

# Creating Common Operating Picture for a Large-scale Earthquake Disasters

Haruo Hayashi  
Kyoto University

# Emergency Mapping Team

## 【Great Eastern Japan Earthquake】

14:46:23, 11 March 2011 : 2011 Tōhoku earthquake and tsunami (M=9.0)

- Seismicity occurred serially at Miyagi coast, Fukushima coast, and Ibaraki coast of Pacific Ocean Sanriku coast
  - Multiple prefectures devastated catastrophe
  - Tsunami, shake, liquefaction, radiation leakage of complex disaster
- 
1. respond organization cross several prefectures
  2. hard to obtain general picture of damage
  3. various organizations and staffs associated with disaster response

## 【Necessity of mapping service at a national level】

Developing common operating picture at national-level disaster response

- necessary to generate different sorts of information (internet)
- necessary to visualize information for decision-makers (maps and so on)
- necessary to generate spatial information specialists' intelligence to estimate the situation

To make it possible for developing common operating picture at a national level, those who share same idea organized “Emergency Mapping Team” on March 12, 2011 and started mapping service with the Cabinet’s support.

# Activity and Contribution

<p>March 12 10:00</p>	<ul style="list-style-type: none"> <li>• Explain the idea to Director for Disaster Prevention and Preparedness, Cabinet</li> <li>• Special meeting room provided for EMT activity</li> <li>• Members start mapping of EMT activity by owned computers</li> </ul> <p>(1) collection of buildings at evacuation zone of Fukushima 1 nuclear power plant</p>
<p>March 13 (activity in real earnest)</p>	<ul style="list-style-type: none"> <li>• Building database from "Cabinet report"</li> <li>• Procuring base map from associated agencies             <ul style="list-style-type: none"> <li>2005 Population census data/ administration boundary/ digital map/ building point data etc</li> </ul> </li> </ul> <p>Hazards</p> <ul style="list-style-type: none"> <li>Tsunami : low elevation area/ satellite photo/ drainage area</li> <li>Seismicity : city-based /1km<sup>2</sup> mesh-based seismicity</li> <li>Fire : reports from each ministry</li> <li>Nuclear: estimation based on expansion model/ evacuation areas (count backwards)</li> <li>Liquefaction : estimation based ground ft. seismicity</li> </ul> <p>Vulnerability</p> <ul style="list-style-type: none"> <li>Population: population census data</li> <li>Building : building map/ address point data</li> <li>Lifeline</li> </ul>

# Activity and Contribution

<p>March 23</p>	<ul style="list-style-type: none"> <li>•Constructed EMT homepage released the maps manufactured before March 23 and dynamic map, traffic recovery data provided by ITS-JAPAN (raster data only)</li> </ul>
<p>March 28</p>	<ul style="list-style-type: none"> <li>•Established “Tohoku Earthquake Emergency Mapping Conference” Necessity of “MashUp” Release rules for MashUp and so on</li> </ul>
<p>April 6</p>	<ul style="list-style-type: none"> <li>•Identified long-term evacuation area, a request from the Cabinet Creating new knowledge from MashUp Applying knowledge from researchers and previous as a model</li> </ul>

(May 1, 2011)

Map Manufacture : **502 Maps**

# Activity and Contribution



Activity Office of EMT  
(Central joint Government building #5  
special meeting room, Cabinet)

