Towards Smart and Resilient Cities:

A Risk-Based Policy Perspectives on Integrating Infrastructure, Urban Planning and Evacuation Preparedness

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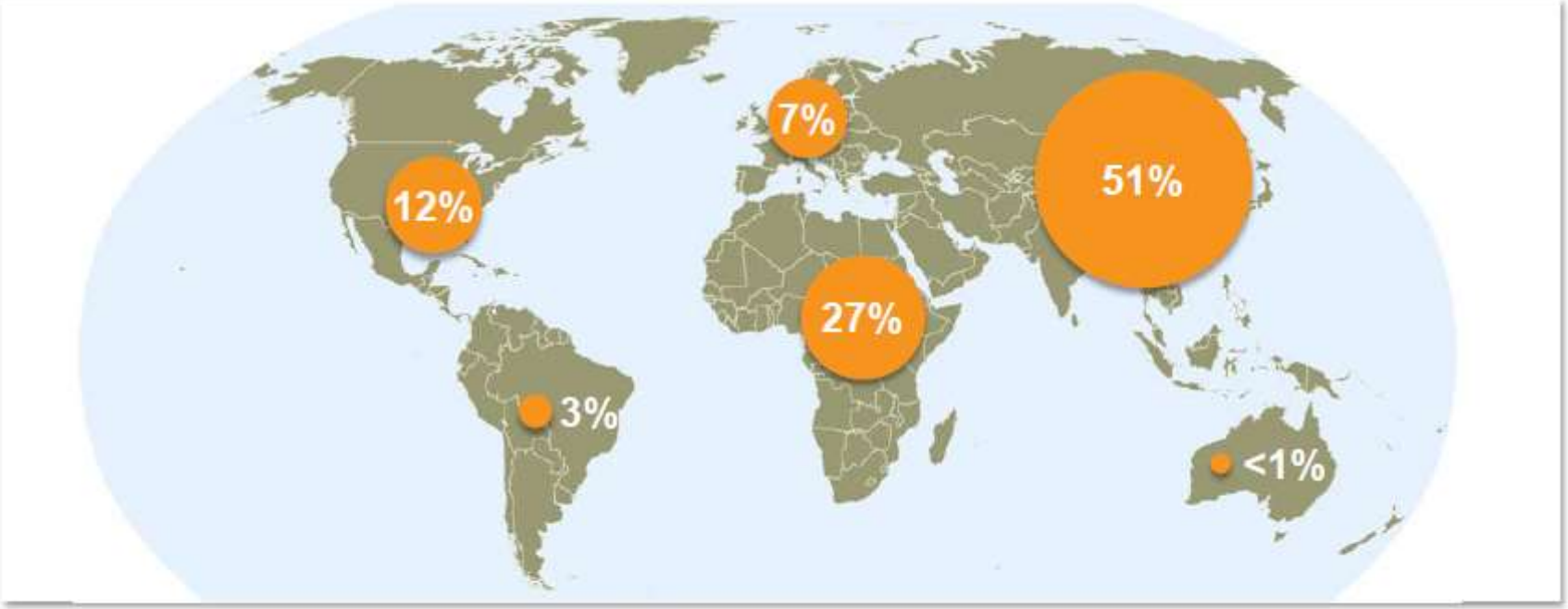
Distribution of Water-Related Disaster Risks (Human Losses)

NatCatSERVICE

Natural catastrophes 1980 – 2010

2,275,000 Fatalities - Percentage distribution per continent

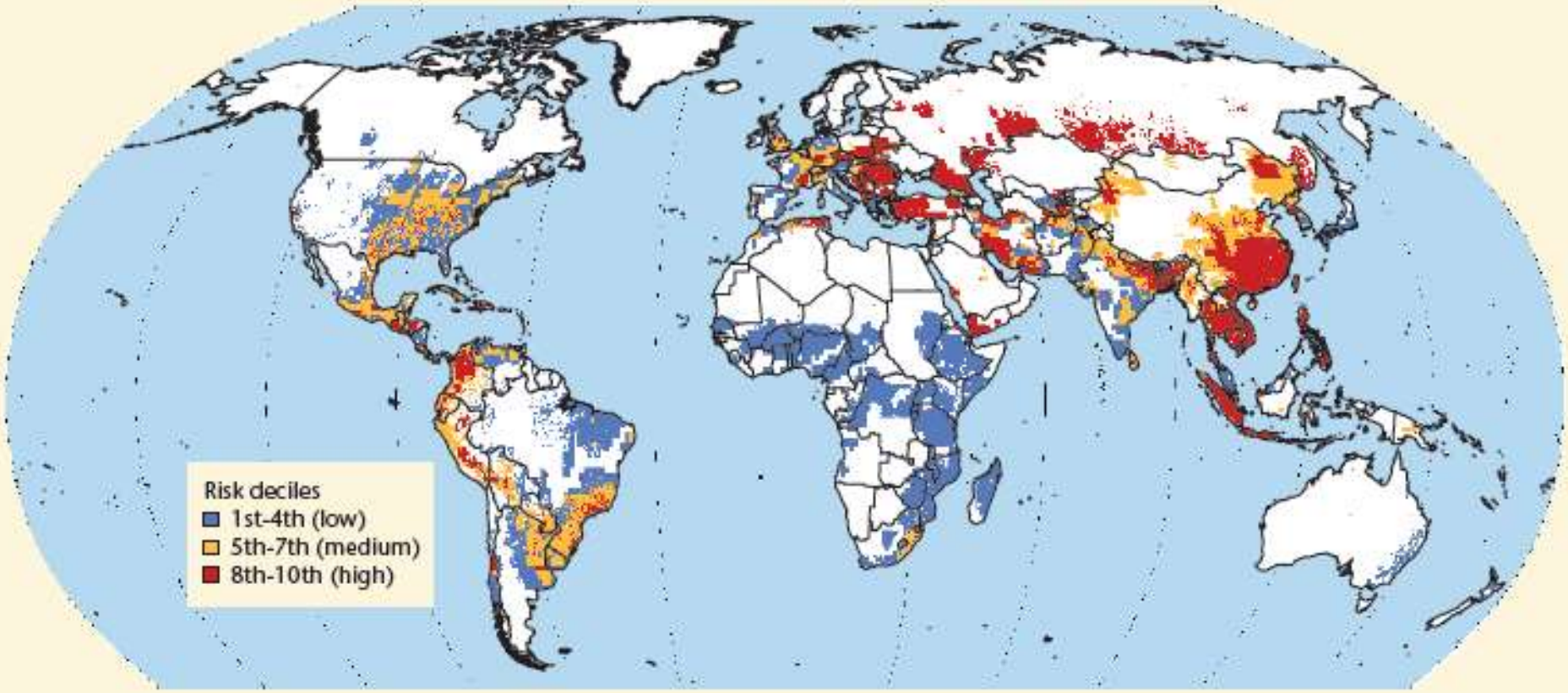
Munich RE



Continent	Number of Events	Fatalities	Overall losses* [US$ m]	Insured losses* [US$ m]
Africa	1,700	607,000	43,000	2,000
America (North and South America)	5,900	362,000	1,265,000	496,000
Asia	6,200	1,150,000	1,150,000	66,000
Australia/Oceania	1,470	5,620	77,000	23,000
Europe	4,100	150,000	485,000	148,000

