

**ASSESSING LONG-TERM ECONOMIC VIABILITY: A CASE
STUDY OF FLOOD PROTECTION INVESTMENT
SS-3-4 PROMOTING INVESTMENT IN DISASTER RISK REDUCTION AND
CLIMATE CHANGE ADAPTATION: POLICIES AND INNOVATIVE
APPROACHES FOR A RESILIENT FUTURE, SEPTEMBER 11, 2023
18 WORLD WATER CONGRESS, BEIJING**

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Estimating the economic viability of long-term investment in flood protection: Case study of the Natorigawa River ←



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(in Press)

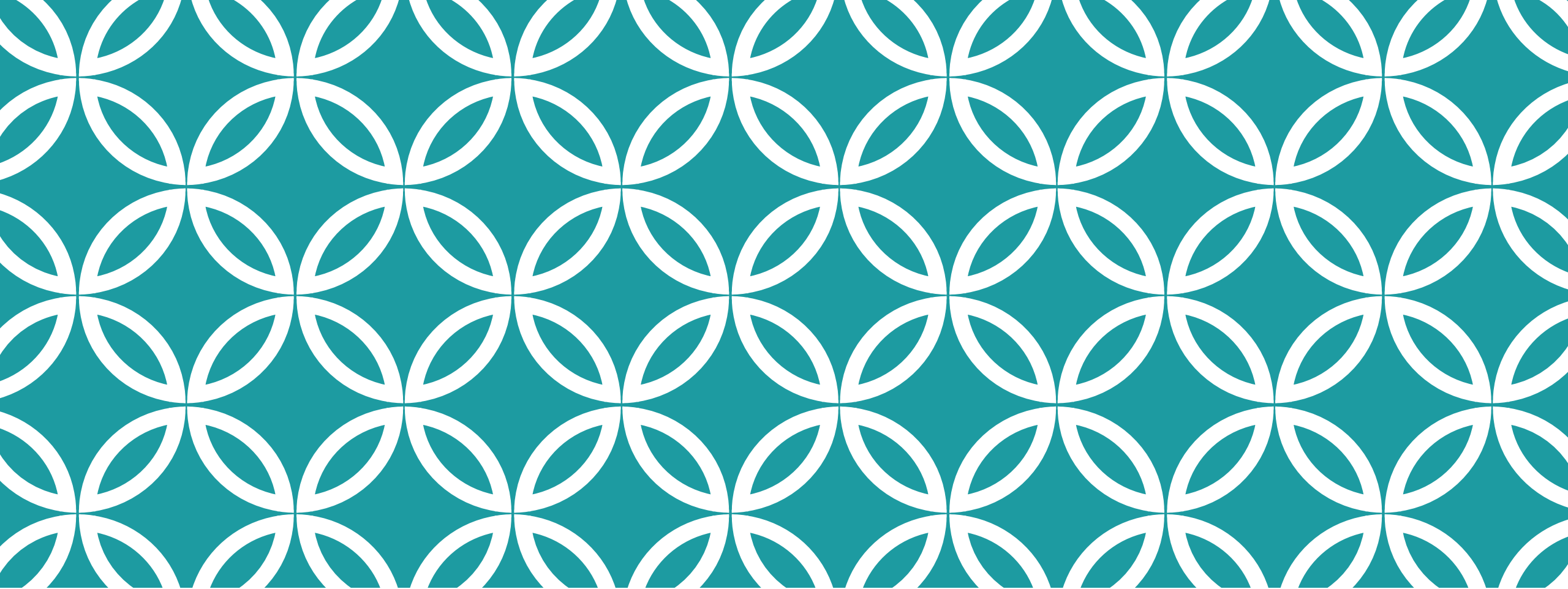


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1. Introduction

2. Economic benefits of flood protection in Sendai City

3. How to share benefits and costs among multi-stakeholders



I. INTRODUCTION



1. INTRODUCTION

Disaster risk reduction (DRR) Investment

- ✓ crucial for decreasing damage
- ✓ Policy- and decision-makers need hard facts on which to base investment policies and promote projects for DRR and CCA.

