

# Local Resilience after Recent Flood Disaster in Japan

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United Nations  
Educational, Scientific and  
Cultural Organization



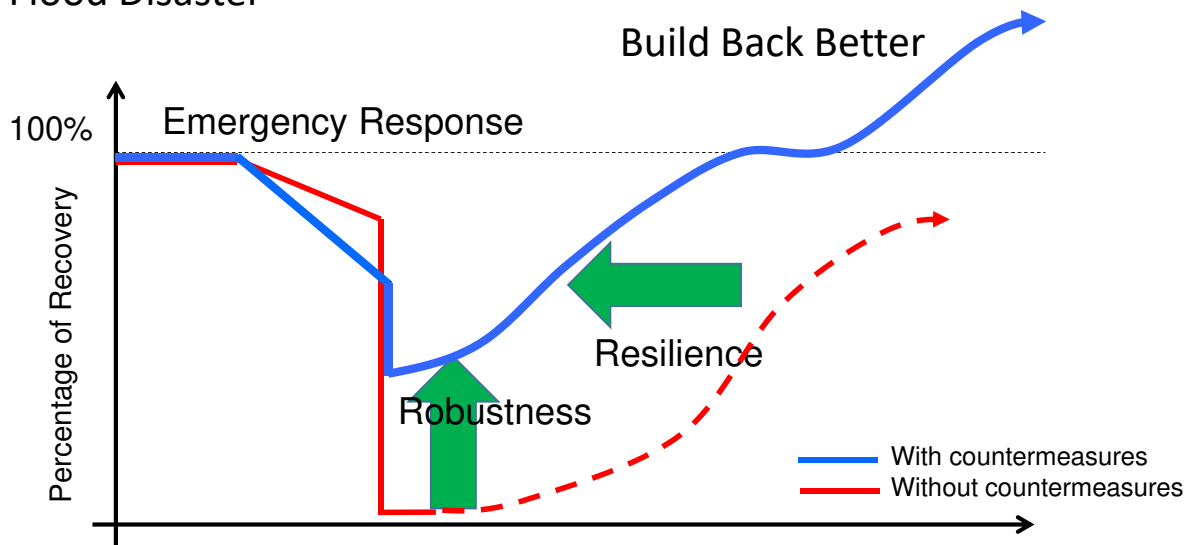
International Centre for  
Water Hazard and Risk Management  
under the auspices of UNESCO



Public Works Research Institute  
National Research and Development  
Agency, Japan