Captured the Cabinet office's movement to  
examine the possible needs of maps



# Activity Organization Reinforcement

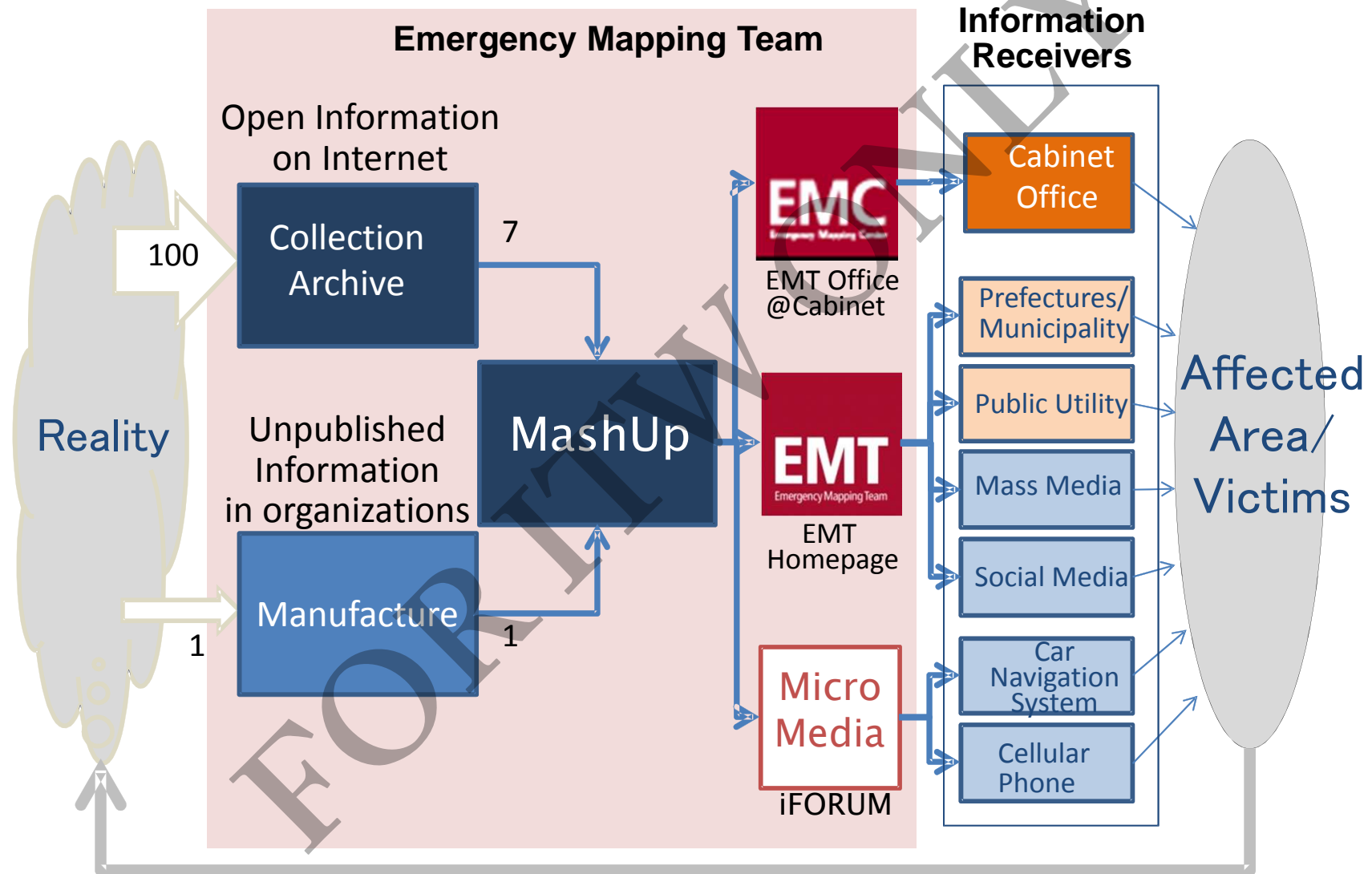
Initial Period



Developing Period



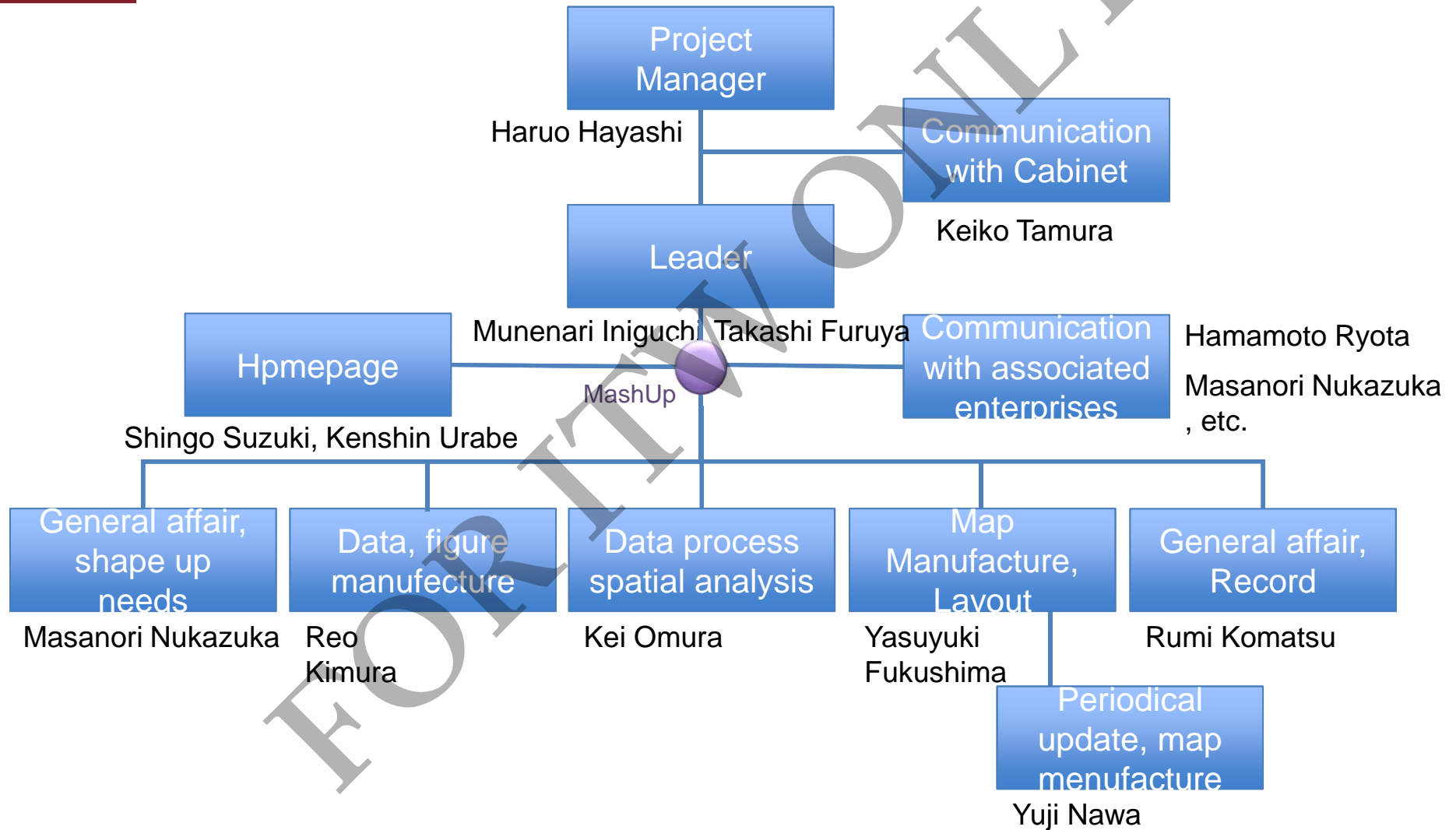
# Allocating EMT in MashUp





# Activity Organization in Field

March 17, 2011



# Joint Organizations

- Developing organization framework as enterprise, administration, academy, civilization cooperating, supporting team
- Haruo Hayashi (DPRI, Kyoto University)
  - 【Administration】
    - Insurance Group, Dept., of R&D
    - Kajima Technical Research Institute
    - Pasco Corp.
    - Increment P Corp.
  - 【Academy】
    - JAXA
    - ASTEM
    - NTT, IS Lab.
    - Science Craft
    - GK Kyoto
    - Xceed Co.
    - Duplo Group
    - Hyper Research Co.
    - Arutsu Media Solution, etc.
- Director for Disaster Prevention and Preparedness, Cabinet
- 【Academy】
  - Kyoto Univ., DPRI
  - Niigata Univ., NHDR
  - Yokohama National Univ., CRMSS
  - Fuji-Tokoha Univ.
  - Kansai Univ., Dept. of Safety Science
  - Kyoto Univ., ISS
- 【Enterprise】
  - ESRI (USA)
  - ESRI(Japan)
  - NTT Data CCS
  - NTT-ME

•株式会社Agoop



•明堂G



•京都大学防災研究所巨大災害研究センター



•パシフィックコンサルタンツ株式会社



•ASTEM



•有限会社 アールツー・メディアソリューション



•株式会社サイエンスクラフト



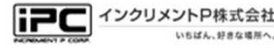
•株式会社パスコ



•ESRI



•インクリメントP株式会社



•株式会社 ジイケイ京都



•兵庫県立大学



•ESRIジャパン株式会社



•株式会社 インターリスク総研



•地理情報システム学会



•富士常葉大学



•NPO法人 地域自然情報ネットワーク (GCN)



•宇宙航空研究開発機構



•東北大学



•特定非営利活動法人 防災デザイン研究会



•iForum



•株式会社エクシード



•デュプロ株式会社



•本田技研工業株式会社



•特定非営利活動法人 ITS Japan



•大阪産業大学



•奈良大学



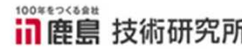
•ヤフー株式会社



•株式会社NTT-ME



•鹿島建設株式会社 鹿島技術研究所



•新潟大学



•横浜国立大学 (安心・安全の科学研究教育センター)



•株式会社NTTデータCCS



•関西大学



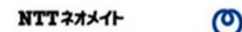
•バイオニア株式会社



•酪農学園大学



•株式会社NTTネオメイト



•岐阜大学



•ハイパーリサーチ株式会社



# Static Maps and Dynamic Maps

- Static Maps (Paper, PDF)
  - Announced inside organization in a large-sized printing (perspicuity)
  - Released by PDF (Easiness : GIS not required)
- Dynamic Maps (WebGIS)
  - Zoom-in/out, Layer display/hidden (Flexibility)
  - Other contents to MashUp (add-value creativity)
  - Application with GIS soft (analysis, advanced utilization)



# Static Maps and Dynamic Maps

EMT Website

Static Maps

Dynamic Maps

The screenshot shows the EMT website interface. At the top, there is a navigation bar with the EMT logo and the text "東北地方太平洋沖地震緊急地図作成チーム Emergency Mapping Team". Below this, there is a main content area with a header in Japanese and a list of activities. The page is divided into two main sections: "静的MAPカタログ (ORIGINAL) へ" (Static Map Catalog) and "動的MAP ( MashUP ポータル) へ" (Dynamic Map MashUP Portal). The static map section features a grid of nine maps under the heading "東京電力計画停電" (Tokyo Electric Power Company Planned Power Outage), with a legend and a small table. The dynamic map section lists four items: (3) Aerial Photos, (1) Hazard: Earthquake occurrence status, (1) Hazard: Fukushima Daiichi nuclear power plant status, and (4) Evacuation Sites. Each item includes a thumbnail, a title, a description, the creator's name, the last modified date, and a star rating. The footer contains copyright information for 2011 and a logo for EMT.

Emergency Mapping T... x

www.drs.dpri.kyoto-u.ac.jp/emt/

Google Esri - The GIS Sof... ESRIジャパン株式... ArcGIS Explorer ... ArcGIS.com Emergency Mappi... その他のブックマーク

EMT 東北地方太平洋沖地震緊急地図作成チーム  
Emergency Mapping Team

EMTとは マッシュアップのちから Japanese  
参加団体 利用規程 協議会 English

平成23年3月11日に発生した東北地方太平洋沖地震(M=9.0)は、複数の都県が同時被災した超広域災害となりました。わたしたちは、全国に広がる各種の被害および対応に関する状況認識の統一のため、以下の活動を行っています。

- 国レベルでの広域的な状況認識のための情報の地図による可視化
- 都県レベルでの活動の調整に必要な情報の地図による可視化
- 緊急性・重要性が高い現場での活動を支援する情報の地図による可視化

静的MAPカタログ (ORIGINAL) へ

東京電力計画停電

東北電力 計画停電グループ (平成23年3月17日付け)

第1グループ	第2グループ	第3グループ
第4グループ	第5グループ	第6グループ
第7グループ	第8グループ	

ID: 090 東北地方太平洋沖地震緊急地図作成チーム (EMT)

動的MAP ( MashUP ポータル) へ

(3)被害:浸水被害(空中写真および衛星画像による判読結果) (Aerial Photos)  
平成23年(2011年)東北地方太平洋沖地震(東日本大震災)による被災地の空中写真および判読結果  
Web Map by EMT2011 (last modified: March 31, 2011)  
★★★★☆ (3 ratings, 0 comments, 3336 views)

(1)ハザード:日本周辺の過去一週間の地震発生状況 (Web マップ)  
日本周辺の過去一週間の地震発生状況 (Web マップ)  
Web Map by Himiyama (last modified: March 23, 2011)  
★★★★☆ (2 ratings, 0 comments, 1081 views)

(1)ハザード:福島第一原子力発電所の状況 (2011年4月29日 15:00現在)  
福島第一原子力発電所の状況  
Web Map by awuk (last modified: April 30, 2011)  
☆☆☆☆☆ (0 ratings, 0 comments, 1041 views)

(4)災害対応:避難所 (Evacuation Sites)  
東北地方太平洋沖地震(東日本大震災)被災地付近の避難所分布と避難者数推移  
Web Map by EMT2011 (last modified: March 29, 2011)

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EMT 東北地方太平洋沖地震緊急地図作成チーム

# Estimation of buildings at evacuation areas of Fukushima nuclear power plant

- Plant 1 : evacuates if at 20 km radius
- Plant 2 : takes shelter indoors if at 10km radius
- Collected address points at announced areas to visualize possible impact