Distribution of Water-Related Disaster Risks (Economic Losses)

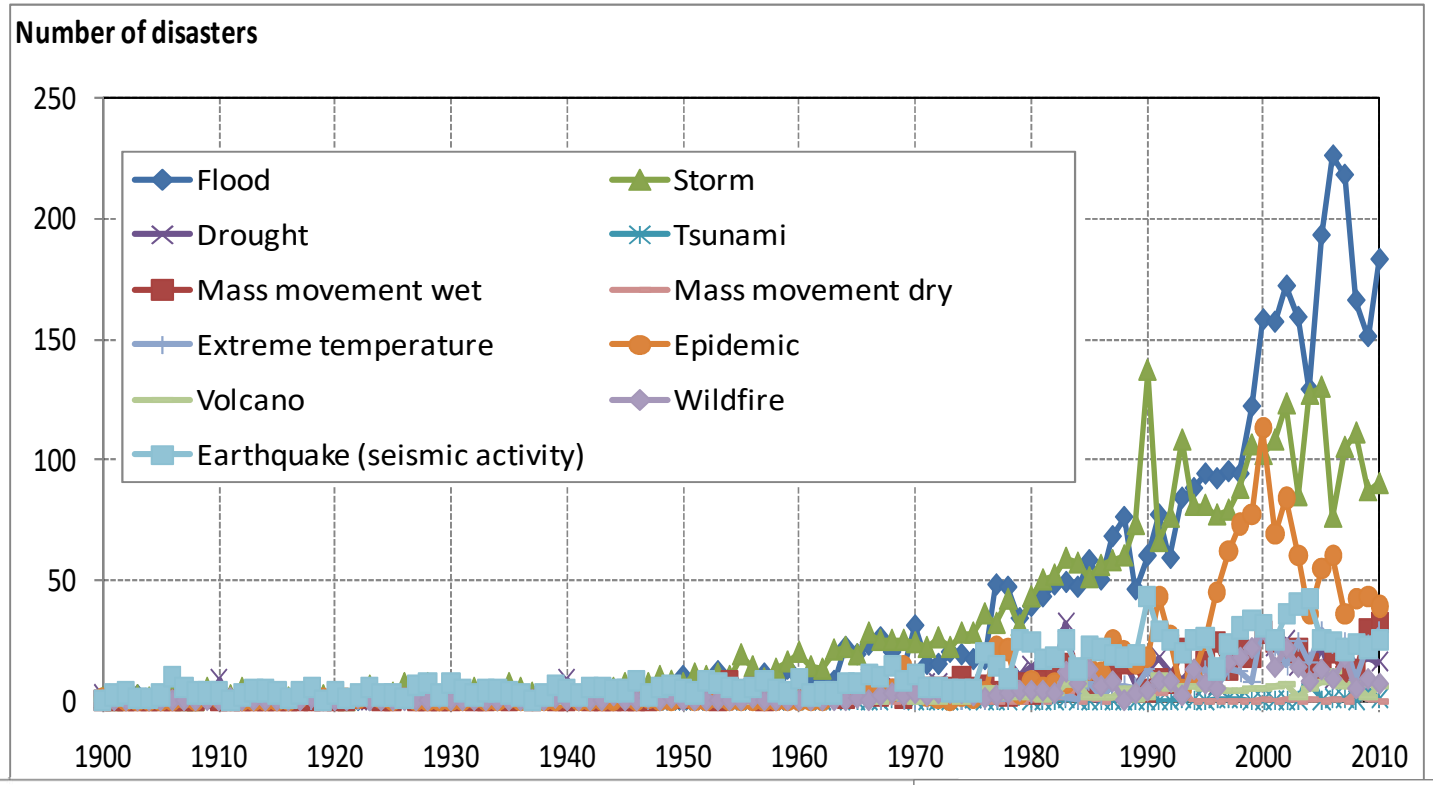
Map 10.3 **Impact of flood losses (comparative losses based on national GDP)**

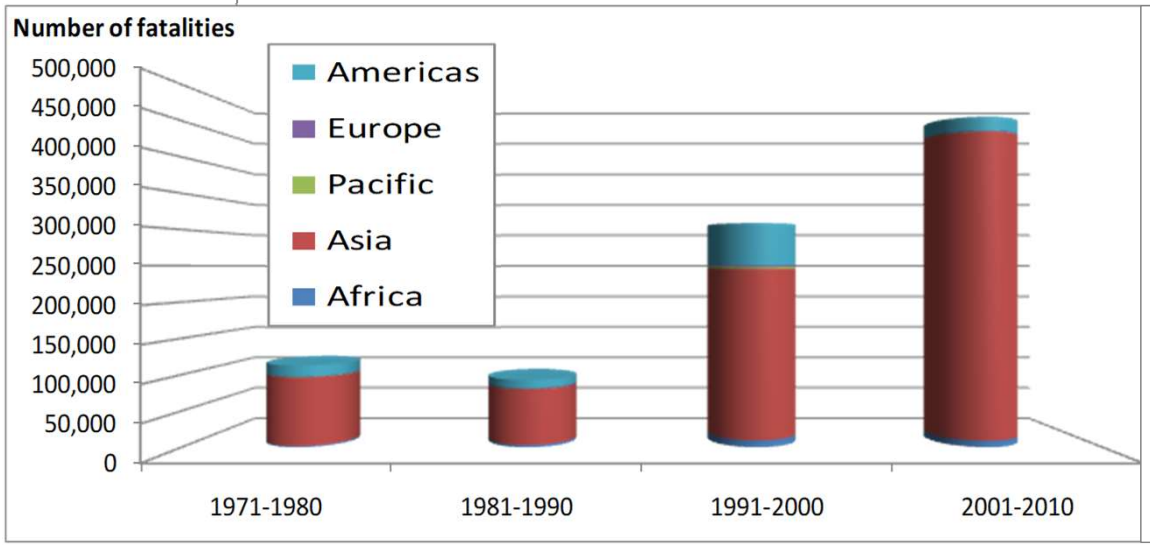


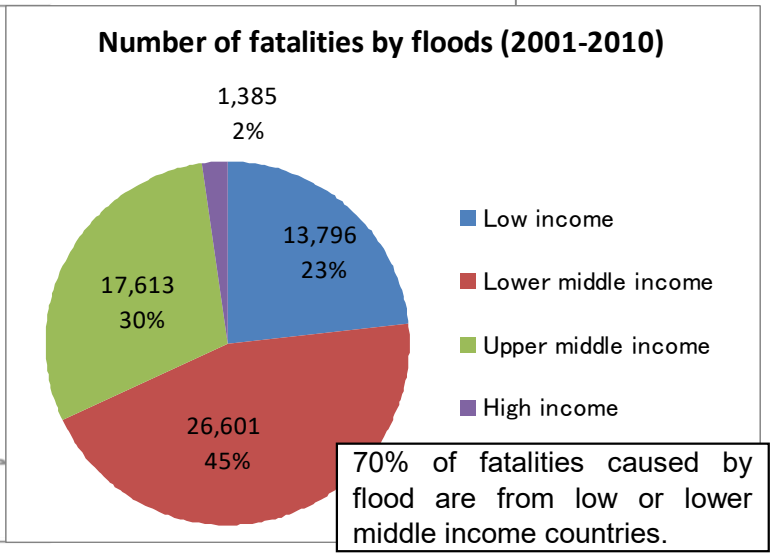
Note: Deciles refer to the level of risk, normalized for comparing 10 categories.
Source: Based on Dilley et al. 2005.