## Four Major Components of Disaster Countermeasures

Flood Disaster

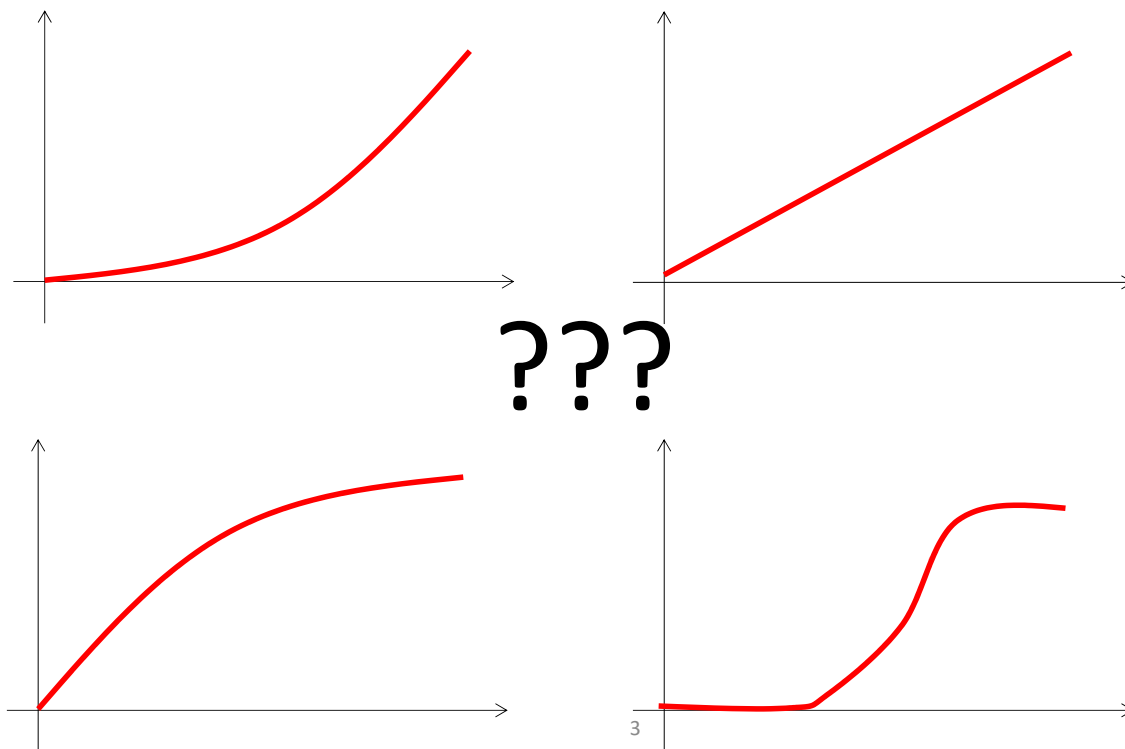


My interest:

-What is the situation of the current resilience?

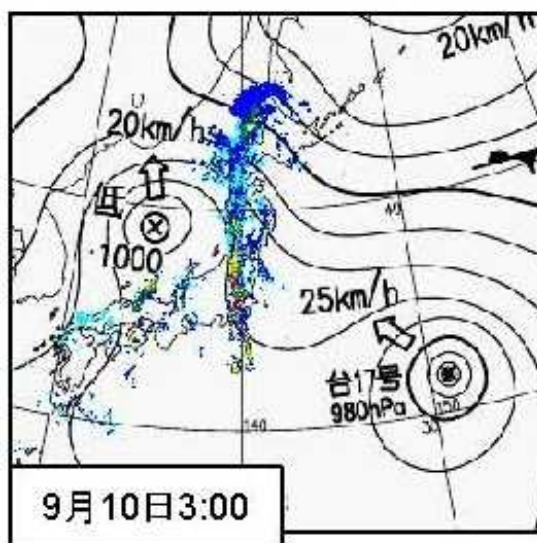
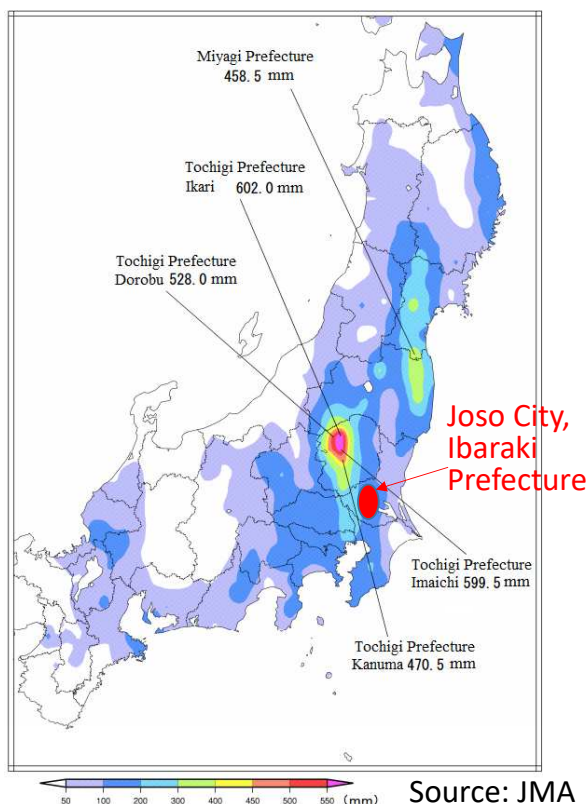
-What is the ideal resilience to be achieved in the future?

# Possible Variation of Resilience Curve



Which is the appropriate curve for describing resilience of the local area?

## Case Study: Torrential Rain in Kanto and Tohoku Regions in 2015



Most of the precipitation fell in the upper Kinu River in Tochigi Prefecture.