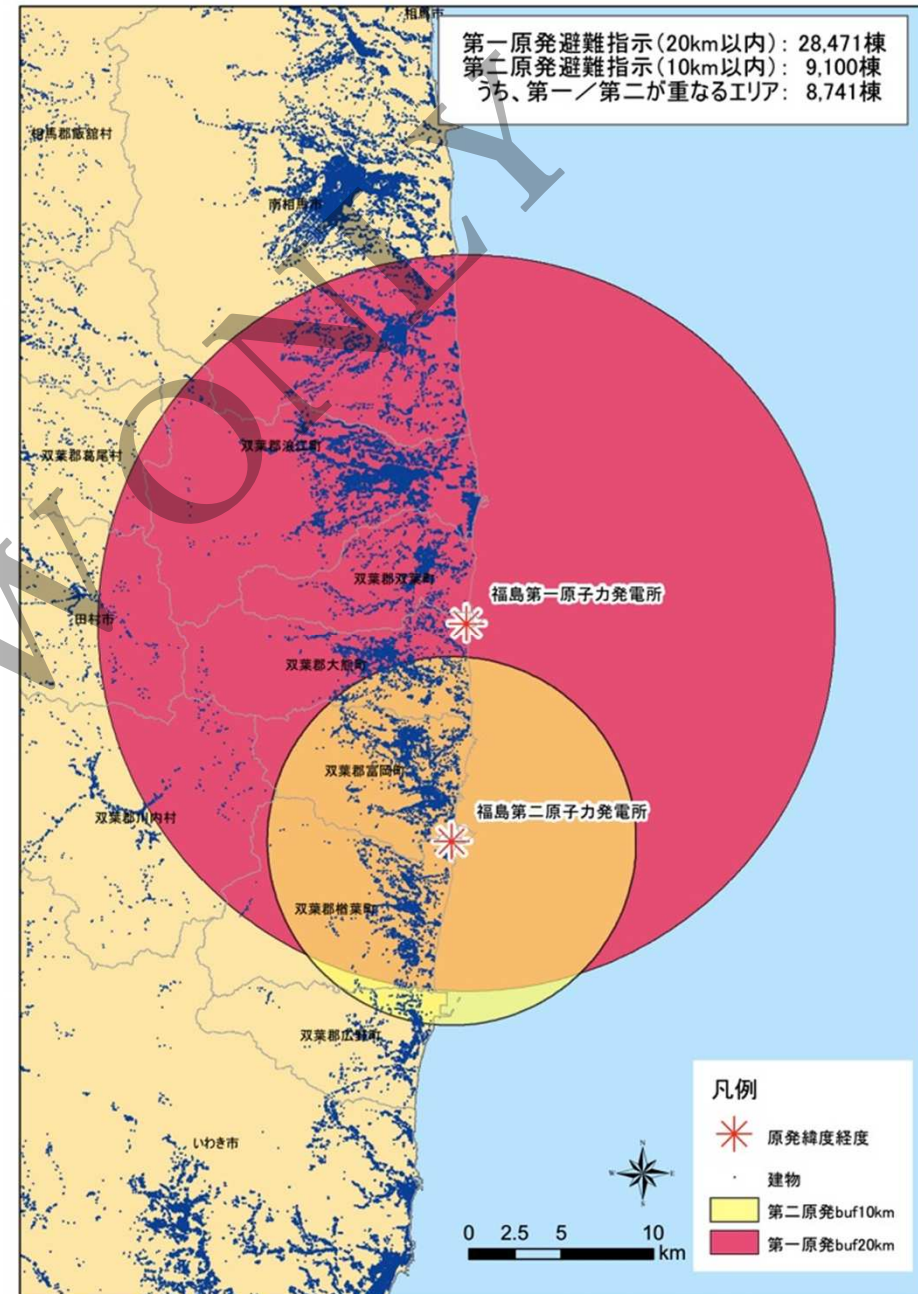
Plant 1 : 28,471 buildings

Plant 2 : 9,100 buildings

Overlapped : 8,741 buildings

Manufacture: March 12, 2011

福島原発避難指示エリアにおける建物棟数の推計



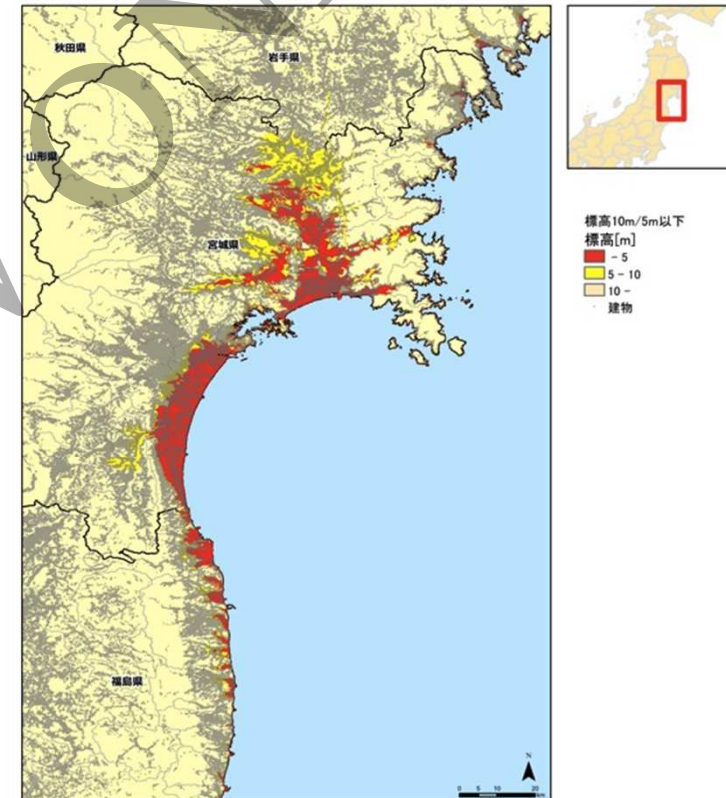


# MLIT : Map application need for estimating required households of disaster recovery public housings



標高5m/10m以下エリアにおける建物棟数の推計

宮城県

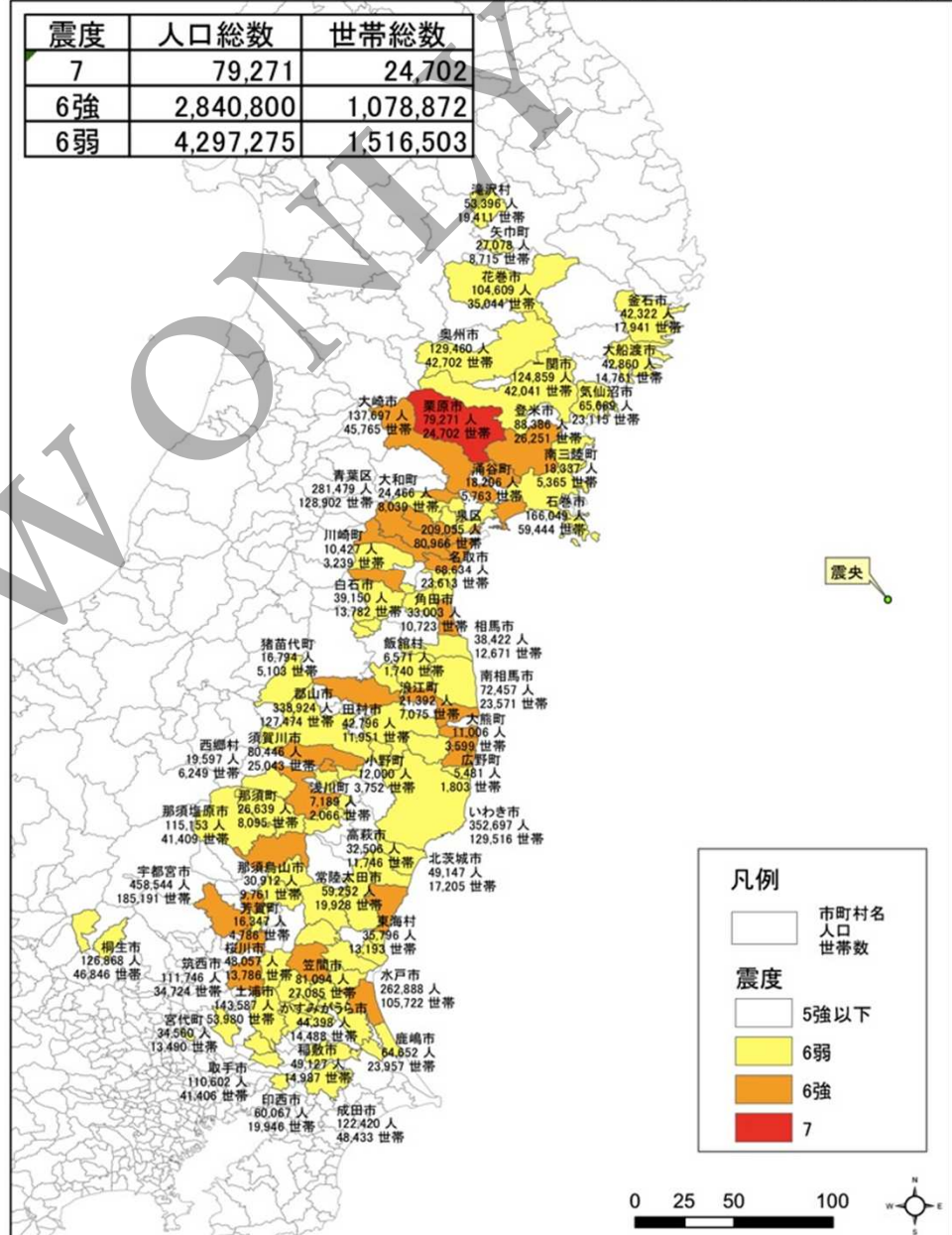


市町村コード	都道府県	市町村	~5 [m]	5~10 [m]	総計
	全域	集計	825,676	587,844	1,413,520
02	青森県	集計	117,164	57,779	174,943
03	岩手県	集計	14,981	27,821	42,802
04	宮城県	集計	135,410	99,815	235,225
07	福島県	集計	52,603	40,807	93,410
08	茨城県	集計	117,040	93,241	210,281
12	千葉県	集計	388,478	268,381	656,859