However,

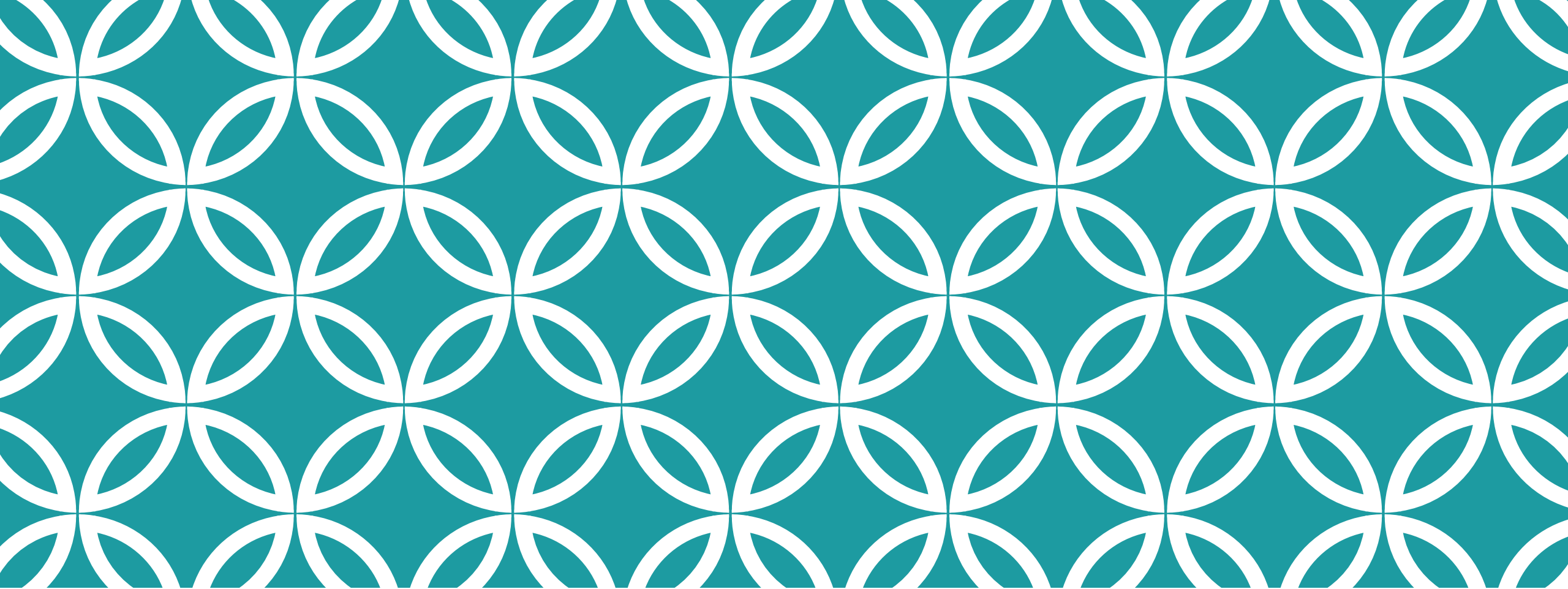
long-term economic analysis at river basin or regional scale rarely conducted. Policymakers need evidence that investments in flood protection contribute to regional growth.

INTERNATIONAL ARENAS

- **Sendai Framework for DRR**, adopted at 3rd UN World Conference on DRR in Sendai in 2015: investment as priority action
- **Copenhagen Accord, COP** in 2009: set a target of \$100 billion per year by 2020 to support mitigation and adaptation measures in developing countries
- **Kumamoto Declaration**, adopted at 4th Asia-Pacific Water Summit in 2022 by participating leaders, double investment to solve water issues.