World Water Development Report 3 (2009), p.172

Increasing Frequency and Impacts of Water-related Disasters in Asia and the Pacific







70% of fatalities caused by flood are from low or lower middle income countries.

Source: EM-DAT: The OFDA/CRED International Disaster Database (As of Sept 2010)

Sustainable Development Goals（SDGs 2015-2030）

- Adopted, with 17 SDGs and 169 targets, at the UN Sustainable Development Summit in September 2015.

Goal 1: End poverty in all its forms everywhere

- Target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

Goal 6: Ensure availability and sustainable management of water and sanitation for all

- Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all
- Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
- Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
- Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
- Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

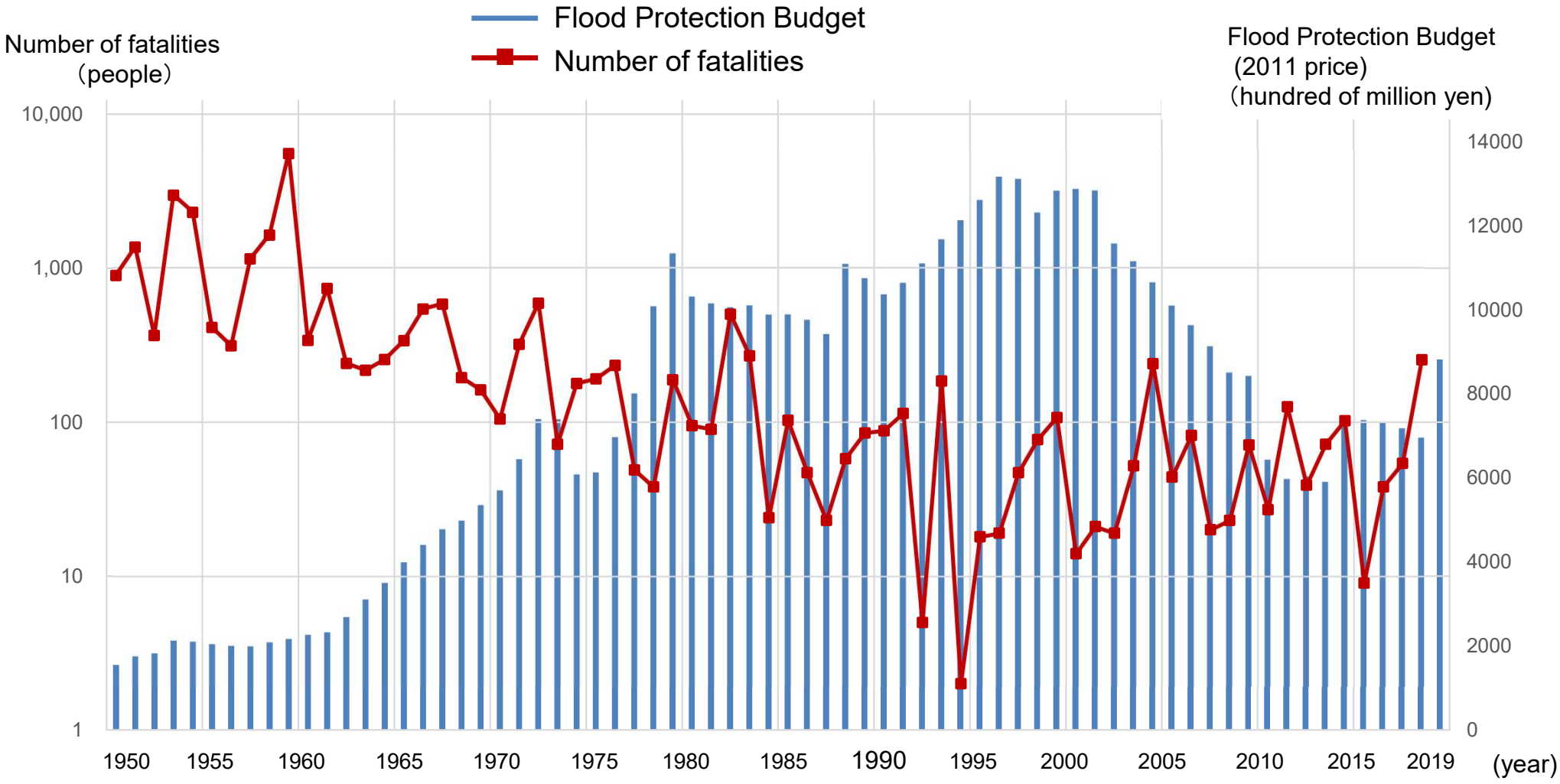
- Target 11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

