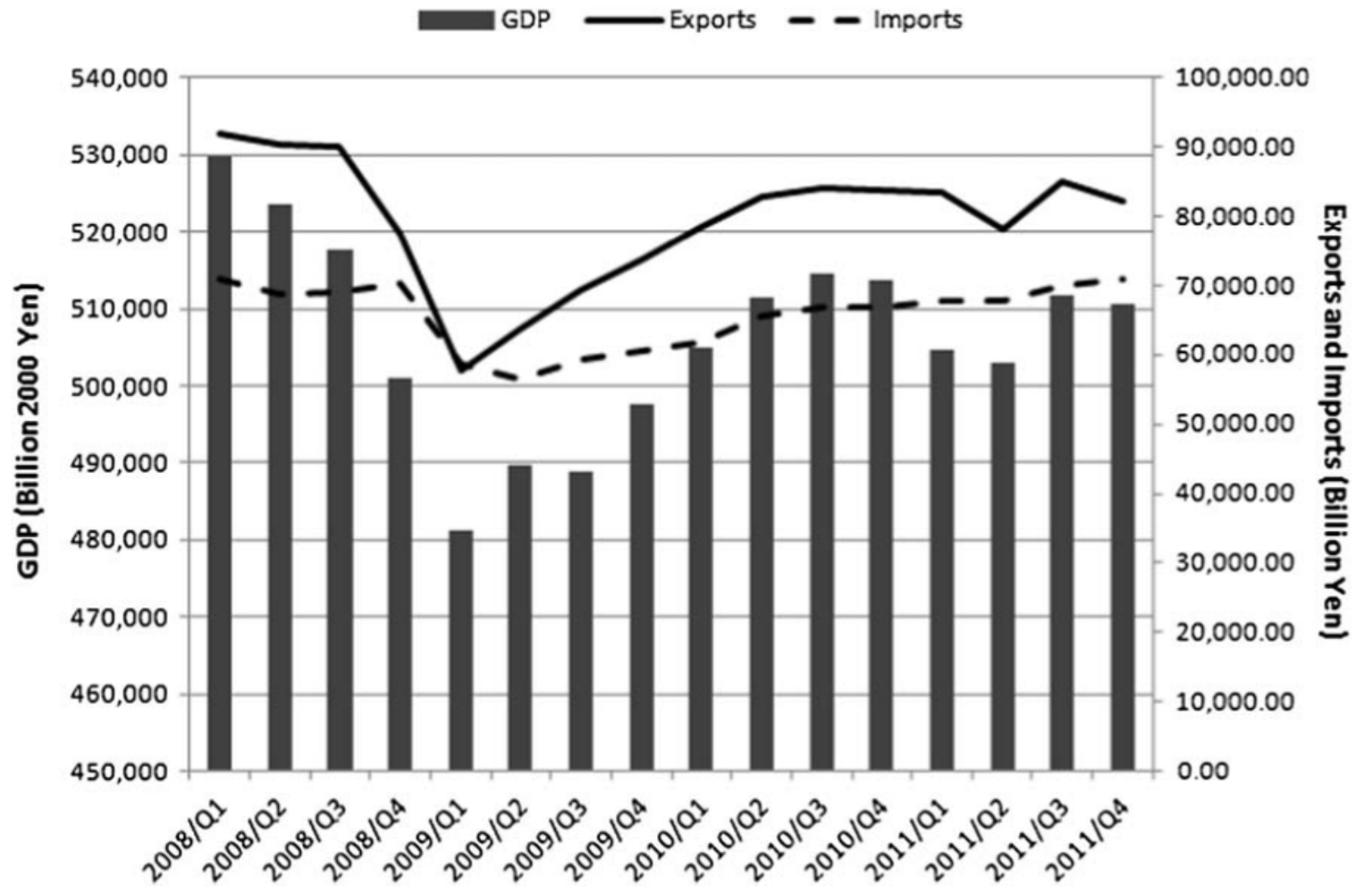
# Reconstruction Plan for Severely Inundated Areas