PURPOSE

- This study aims at proposing methodologies for estimating benefits for flood protection infrastructure in river basin scale
- Case study in Sendai City, Natorigawa River Basin

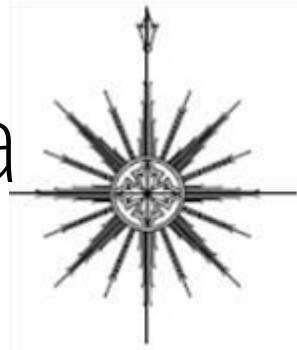


II. ECONOMIC BENEFITS OF FLOOD PROTECTION IN SENDAI CITY

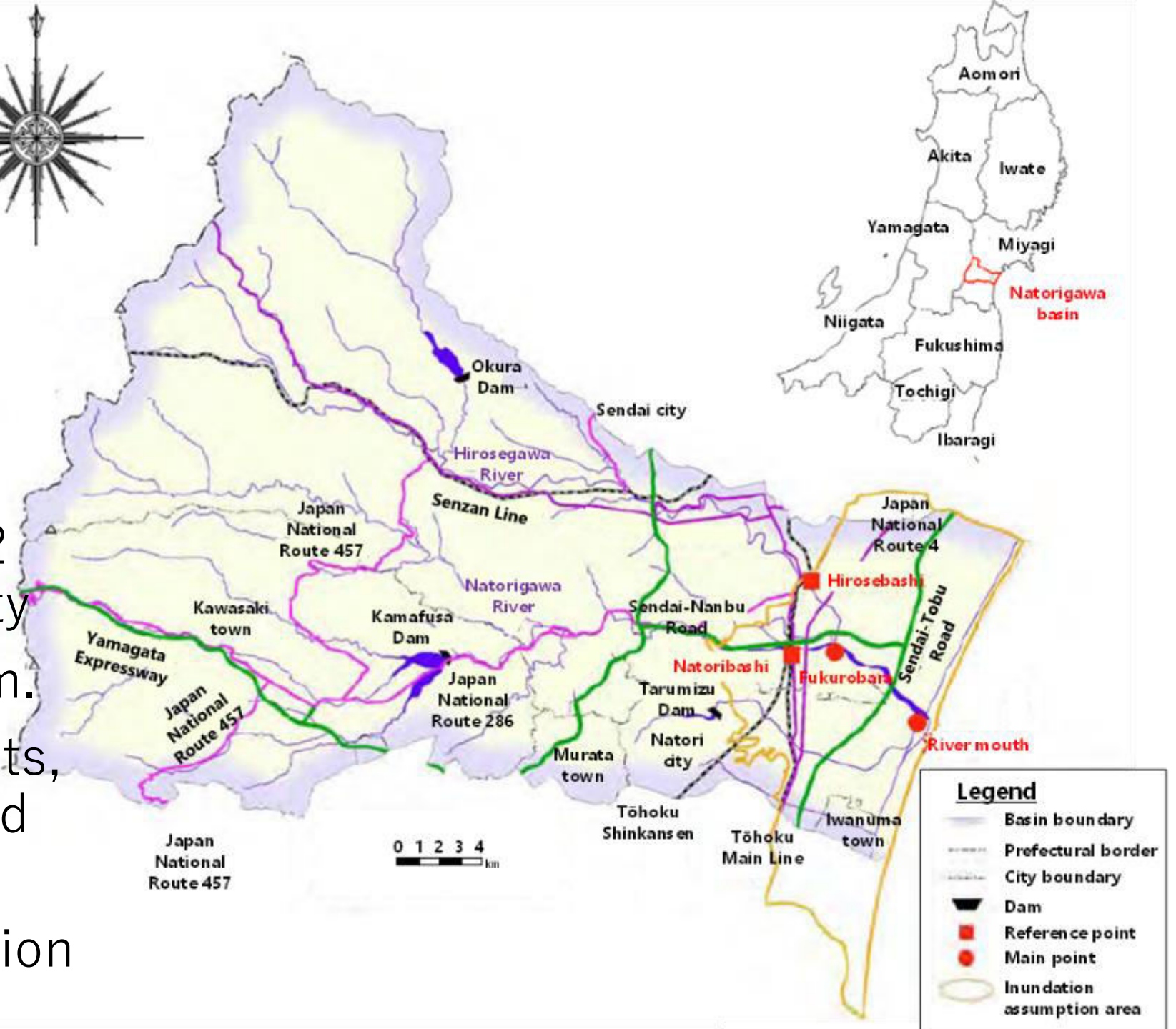


CASE OF NATORI RIVER, SENDAI CITY

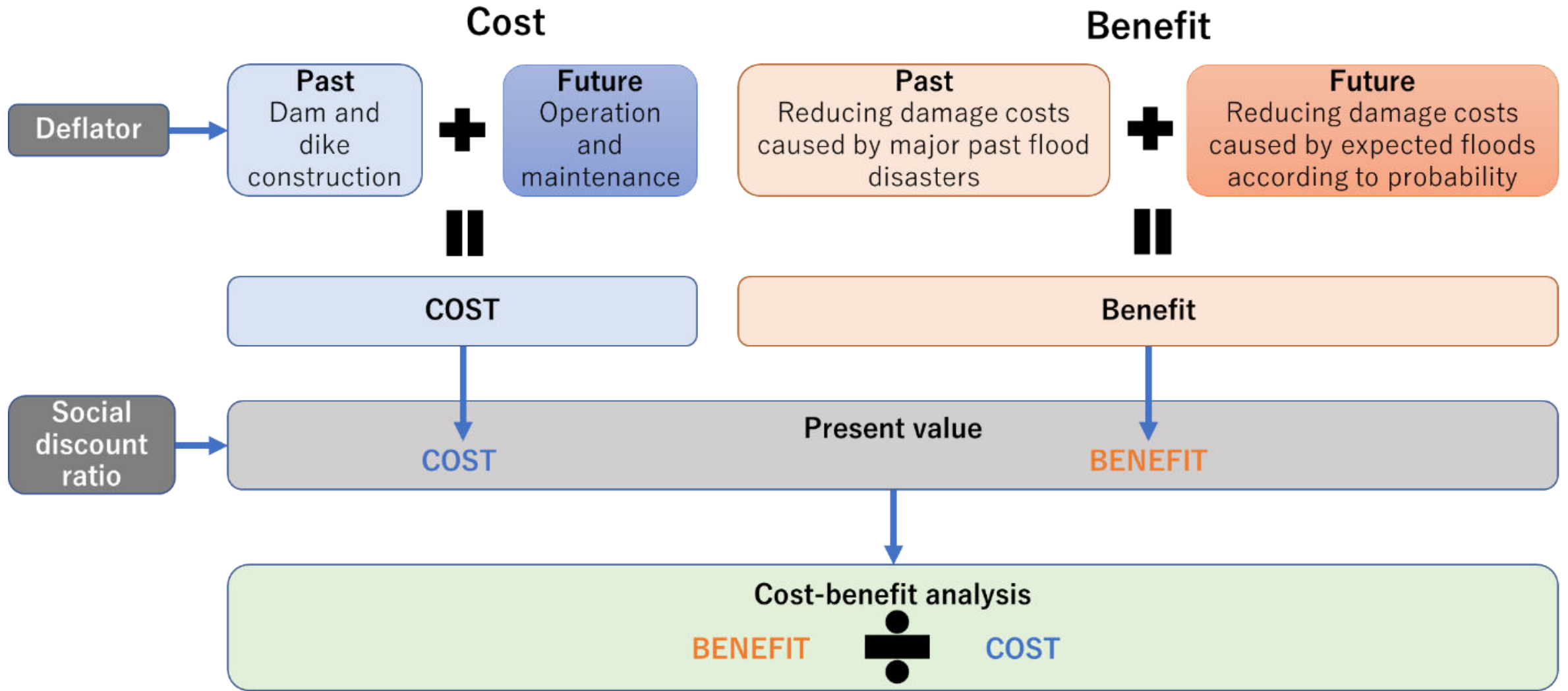
Natorigawa River basin



- river basin: 939 km² including Sendai City
- main channel: 55 km.
- 76% mountain forests, 12% agricultural land 12% urban areas.
- Population; 1.1 million