# Kinu River Flood in Joso City (Sep. 2015)

6:00 a.m. Over Topping at Wakamiyado

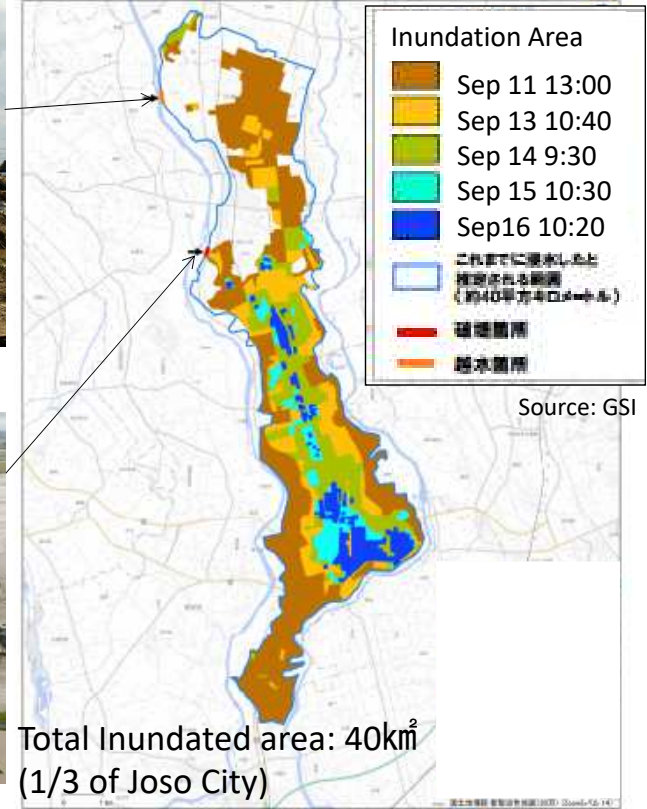


12:50 p.m. Levee Breach at Misaka



<https://www.youtube.com/watch?v=4yJSOWqCcdw>

平成27年9月関東・東北豪雨に係る茨城県常総地区の推定浸水範囲の変化  
月11日13:00時点、13日10:40時点、14日9:30時点、15日10:30時点、16日10:20時点



# Kinu River Flood in Joso City (Sep. 2015)

Many houses and buildings were inundated and more than 4,200 people were rescued.



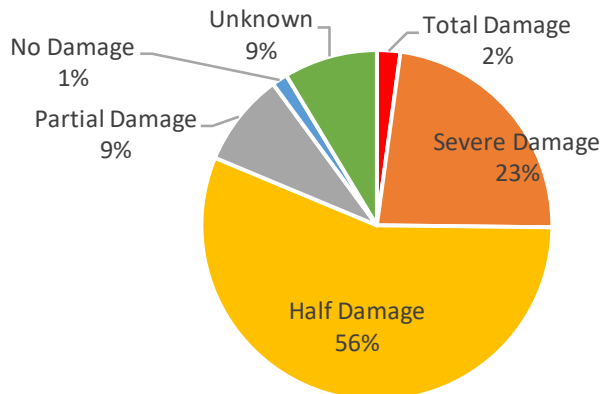
Photo: MLIT

# Interview Surveys for Residents and Businesses

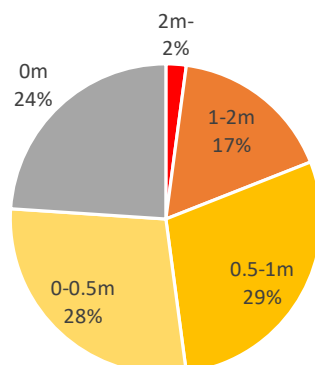
	Survey for Residents	Survey for Businesses
Target	House owners in the inundated area	Local businesses affected by the flood
Survey period	2017.11.23-26	2016.9.1-11.30
Selection of target	516 residents who answered the interview survey conducted in November 2015 by <u>River Eng. and Hydrology Lab. (Profs. Yamada &amp; Nunomura)</u> of Chuo University.	Businesses that were randomly selected from 582 inundated businesses which belonged to the commercial and industrial association of Joso City.
Number of respondents	218	60 (East side of Kinu River: 56, West side of Kinu River: 4)
Note	Of 218 houses, 142 were repaired, 4 rebuilt, 2 planning rebuilding, and 59 having no plan for the houses.	