In total, about 13000 households are planned to move to upland areas  
(c.f. 120,000 houses were collapsed)

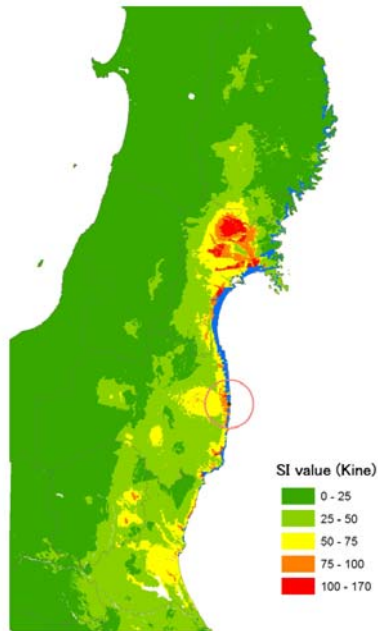
Consensus building (stay or move), equity problem (only selected area),  
large amount of governmental financial aids (tax payer), Legal issues (no previous examples)

# Flow Losses





# (Capacity) Loss Estimation Model



## Hazard

- Tsunami
- Ground Motion
- Evacuation Area (Nuclear)

## Exposure

- Distribution of Businesses (Number of Employees)

## Vulnerability

- Functional Fragility Curve

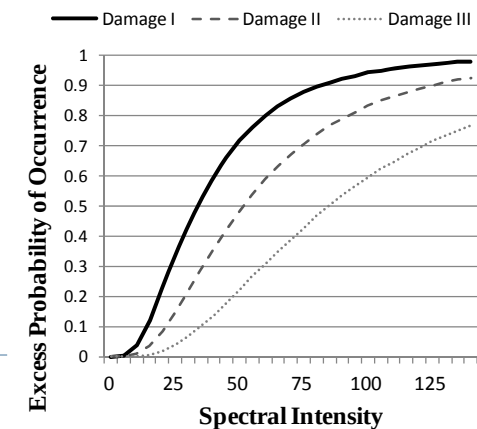
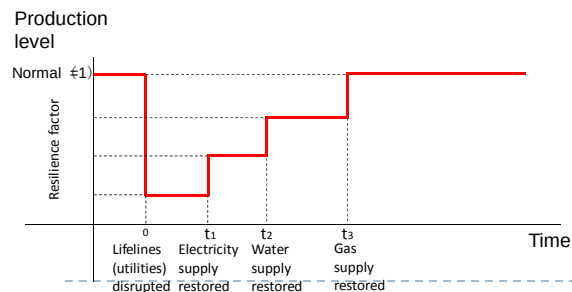
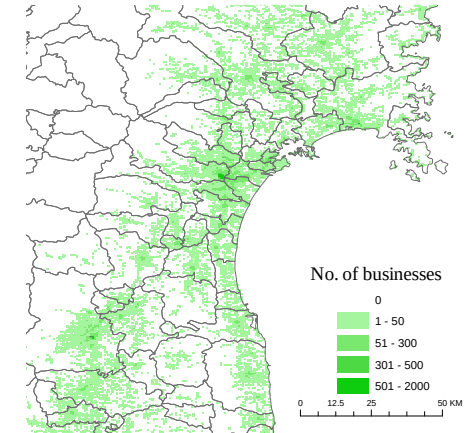
Capacity Losses (Facility Damage)