Goal 13: Take urgent action to combat climate change and its impacts

- Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

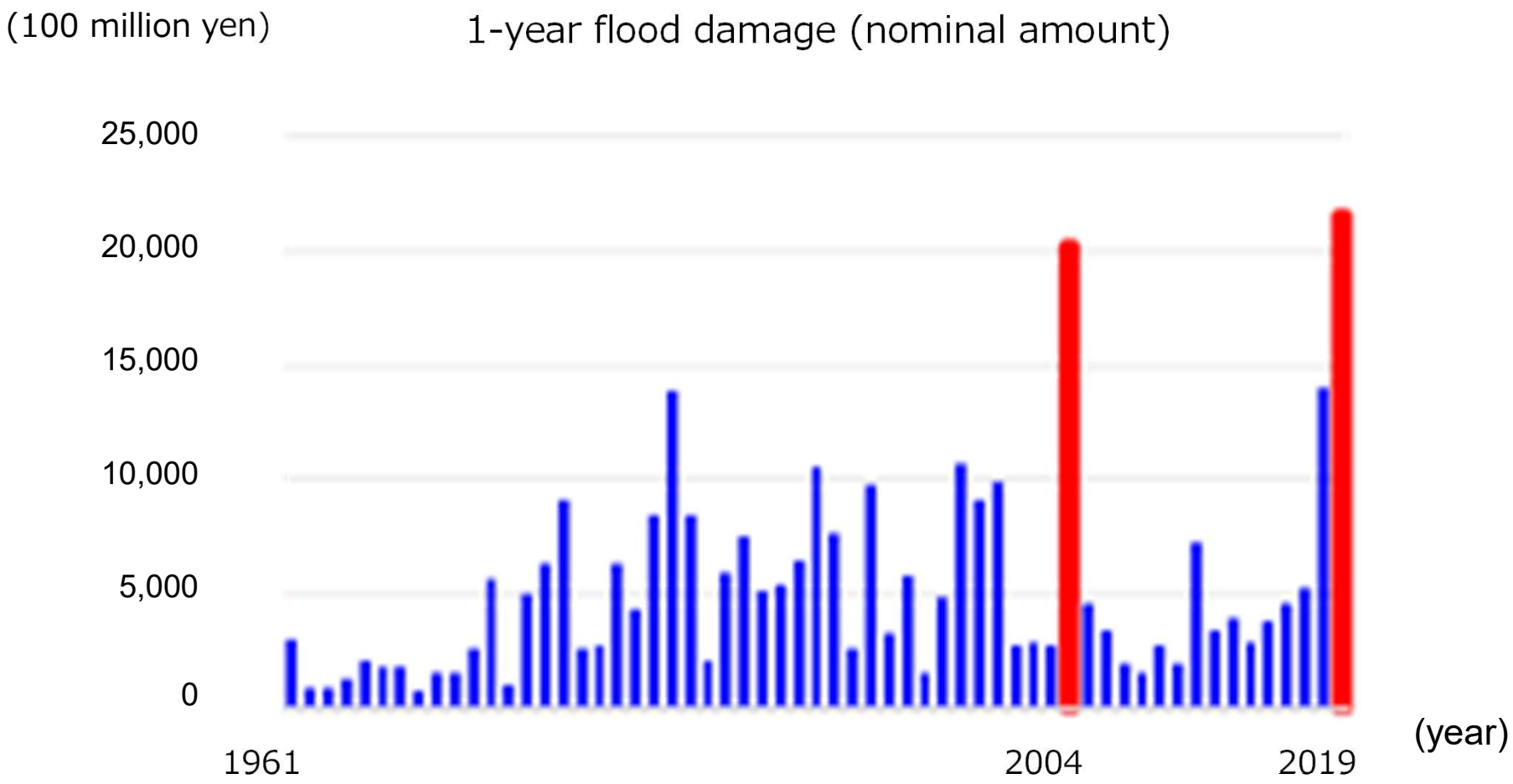
Effect of Flood Protection Investment in Japan – Human Losses

- Number of fatalities significantly decreased after years of flood protection efforts.



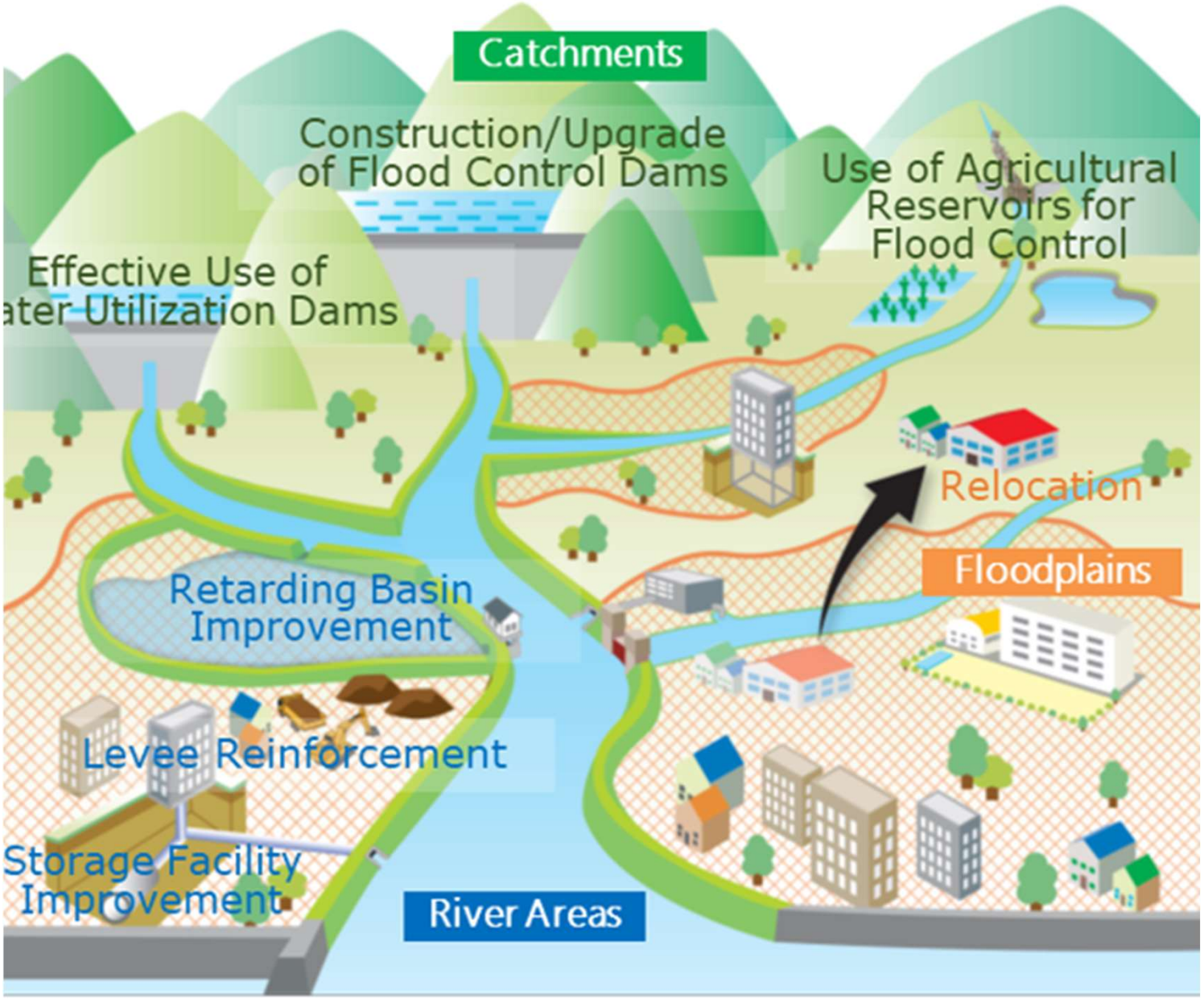
注1）死者、行方不明者数については、明治35年～昭和16年は「戦後水害被害額推計」（河川局）、昭和21年～昭和27年は「災害統計」（河川局）、昭和28年～平成15年は警察庁調べ、平成16年以降は消防庁調べに基づき、国土交通省において水害・土砂災害を原因としない死傷者（例：強風による転倒等）を除いて再集計したもの。
注2）治水投資額については、国土交通省会計課資料、「水管理・国土保全局予算概要」（国土交通省水管理・国土保全局）、財務省HP