## Respondents for Interview Survey for House Owners

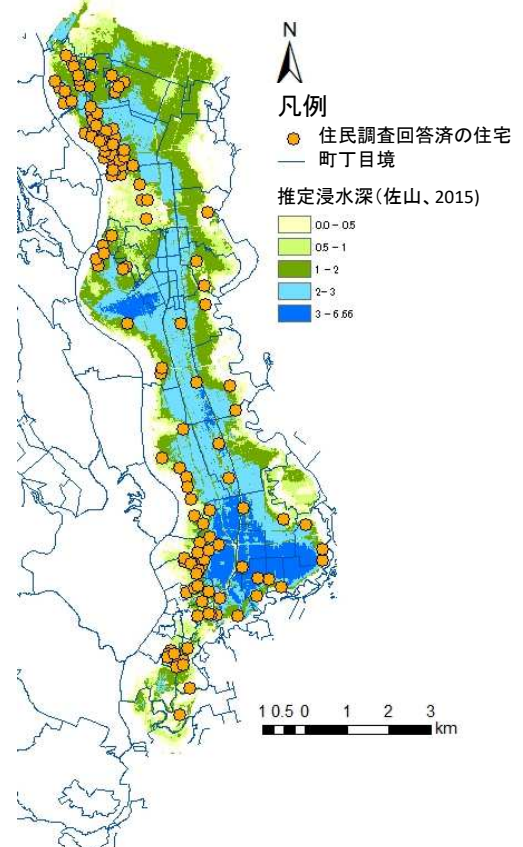
Damage Level of 142 repaired houses



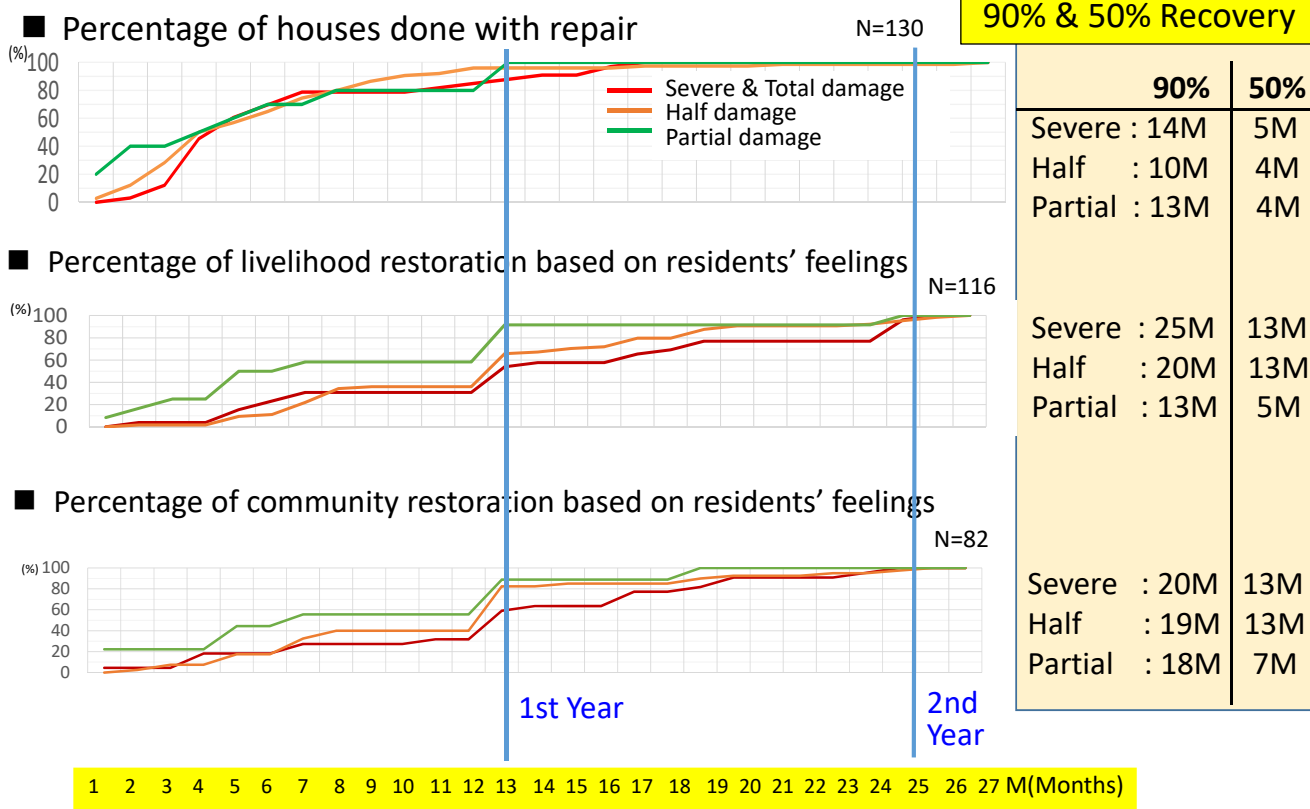
Inundation height above the first floor level of 142 repaired houses