Lifeline Disruption Status

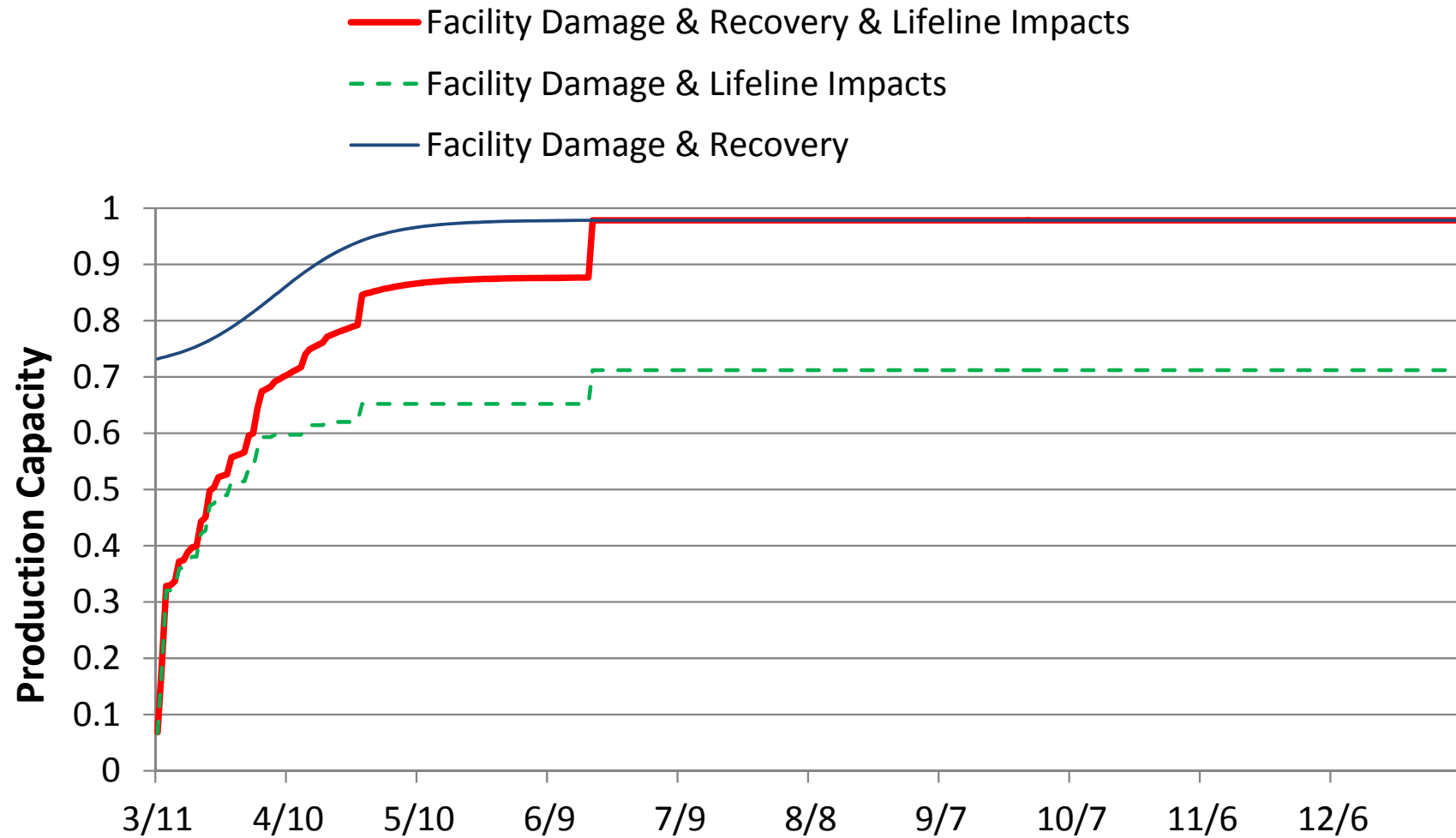
## Resilience

- Lifeline Resilience Factor
- Recovery from Facility Damage