Total Economic Damage by Water-Related Disasters in Japan in 2019

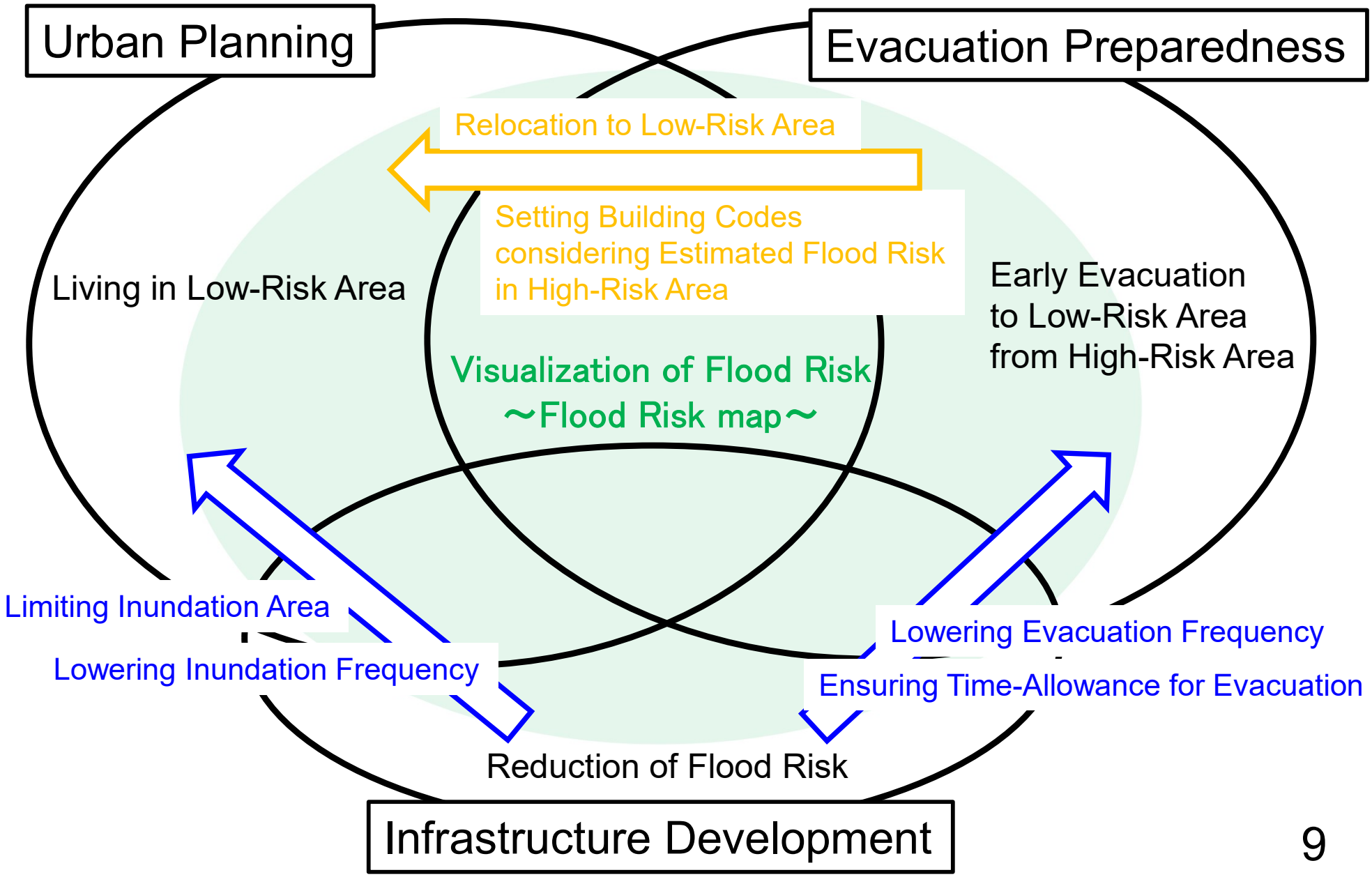


（Except for tsunami disasters）

River Basin Sustainability and Resilience by All in Japan
～ Responses to Climate Change ～



A Risk-Based Policy Perspectives for River Basin Sustainability and Resilience by All in Japan



Plans revised considering the Future Impacts of Climate Change
～ Policy Making for Climate Change Adaptation ～

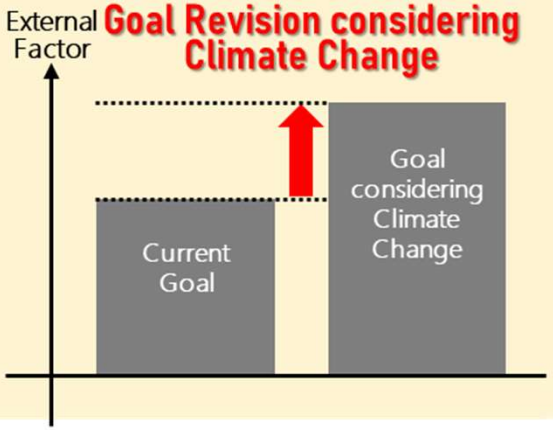
Plan Revision

Current defense plans against floods, inland floods, landslides, storm surge and high tide have been developed based on **precipitation and tide level records in the past.**

However,
these plans may not be able to secure safety considering impacts of climate change such as rainfall increase and sea level rise.

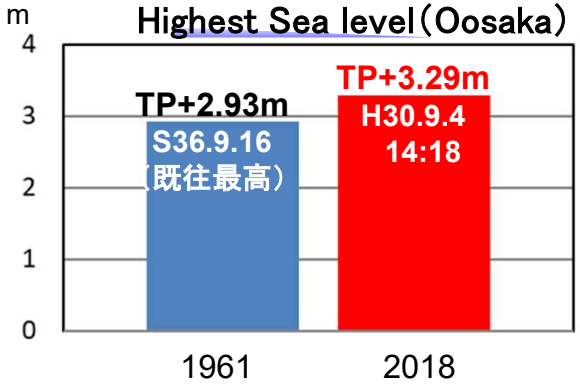
For the future,
revise the plans **considering impacts of climate change such as rainfall increase* and sea level rise**

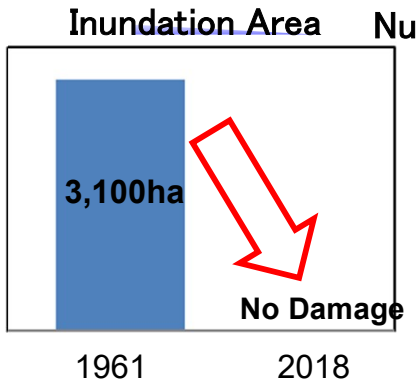
* In case of the scenario below 2 degrees Celsius of global temperature rise (target scenario of Paris Agreement of Climate Change), precipitation is likely to increase 1.1 times