Distribution of the houses

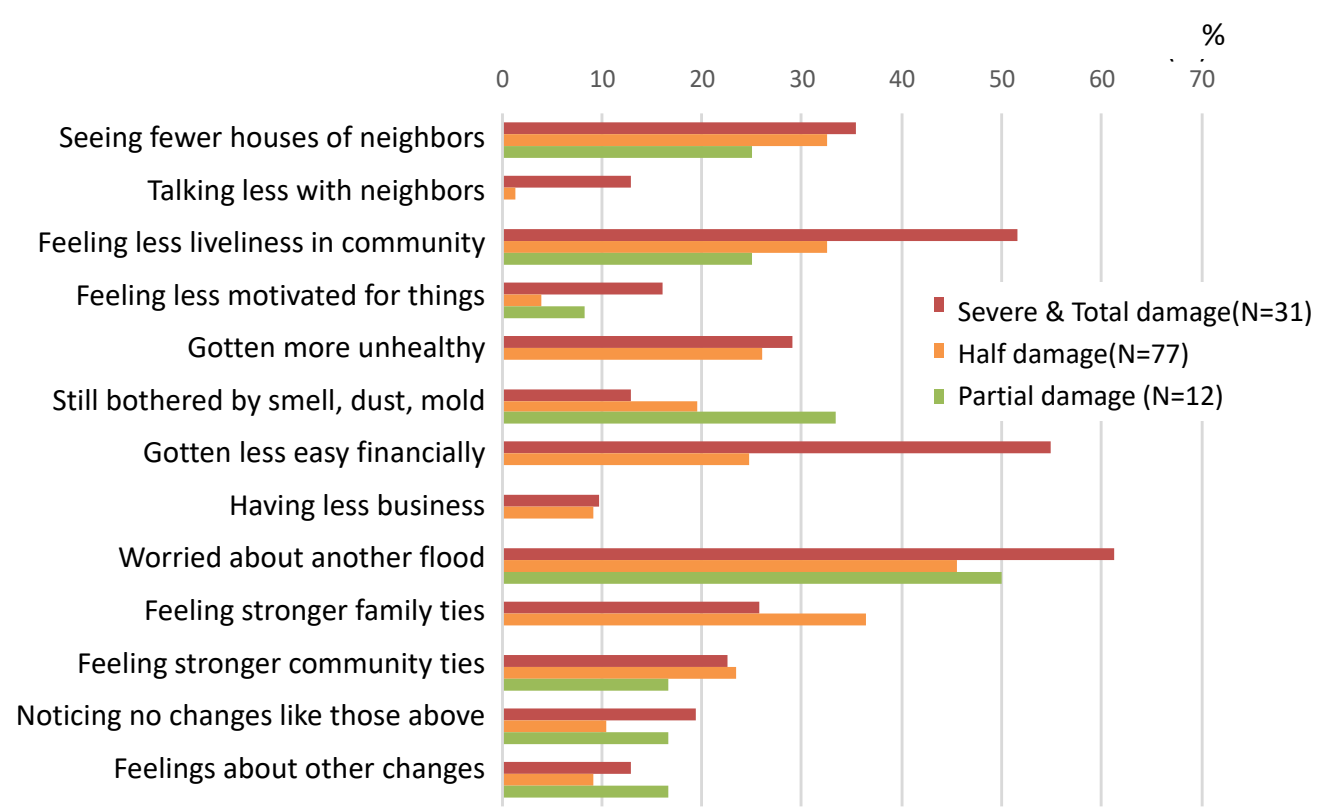


# Resilience observed from Interview Survey for House Owners



90% Recovery ⇒ House repair: 1 year, Residents' feelings: 1-2 year

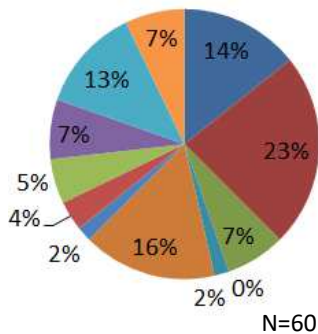
## Changes in Daily Life after the Flood



# Interview Survey for Local Businesses

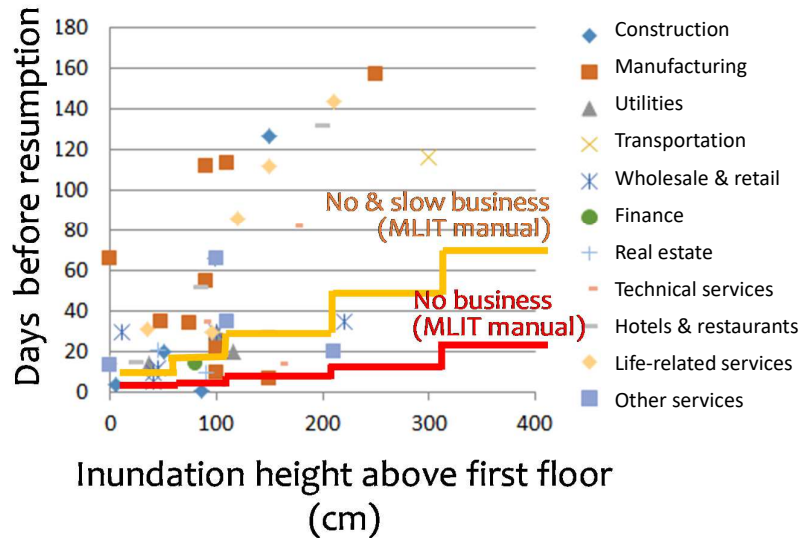
Roughly 60% of the businesses in eastern Joso City were affected due