# Population at seismic intensity levels

## 震度分布別人口・世帯数

(平成23年3月11日現在:消防庁 第14報)



Population/ household at seismic intensity levels

Hazard

Seismic Intensity Areas exposed to seismicity at 6-lower

Social Property

Household/ Population Population Census

# Population Aged 65+ Rate(Disaster Relief Act declared cities)

**Population Aged 65+  
Rate(Disaster Relief Act  
declared cities)**

Grasp of damage

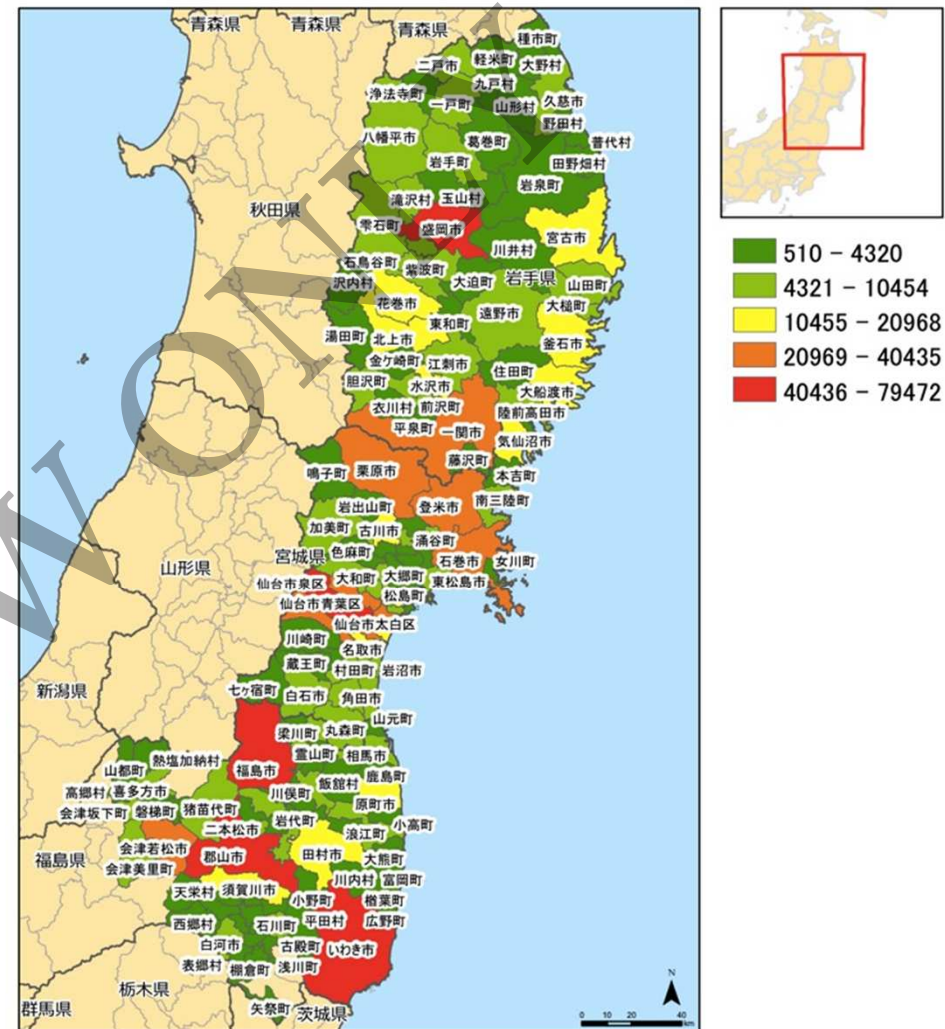
Disaster Relief Act  
declared areas

社会資産 Social property

Population Population Census

65歳以上人口（災害救助法適用市区町村別）

平成17年国勢調査により作成



	総人口	65歳以上人口	65歳以上人口比率
岩手県	1,385,040	326,562	23.6%
宮城県	2,360,218	339,957	14.4%
福島県	2,091,319	474,860	22.7%

# Estimation of buildings at areas under 5m/10m elevation

Estimation of buildings at areas under 5m/10m elevation

Hazard

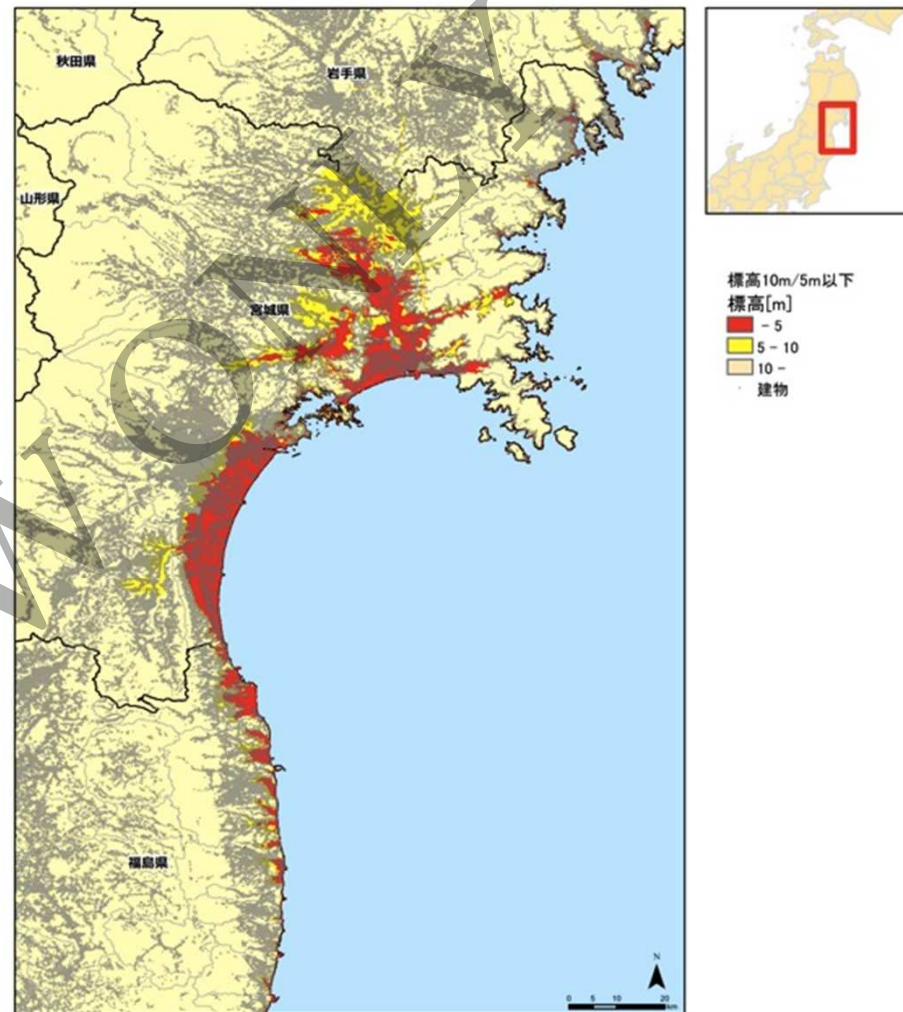
Tsunami Low-elevation area

Social property

Building Address point

標高5m/10m以下エリアにおける建物棟数の推計

宮城県



市町村コード	都道府県	市町村	~5 [m]	5~10 [m]	総計
全域 集計			825,676	587,844	1,413,520
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12	千葉県	集計	388,478	268,381	656,859