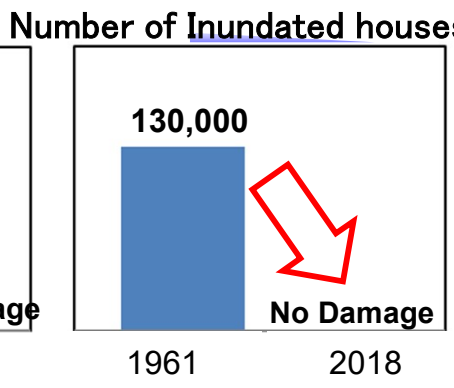


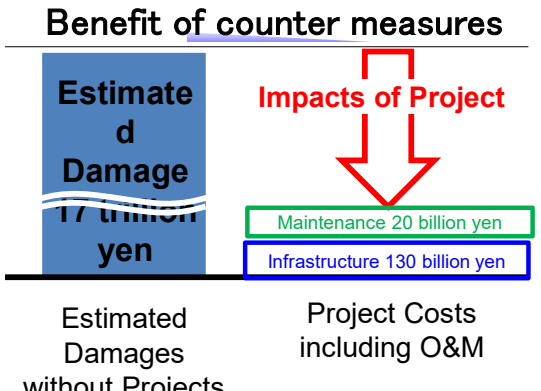
Long Lasting Benefit of Prevention Measures in Osaka
－Storm Surge in Osaka Bay Area in 2018, Typhoon 21 －

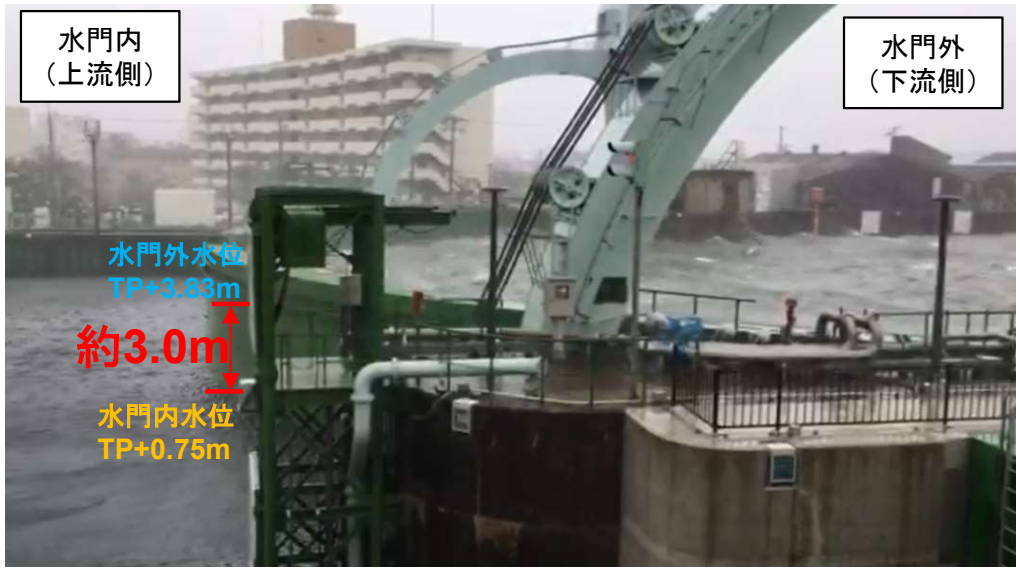
- About 50 years old flood gates saved inundation from the highest storm surge in the record in Osaka Bay Area in 2018.
- Estimated benefits of counter measures exceed its cost by 17 trillion yen.