to wide-area inundation. ICHARM conducted an interview survey for the selected local businesses.

Types of businesses



- Construction
- Manufacturing
- Utilities
- Telecommunications
- Transportation
- Wholesale & retail
- Finance
- Real estate
- Technical services
- Hotels & restaurants
- Life-related services
- Other services

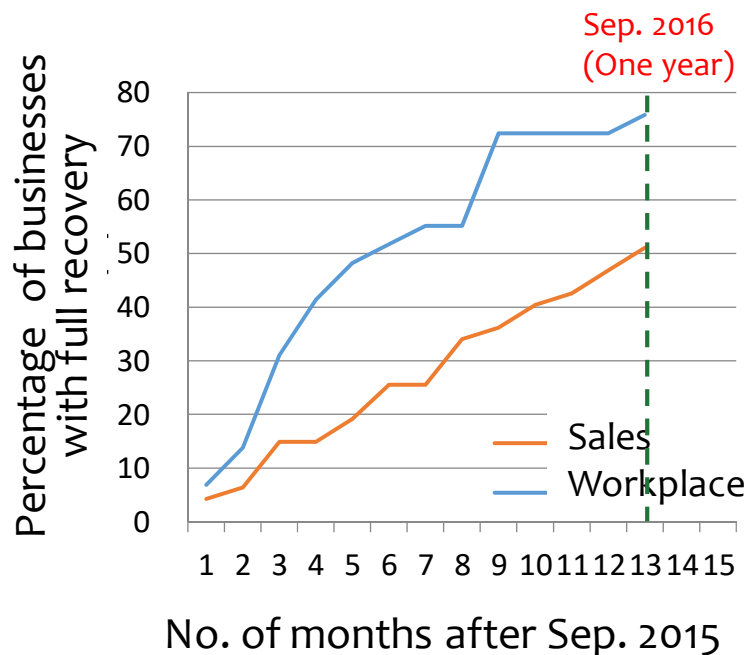
Relationship between inundation height and business disruption