# 死者・行方不明者数（市町村別） 宮城県・福島県

平成23年3月12日（土）23時00分 消防庁災害対策本部



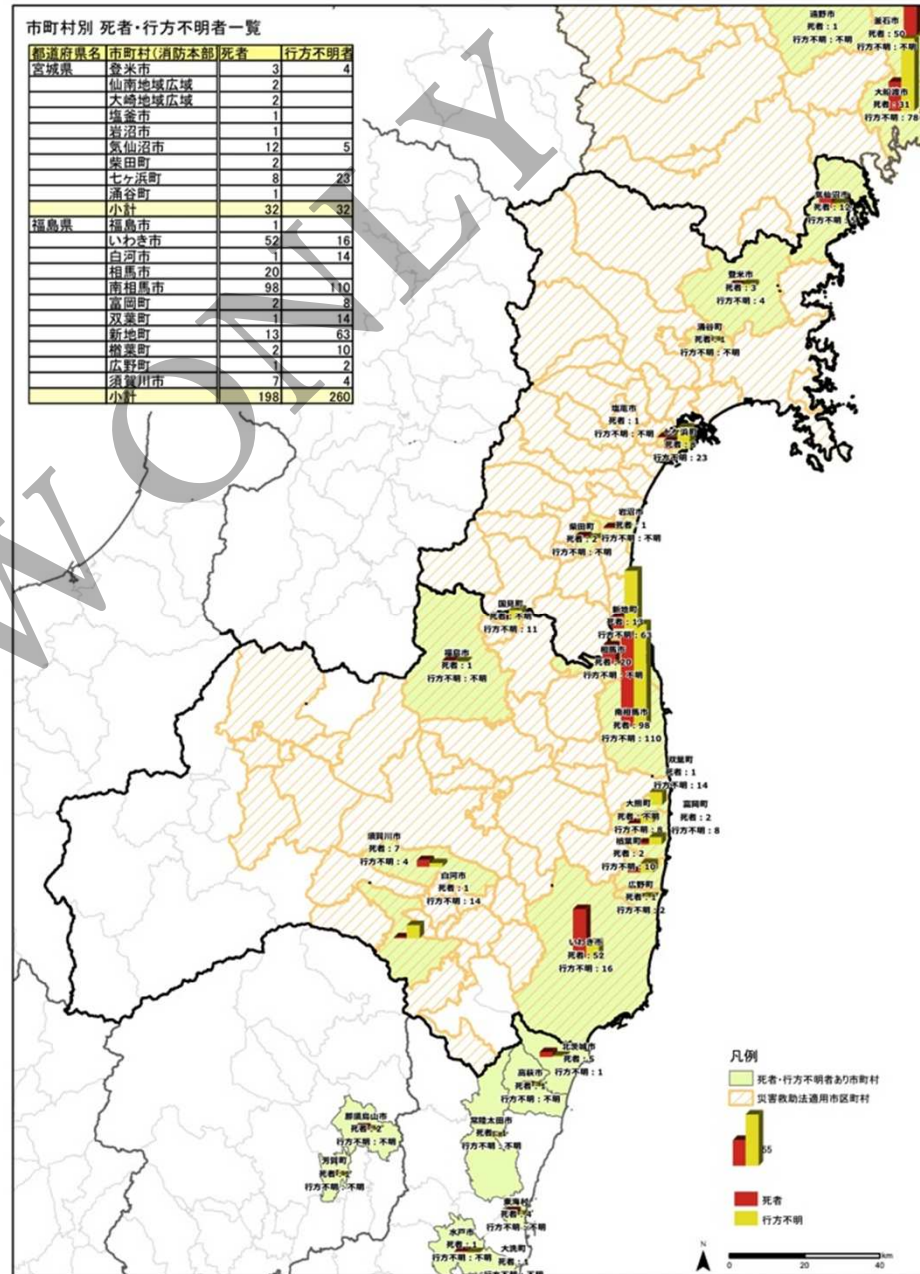
## Injured People every city

### Injured People every city

### Grasp of damage

Human Injured population every city

Disaster Relief Act declared areas





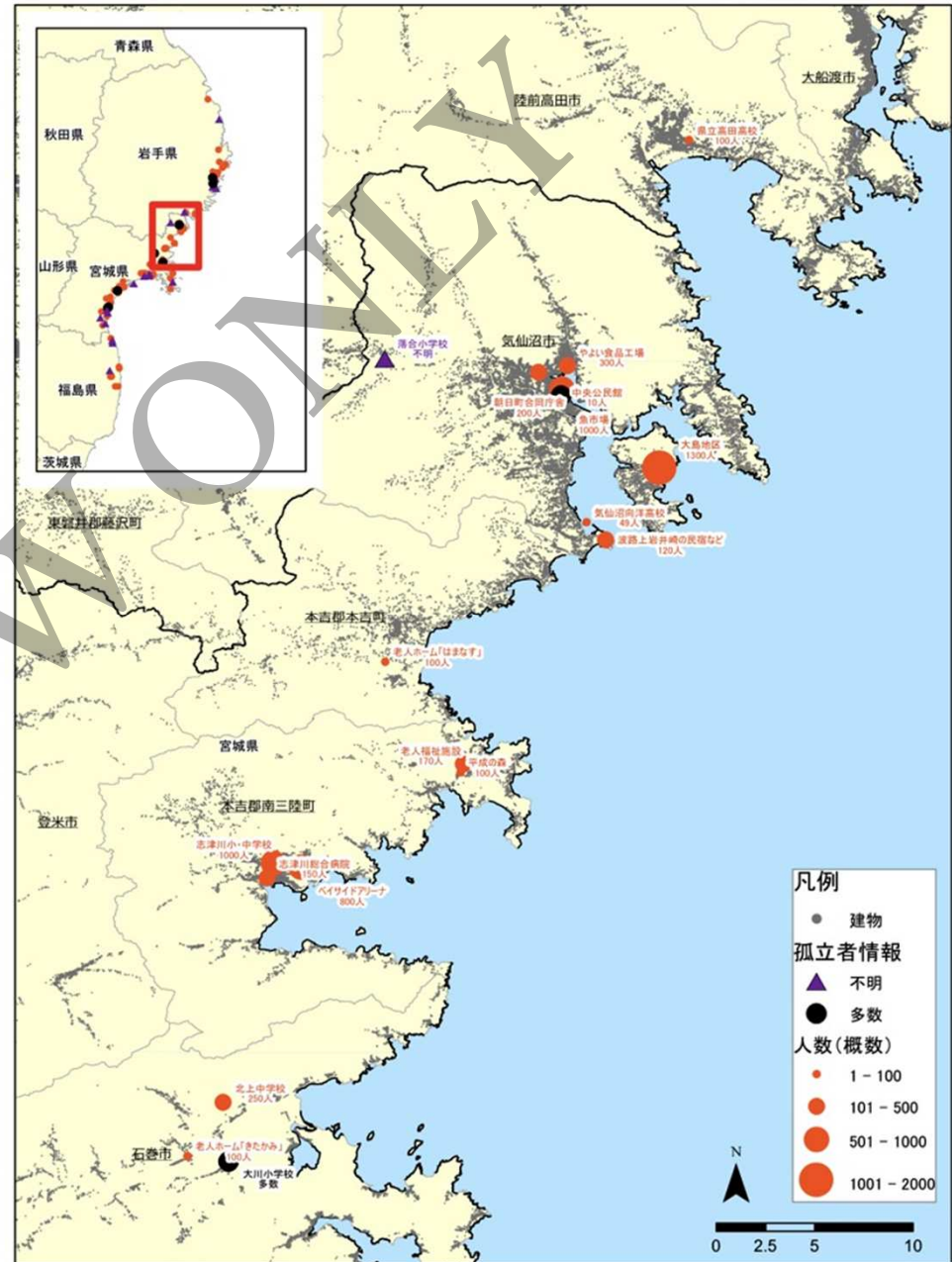
# Isolated People (Iwate Pref., Miyako city ~ Kamaishi city)

- Isolated People  
(Iwate Pref., Miyako city ~  
Kamaishi city)
- Grasp of damage
- Human Isolated population  
information
- Social property
- Address point
- Building