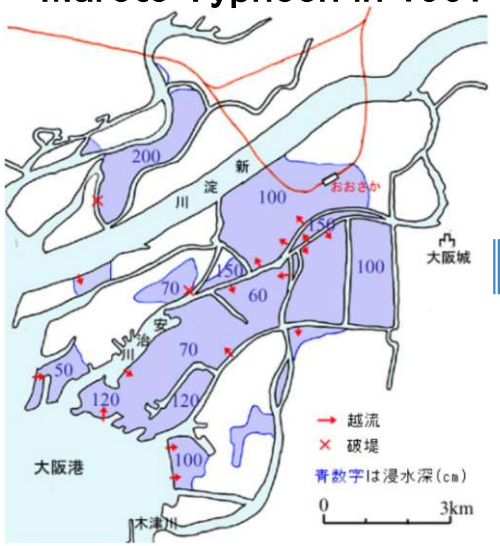






Kizugawa-Flood Gate, completed in 1970, during Typhoon 21 in 2018

Inundate Area of 2nd Muroto Typhoon in 1961

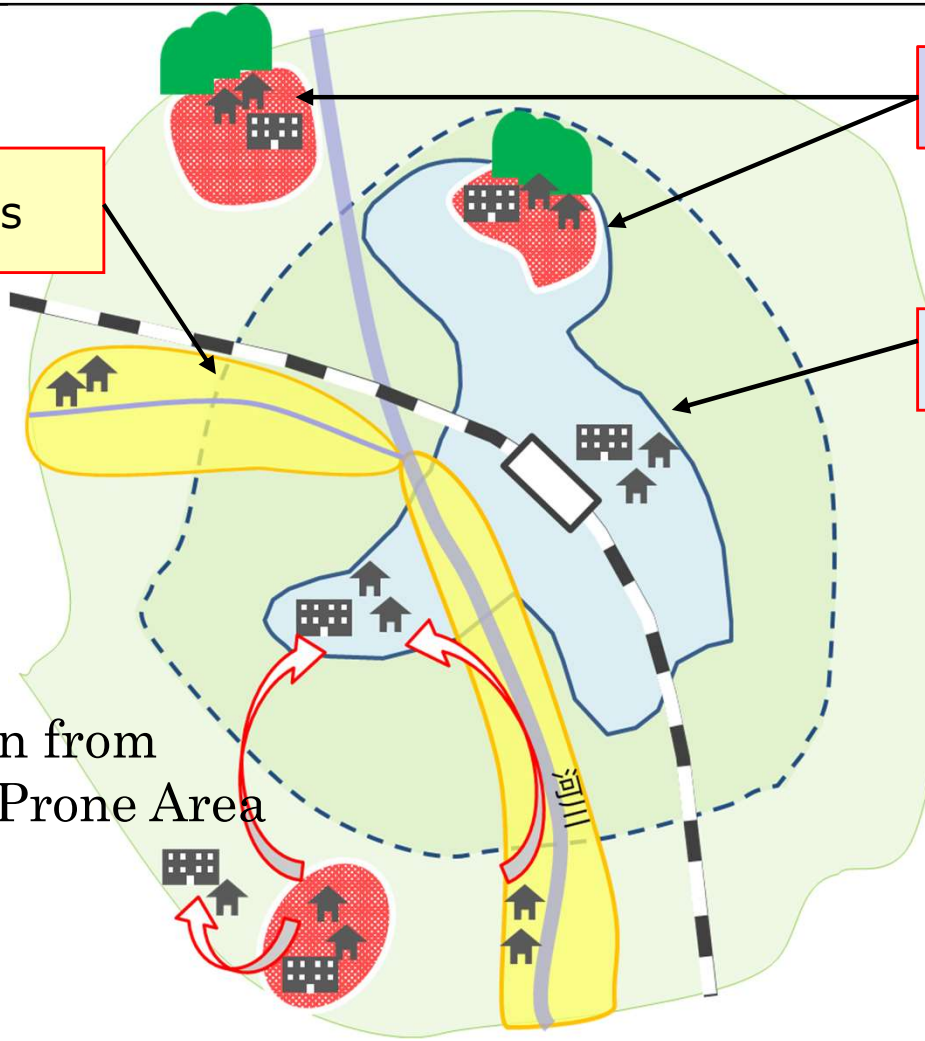


引用：大阪管区気象台（1962）：第二室戸台風報告．大阪管区異常気象調査報告9.3

Counter Measures for Storm Surge

Land Use Management --- City/Urban Planning

- Restrict urban development in disaster-prone areas.
- Encourage relocation from disaster-prone areas.



red zones

In principle, prohibition of urban development

Inundation-prone areas

Strict Development permission

Residential Area

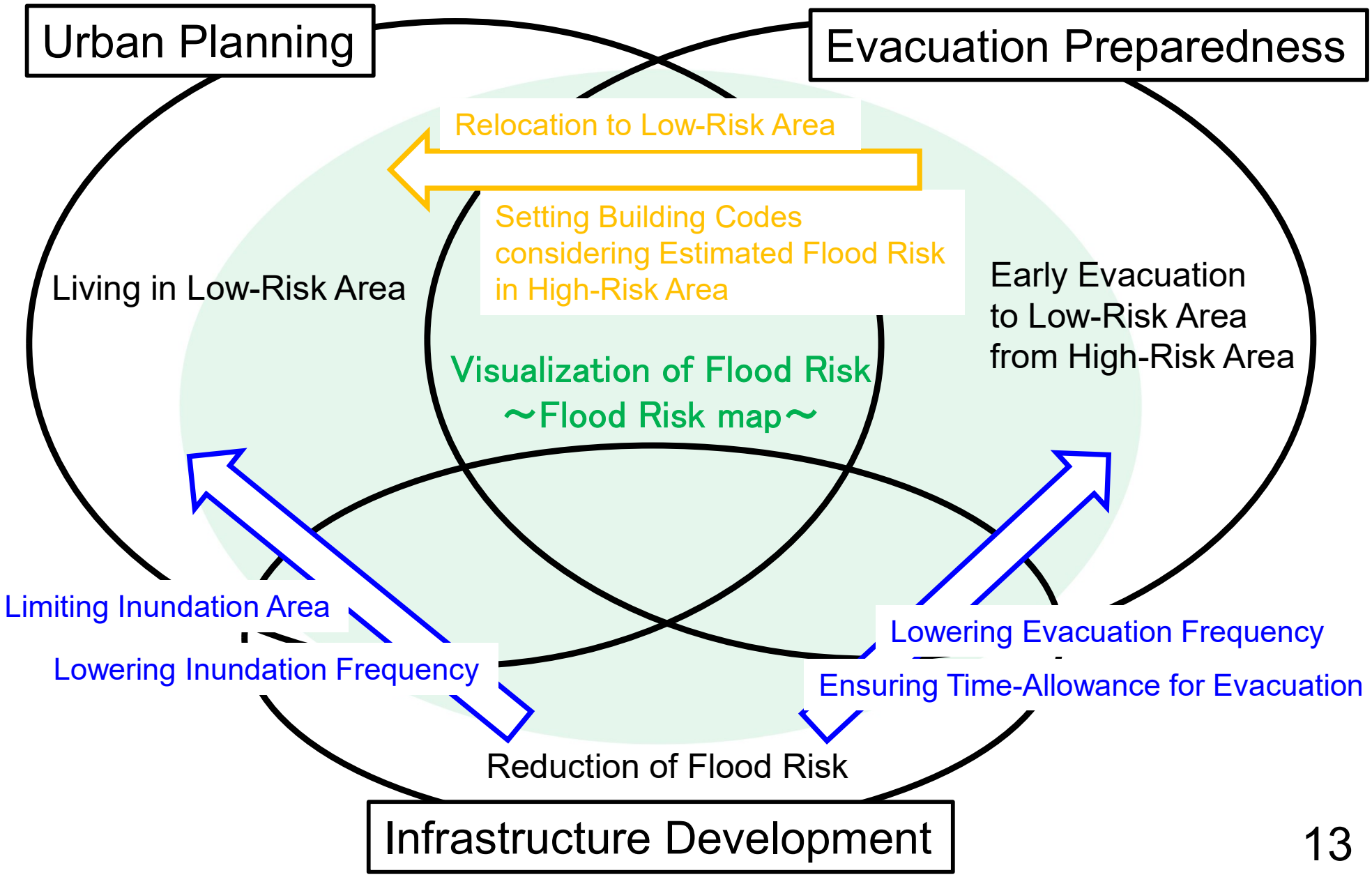
Preparation of "disaster prevention guidelines"

- Evacuation Routes
- Evacuation Area/facilityies etc.

Relocation from Disaster Prone Area

Area restrained in urbanization
Area designated for urbanization
Area promoted for inhabitation
Red zone
Inundation-prone areas

A Risk-Based Policy Perspectives for River Basin Sustainability and Resilience by All in Japan

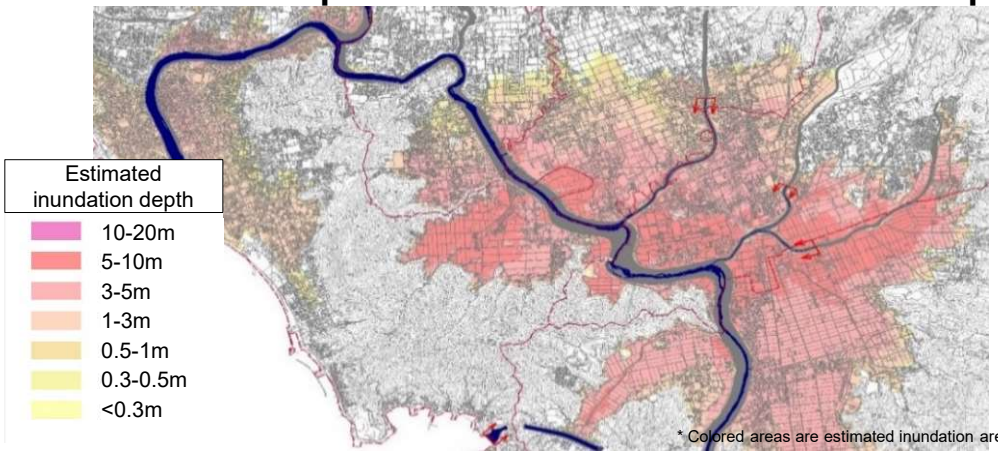


Making use of the Flood Risk Map

- Flood hazard maps have been provided with the inundation depth with the probable maximum precipitation.
- In addition to the above, to provide further flood risk information, the estimated inundation area with different flood probabilities will be provided.
- It is expected that these maps will promote more resilient residential and urban planning considering flood risk.