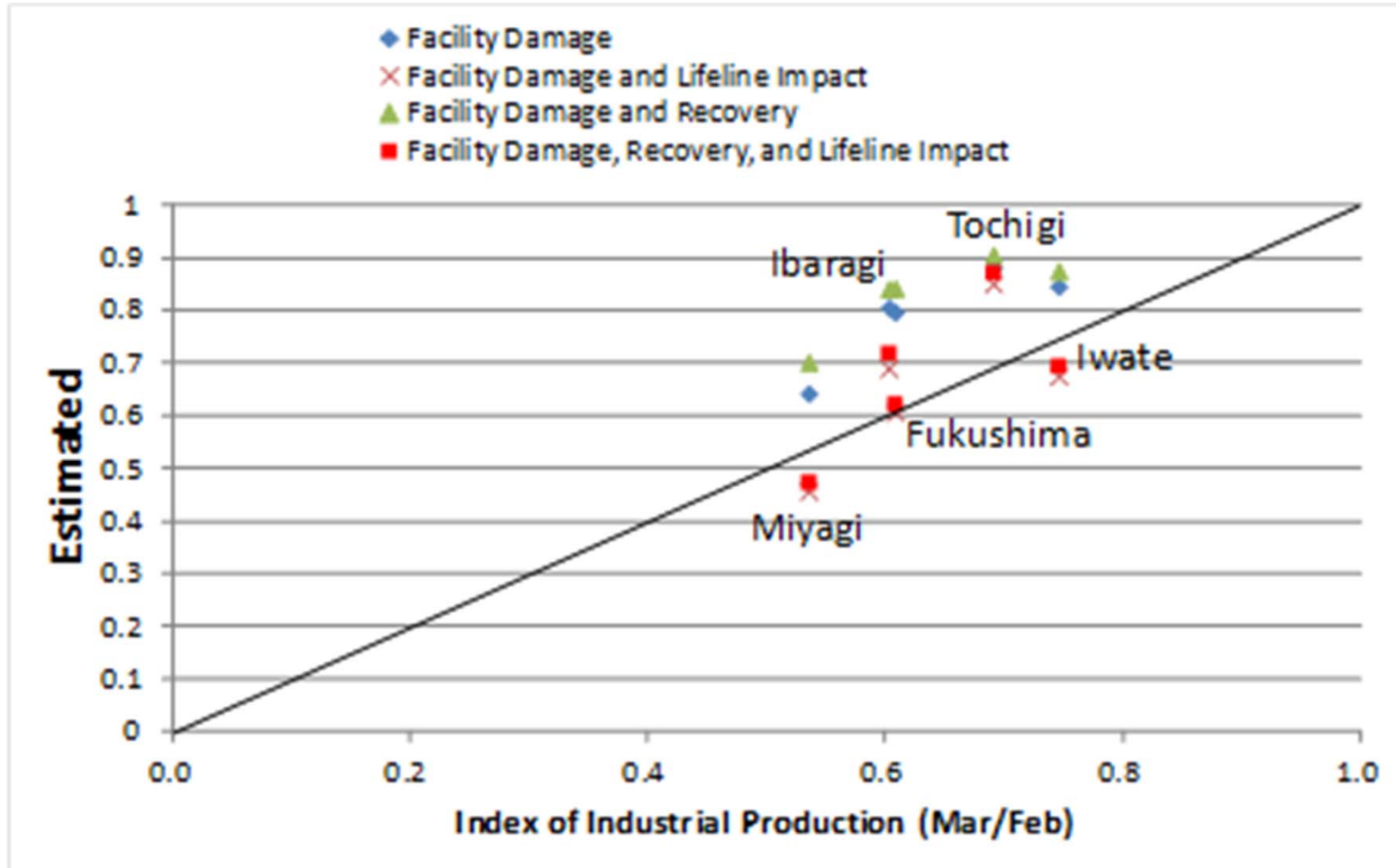
Production Capacity Losses due to Facility Damage/recovery and Lifeline Disruptions