## 孤立者情報(宮城県)

大船渡市～石巻市

平成23年3月15日 06時00分現在



# Completely/Half Destroyed Houses every city

Completely/half destroyed houses every city

Grasp of damage

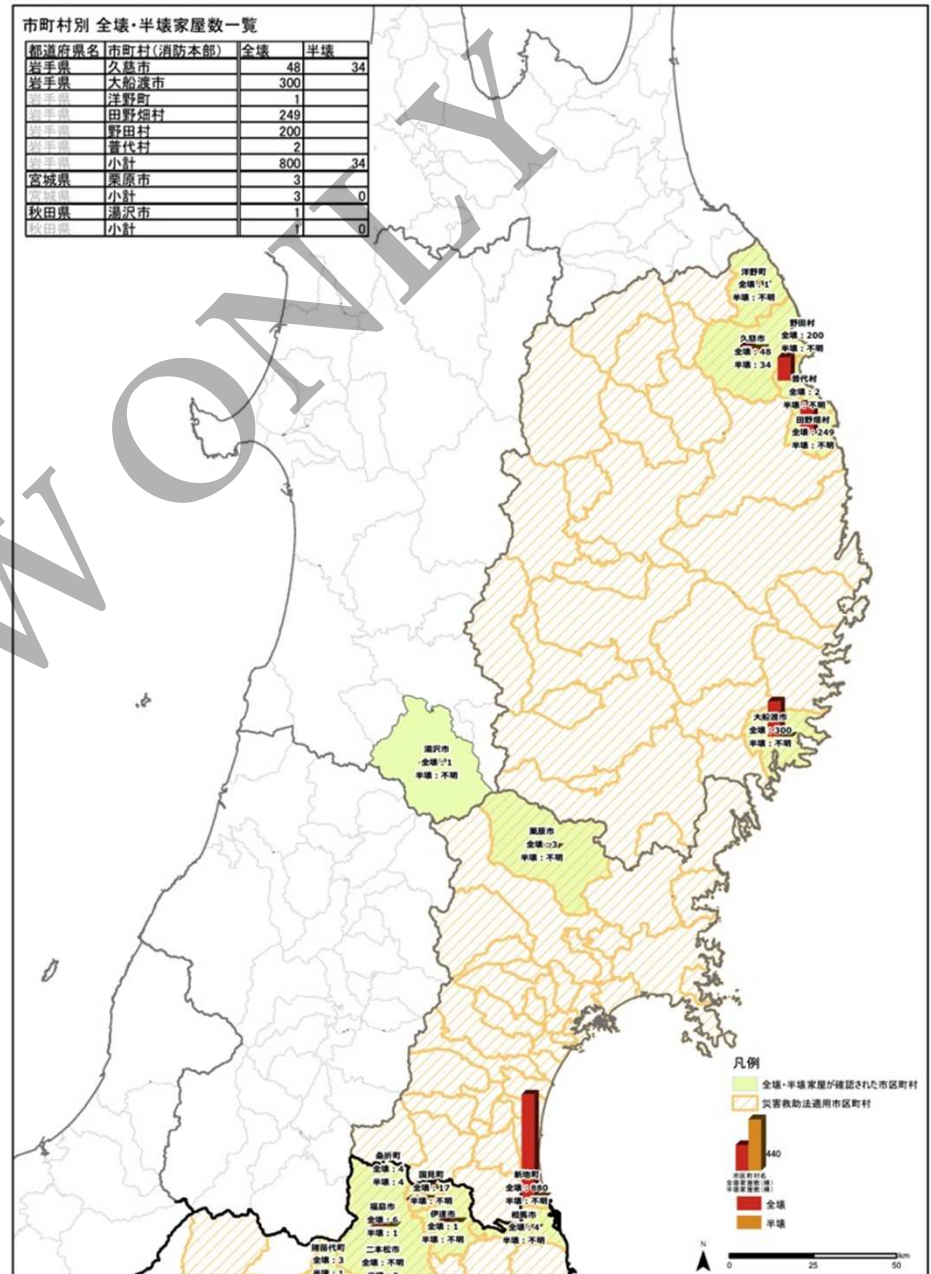
Building Completely/ Half destroyed houses

## 全壊・半壊家屋数 (市町村別)

(2/3)

岩手県・秋田県・宮城県

平成23年3月12日(土) 23時00分 消防庁災害対策本部





# TEPCO Planned Outage

東京電力 計画停電グループ (平成23年3月15日付け)

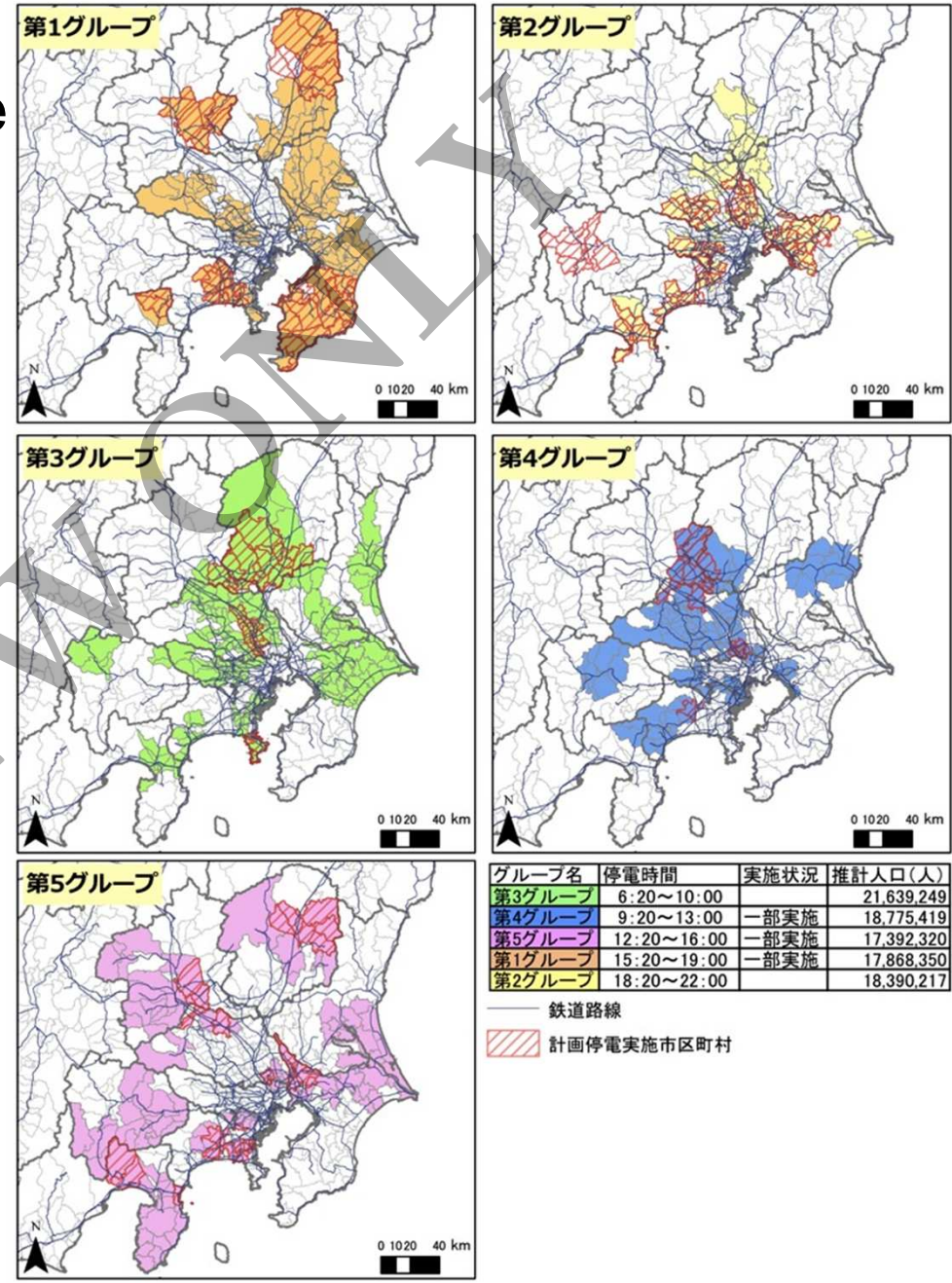
TEPCO Planned Outage

Hazard

Outage Planned outage (TEPCO)

Social Property

Lifeline 鉄道ライン



# Environmental Radiation Survey Result

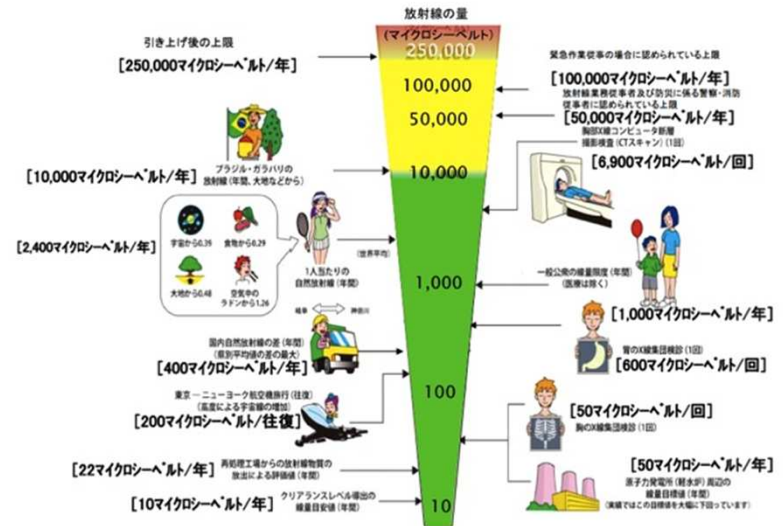
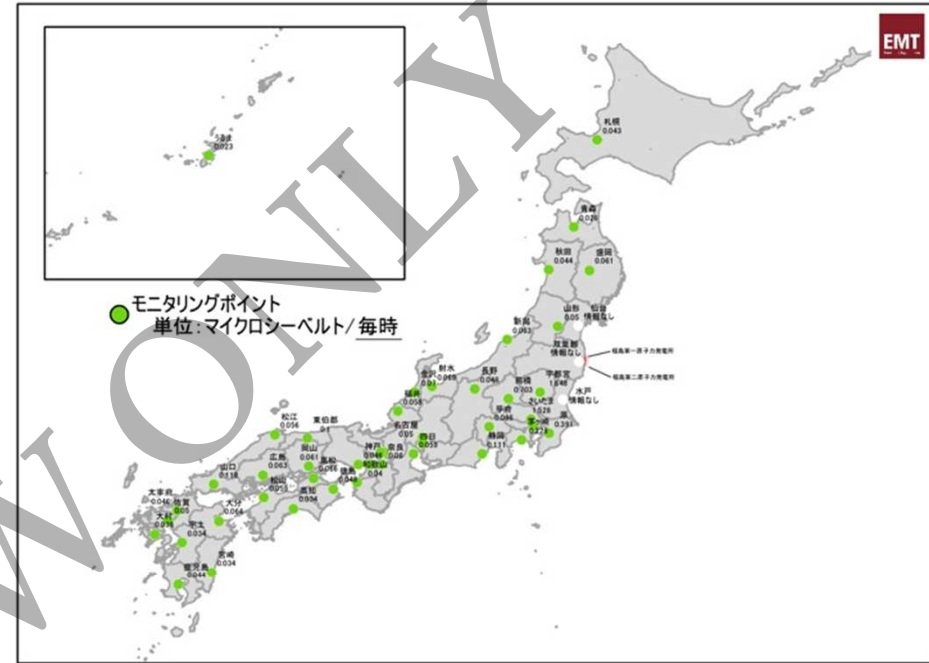
## 環境放射能水準調査結果(最大値)