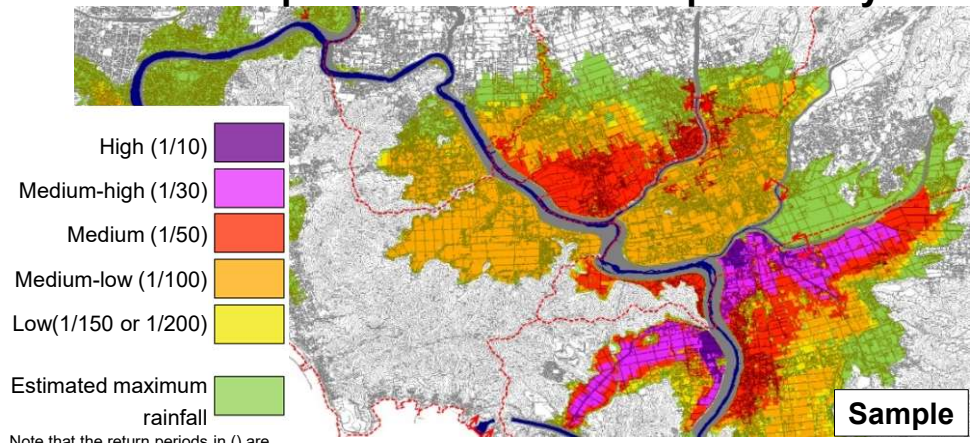
Improved flood risk information

Flood hazard map estimated maximum inundation depth



* Colored areas are estimated inundation area

"Flood Risk Map" with different flood probability

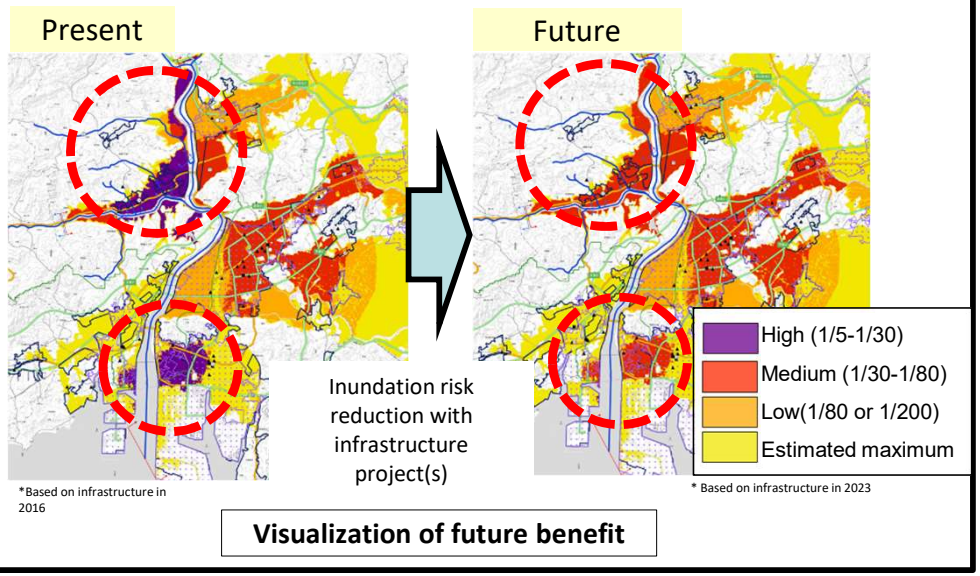


* Note that the return periods in () are non-deterministic value but written for support understanding.

* This map overlays estimated inundation areas with more frequent events on the maximum depth map.

Resilient residential and urban planning considering flood risk

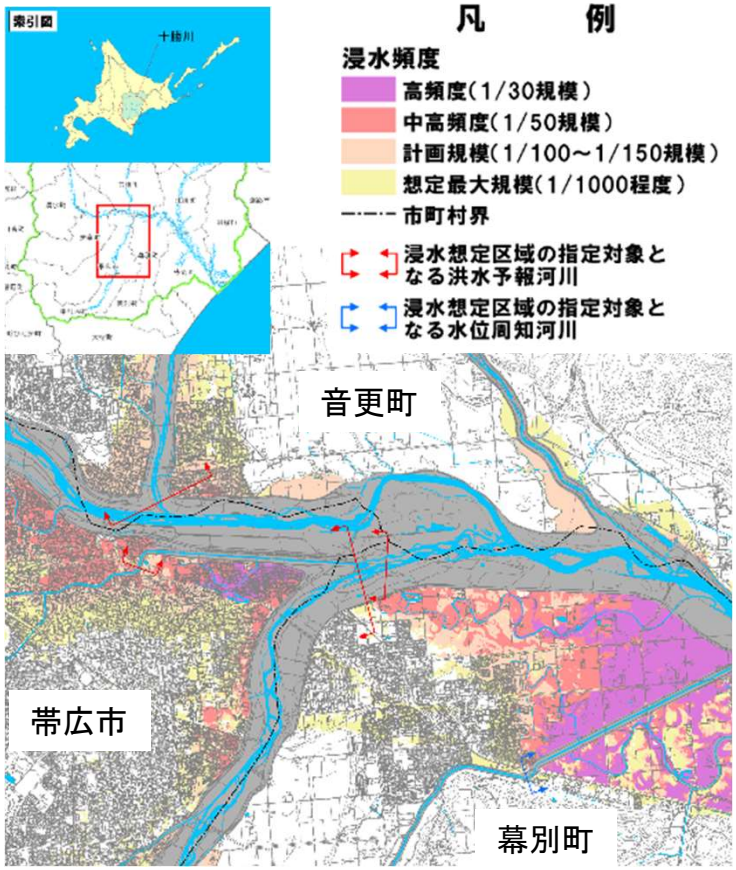
- Visualize future risk with the benefits of ongoing projects
- Improve land use control and resilient residential planning
- Feed into the private sector such as BCPs and flood insurance



Visualization of future benefit

Flood Risk Assessment and Risk Mapping

【Water-related Disaster Risk Map (Image)】



出典：北海道開発局帯広開発建設部浸水頻度マップ
（帯広市、音更町、幕別町）

【Example of Usage】

＊Land Use Management

→Restriction of development,
Encouragement of relocation

＊Flood Protection Measures

→Dissemination of project impacts

＊Flood Insurance

→Setting premium based on flood risk

＊Evacuation

→Appropriate evacuation route

＊BCP

→BCP based on flood frequency and probable inundation depth

Water-related disaster risks can be estimated even in the area where observation is still inadequate