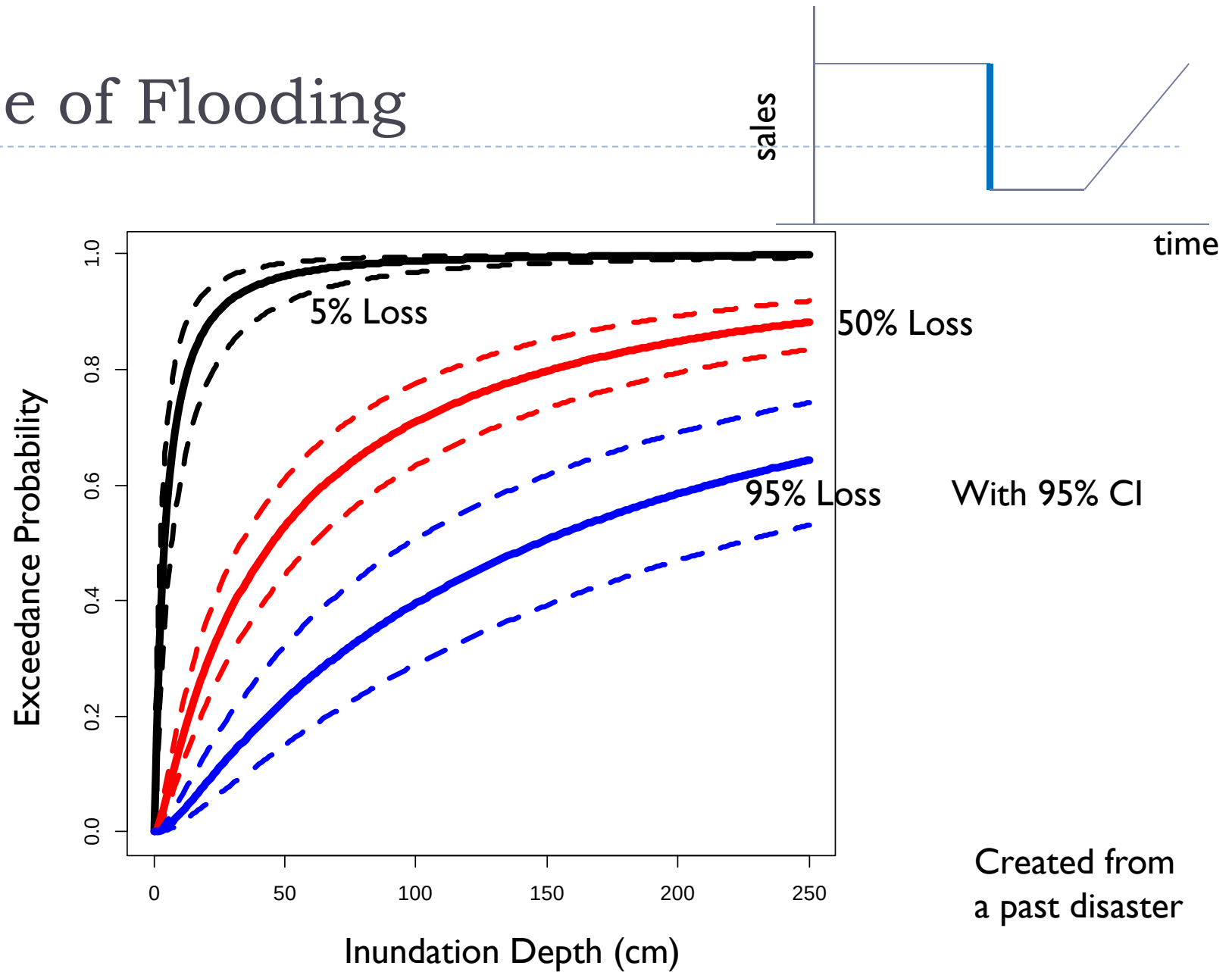
# Est. Result (Transport. Manf. in Fukushima)



# Estimated Results 1 (March, 2011)



# Case of Flooding



# Summary

---

- ▶ Difficulty of implementing recovery plans
  - Planning (consensus building among stakeholders, legal issues)
  - Reconstruction capacity problem
  - > need to monitor recovery conditions
- ▶ Enhancement of loss estimation model is necessary (higher-order impacts) with reconsideration of size of hazards (various scenarios)
  - > cost-benefit, recovery planning before a disaster comes

## Remaining issues:

- ▶ Environmental issues (CO2, nuclear problems)
- ▶ Some good aspects (Insurance, early warning system for Shinkansen, Energy saving efforts, etc.)