2011年3月15日 9:00-17:00時点

### Environmental Radiation Survey Result

Hazard

Radiation Survey  
Radiation Volume



## Logistics and Shelters

## Organization Information

## Shelters

## Logistics bases

## Distance from logistics bases

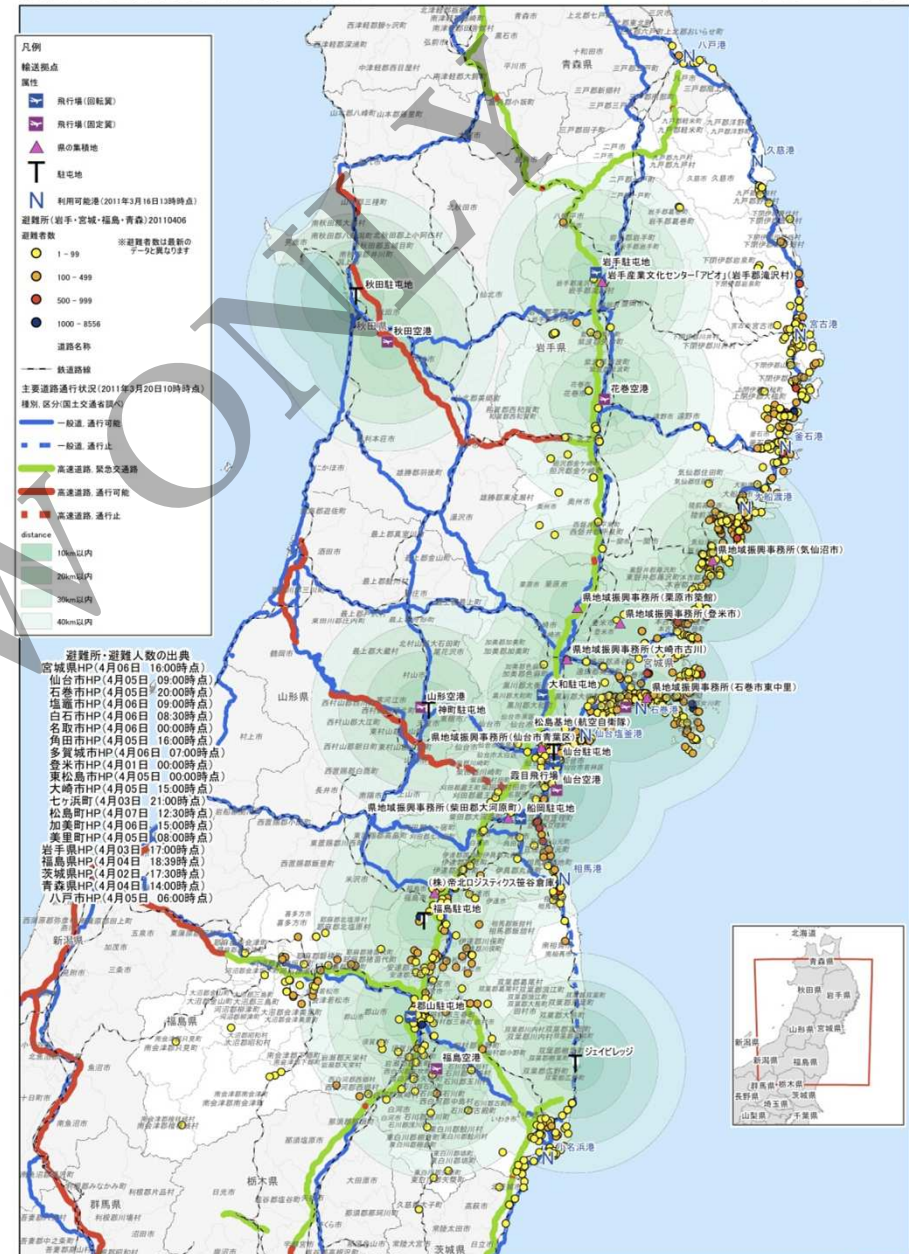
## Information from internet

## Traffic recovery

輸送・避難所位置関係図

青森県、岩手県、宮城県、福島県、茨城県

2011年4月6日16時時点



ID:386

問い合わせ先: 中央防災無線 2310  
内 線 : 51021  
受付時間: 10:00 ~ 22:00

# Dynamic Maps Catalog

Search by keywords

www.arcgis.com/home/group.html?owner=EMT2011&title=東北地方太平洋沖地震(The Pacific coast of Tohoku Earthquake)

Search this group...

Group Content

All Results

Title	Owner	Rating	Views	Date
(3) 被災地: 浪水被害(空中写真および衛星画像による判読結果) (Aerial Photos)	EMT2011	3 ratings, 0 comments	3336 views	March 31, 2011
(1) ハザード: 日本周辺の過去一週間の地震発生状況 (Web マップ)	Himiyama	2 ratings, 0 comments	1061 views	March 23, 2011
(1) ハザード: 福島第一原子力発電所の状況 (2011年4月29日 15:00現在)	awuk	0 ratings, 0 comments	1041 views	April 30, 2011
(4) 災害対応: 避難所 (Evacuation Sites)	EMT2011	1 rating, 0 comments	906 views	March 29, 2011

explorer.arcgis.com/?open=5aba1fc60b9d4d91a86ecd200e4ea5b5

(4) 災害対応: 避難所 (Evacuation Sites)

マップの凡例

Evacuation Sites

避難所\_20110408

- 1.000000 - 10.000000
- 10.000001 - 20.000000
- 20.000001 - 30.000000
- 30.000001 - 50.000000
- 50.000001 - 75.000000
- 75.000001 - 100.000000
- 100.000001 - 250.000000
- 250.000001 - 500.000000
- 500.000001 - 1000.000000
- 1000.000001 - 2500.000000

Click to open

# MashUp is

- Divergent organizations take advantage of owned expertise and deliver information
- Information provided by a closed framework inside each organization only is represented in an individual aspect
- While the information is constructed, then new meaning is shown
- Yet, nonprofessional hardly knows where and what the information is, or how to the information
- MashUp themes, places, time based various information to create new value

# MashUp

## (Generating dynamic information on web)

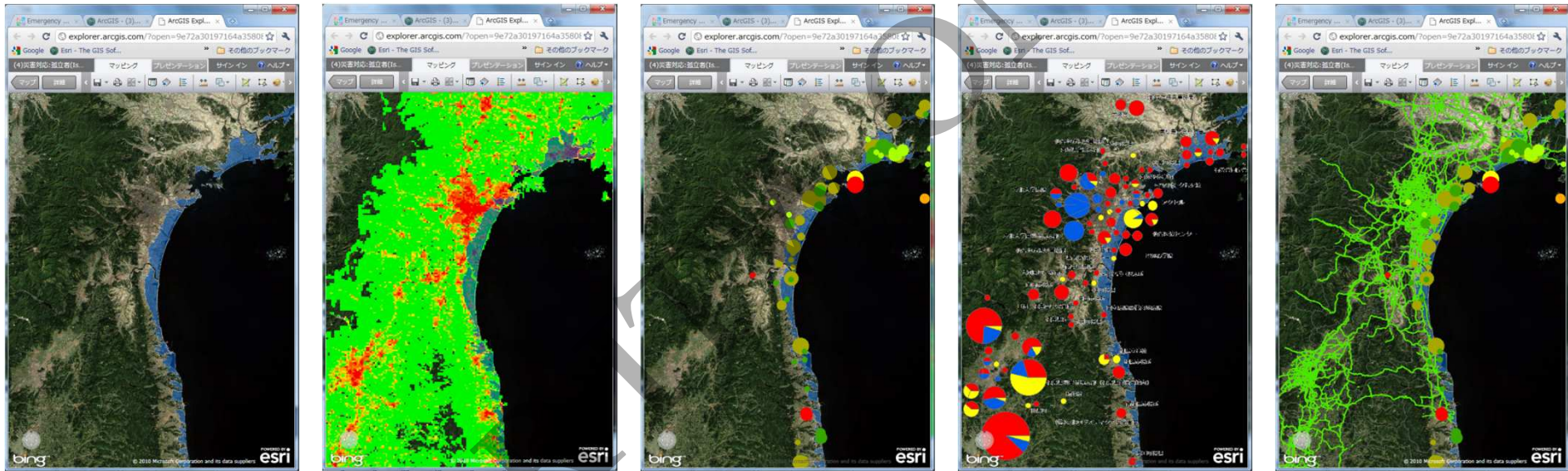
Where is tsunami damage ?