Actual business disruption was severer than estimation based on an MLIT (Ministry of Land, Infrastructure, Transport and Tourism) manual. Some businesses experienced disruption due to suspension of water supply even with low inundation.

# Interview Survey for Local Businesses

Trends of recovery of sales and workplace



Only half of the businesses achieved 100% sales recovery a year after the disaster.

# Flood risk assessment tool for businesses

The cabinet office launched a consortium with business sectors and developed a flood risk assessment tool for businesses in April 2019 by partly using our survey data.

**自然災害が事業に与える影響の参考指標ツール（洪水害版）** 内閣府  
Cabinet Office, Government of Japan

以下の情報についてご入力下さい		■留意点 「深達値」を選択した場合、浸水深さの大小と被害の大小が必ずしも一致しない場合があります。 詳しくはP.3「平野部の洪水害と山間部の洪水害について」をご覧ください。	【参考リンク集】 ■国土交通省 重ねるハザードマップ <a href="https://disaportal.gsi.go.jp/">https://disaportal.gsi.go.jp/</a> 上記Webページから、自社事業所位置での想定浸水深を確認し、まじょう(詳細)P.2参照。 ■内閣府 防災情報のページ <a href="http://www.bousai.go.jp/index.html">http://www.bousai.go.jp/index.html</a> ■国土交通省 自衛水防(企業防災)について <a href="http://www.mlit.go.jp/river/bousai/maim/seisga/puhou/jisuisabou/index.html">http://www.mlit.go.jp/river/bousai/maim/seisga/puhou/jisuisabou/index.html</a>
業種	製造業		
従業員数(人)	5		
年間売上高(万円)	10,000		
表示するデータの権限 <sup>(注1)</sup>	推計値		
地形を選択 (平野部 又は 山間部)	平野部		

**【洪水発生時の想定被害（被害額及び事業中断期間）のグラフ】** <sup>(注1~4)</sup>

以下の点を確認し当てはまる場合は、山間部での洪水高の被害額をご参照ください。詳しくはP.3「平野部の洪水害と山間部の洪水害について」をご覧ください。

- ・土砂災害ハザードマップにて、事業所位置が土砂災害警戒区域などにあり、土砂災害の危険性が確認できる場合
- ・山地、崩壊地に立地している場合

地盤面からの浸水深さ別の被害イメージ：

- ・0.5m未満：事再や屋外設備（空調室外機など）が被災
- ・0.5~1m：屋内に漏水。床面上の資産の被災
- ・1~2m：床上資産の多くが被災
- ・2~3m：1階資産のほとんどが被災、2階床上が被災する場合もあり
- ・3m：2階の資産も多くが被災