What are insufficient materials ?

How population distributes at 3 pm, weekday?

Where are isolated people?

Available route for logistics?



Estimated  
drainage  
areas



Floating  
population  
(Agoop)



Isolated victims  
(media, etc.)



Materials supply  
(municipality)



Traffic recovery  
(Honda, ITSJ)

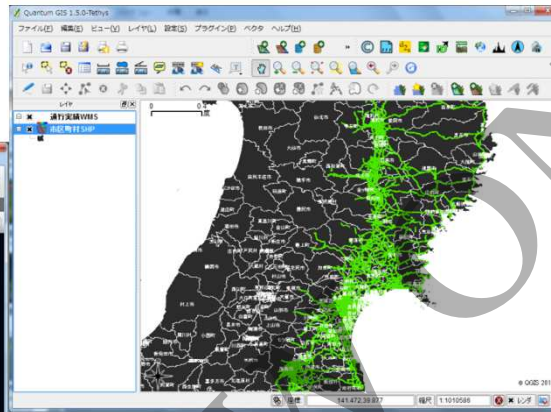
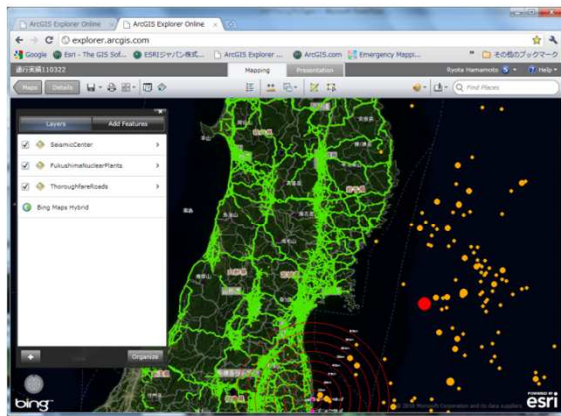
# MashUp: Terms of Use

- **Extent of information as MeshUp object**
  - Each organization or person takes advantage of owned expertise to releases information useful to disaster response or recovery with responsibility as premise.
  - Following 3 situations might exist in MashUp, situation#1 and #2 are followed the terms of use.
    - #1 Mix up information from internet
    - #2 Mix up information from internet with information manufactured by organization itself
    - #3 Mix up information manufactured by organization itself
- **Open right to use**
  - To understand that when information is released on internet, consent of secondary right to use is given to society.
  - Therefore, anyone can use the information freely.
- **Maintain intelligence right**
  - For those who use the information obligate to always note the information source while the information is used
- **Self-responsibility principle**
  - Information users use the information by his free will.
  - Information users take responsibility to results accompanied with usage of information.
  - Information providers do not take any responsibility to results accompanied with usage of information.

# Open Access

WMS support soft (QGIS)

Web Browser



iPhone

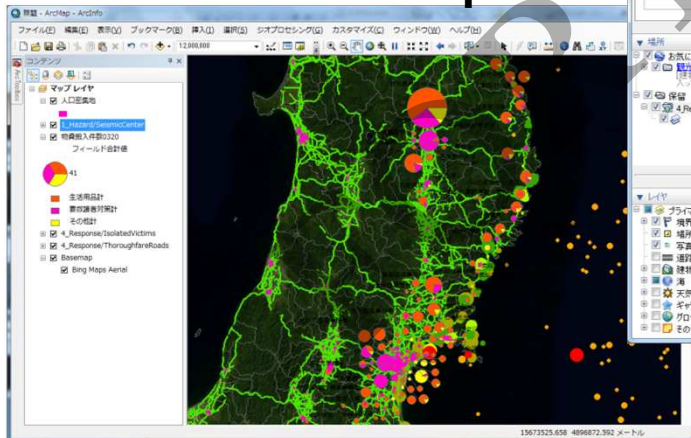


iPad

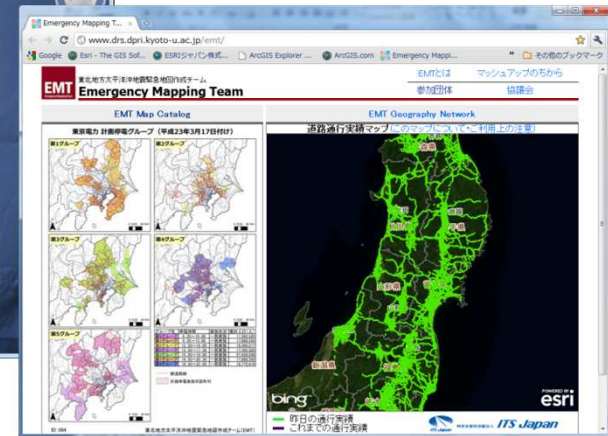


KML support soft (Google Earth)

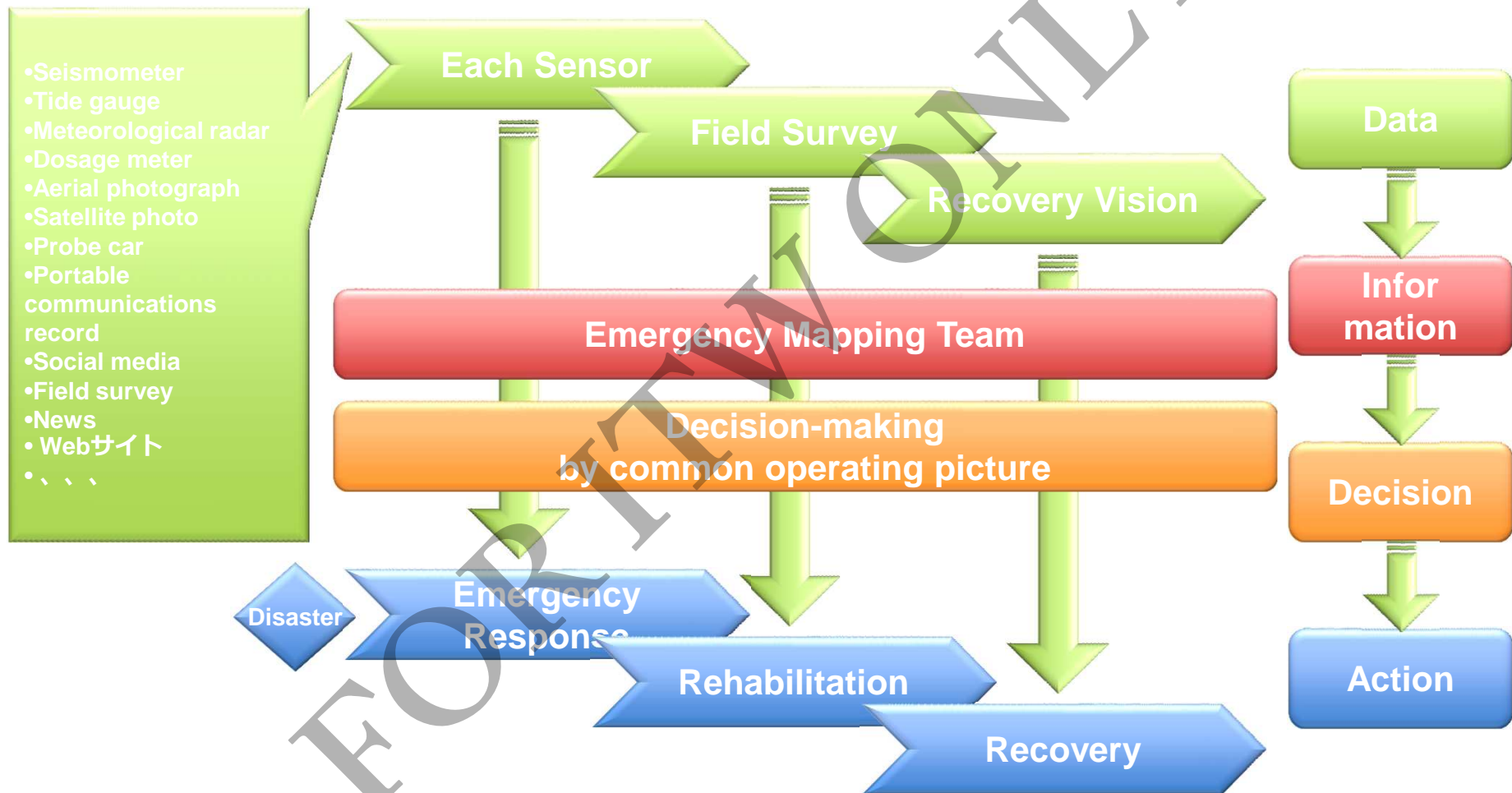
ArcGIS Desktop



Website



# EMT's role in disaster response



**Thank You for Your Attention**

FOR ITM ONLY