(上記に加えて) 山間部の洪水害の場合の被害イメージ：

- ・土砂・流木等の流入による構造躯体の破損、復旧費用の高額化、復旧期間の長期化

**【洪水害による推定被害】** <sup>(注1~4)</sup>

浸水深：洪水時の地盤面からの浸水の深さ

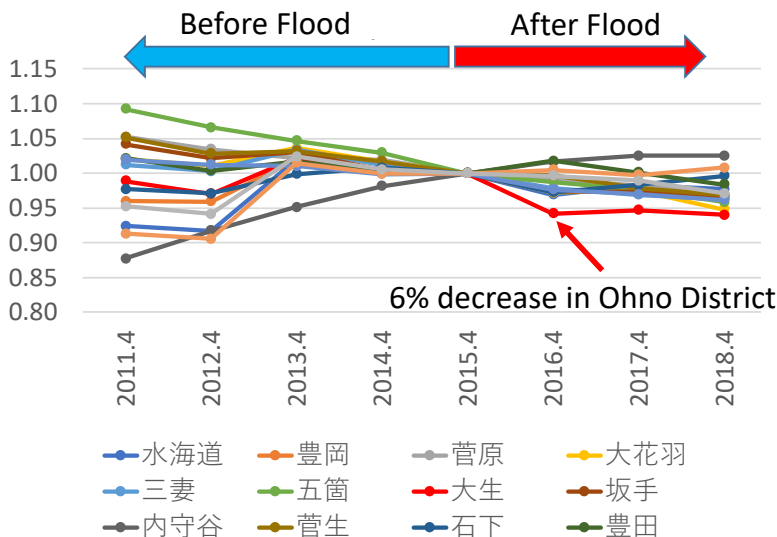
<b>【平野部の洪水害による推定被害：平成27年9月関東・東北豪雨・平成30年7月豪雨の実績被害額をもとに推計して算出】</b> <sup>(注1~3)</sup>					
地盤面からの浸水深さ：	0.5m未満	0.5~1m	1~2m	2~3m	3m以上
有形固定資産の被害(業種区分別での元データのサンプル数：108)					
直接損害額 <sup>(注2)</sup>	1,179	1,639	2,687	5,194	10,042
事業中断期間および売上の被害(業種区分別での元データのサンプル数：21)					
事業中断期間 <sup>(注1)</sup>	0.59	0.97	2.07	5.68	15.59
売上被害額 <sup>(注1)</sup>	488	808	1,724	4,732	12,993
	単位：万円				



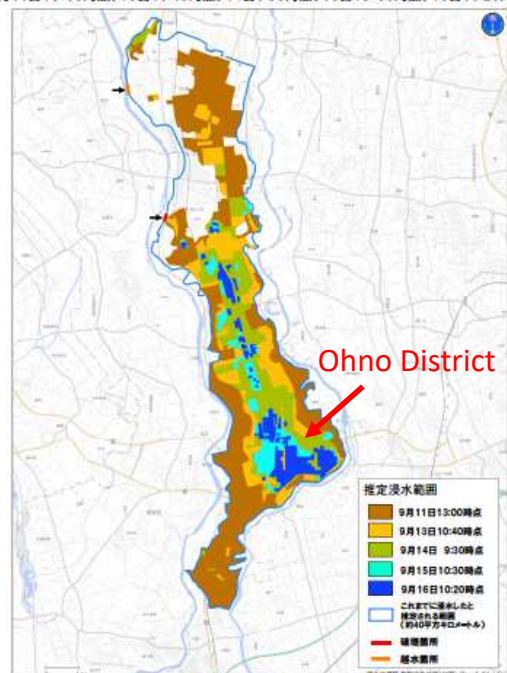
<http://www.bousai.go.jp/kyoiku/consortium/index.html>

## Other social changes: Depopulation

The rate of population change in each district before and after the flood  
(Population in April 2015 before the flood=1)



平成27年9月関東・東北豪雨に係る茨城県常総地区の推定浸水範囲の変化  
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# Summary

Interview Surveys were conducted for house owners and local businesses in Joso city after the Kinu River Flood in September 2015.

◆ Interview survey for house owners:

-It took about one year for 90% of the owners of damaged houses to complete repairing their houses. Even after they finished repairing the houses, they have various kinds of anxiety.

-It took about one or two years for 90% of the residents to start feeling that their life and community returned to its original condition.

◆ Interview survey for local businesses:

-Only half of the surveyed businesses achieved 100% sales recovery a year after the disaster.

◆ Limitation of the Survey and the Way Forward:

-This research **only shows the case study in Joso City.**

-We plan to **conduct similar surveys in rural mountainous area** to compare with this case study to identify the characteristics of local resilience in different flood conditions.

## Iwaizumi Town, Iwate Prefecture after the Omoto River Flood in 2016