Concept of economic analysis for long-term and large-scale investment



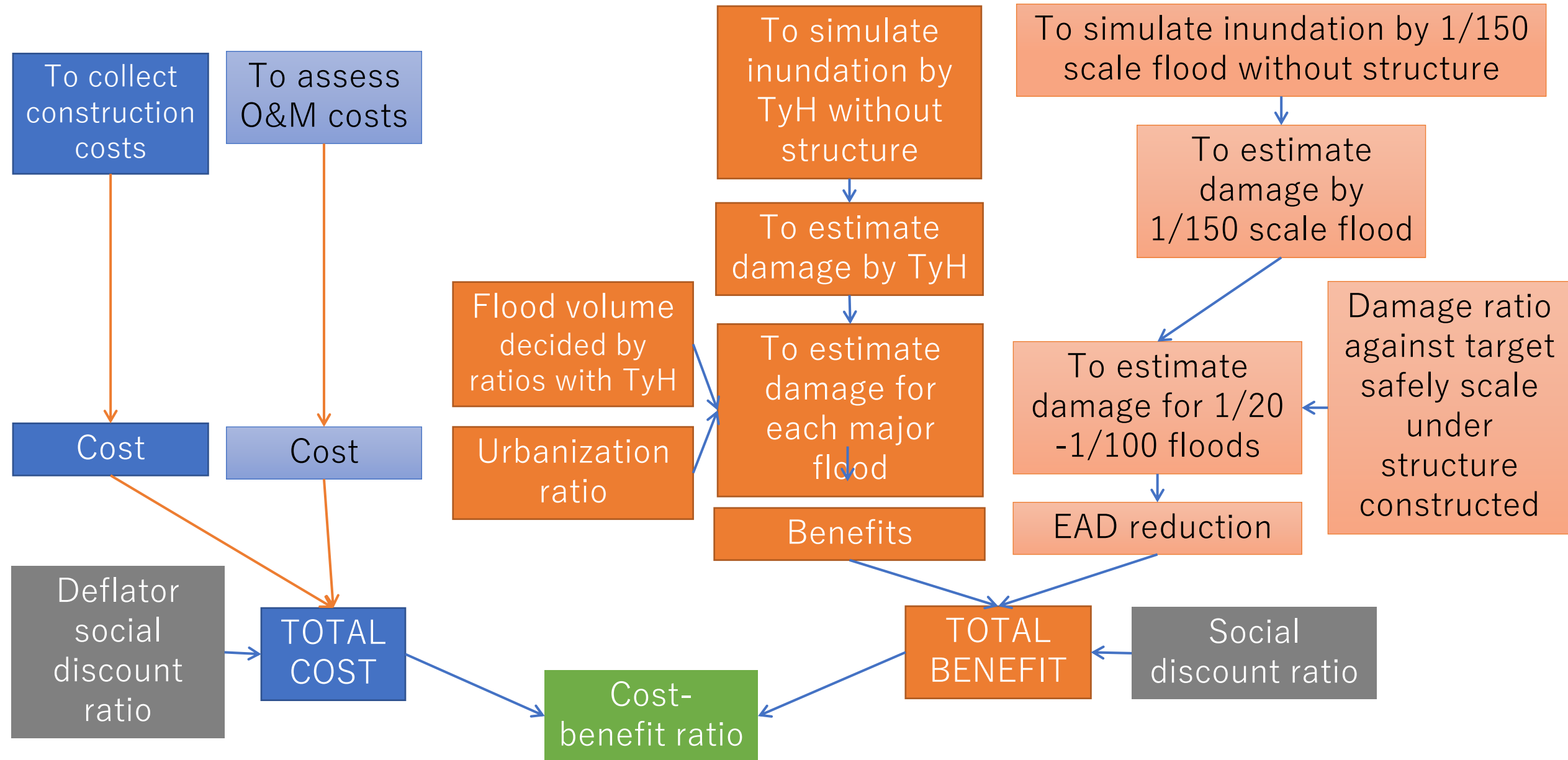
Past cost

Future cost

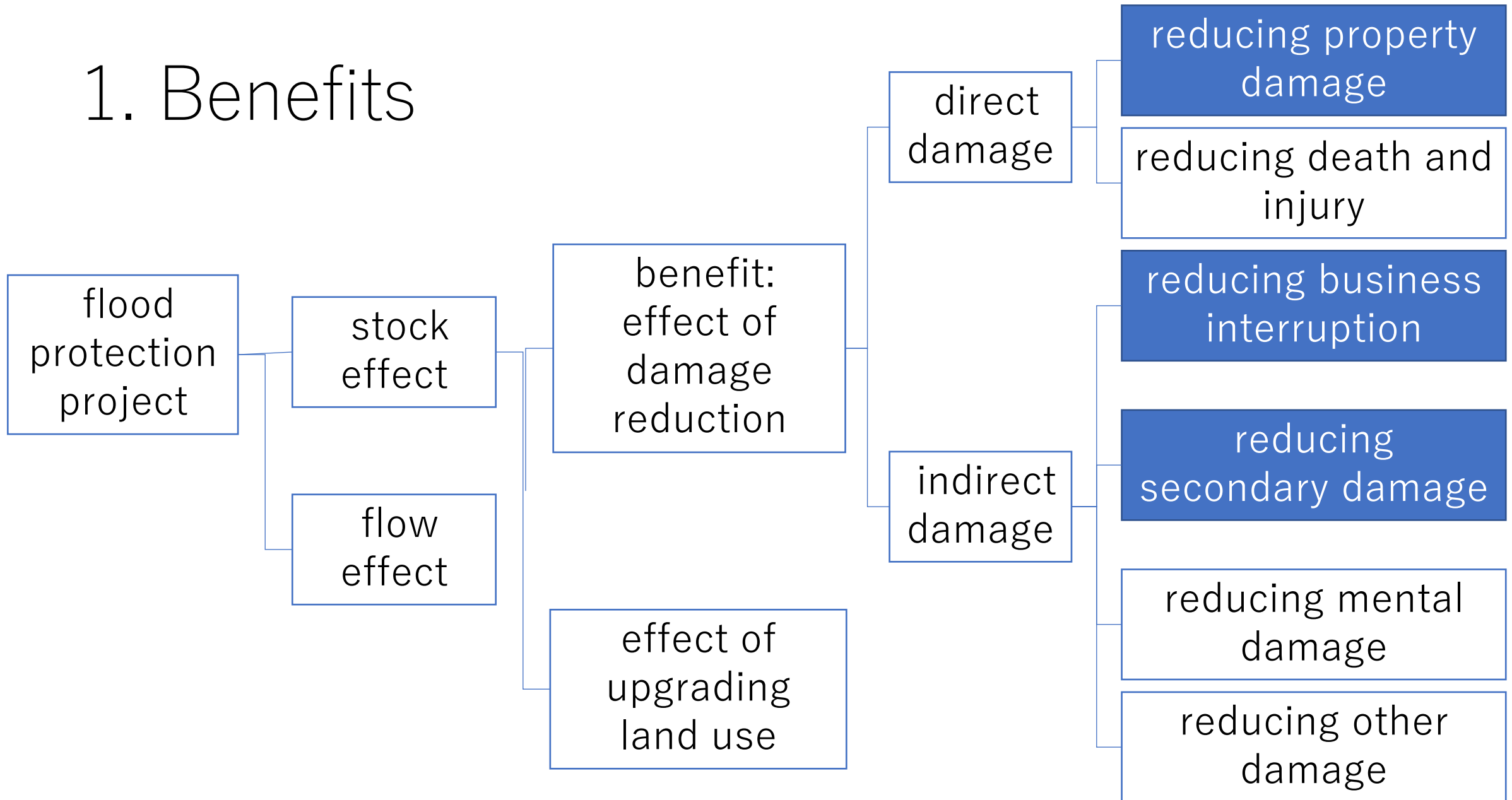
Past benefits

Future benefits

Socio-economic, hydrological, & geographical data



1. Benefits



2019 TYPHOON HAGIBIS WITHOUT INVESTMENT

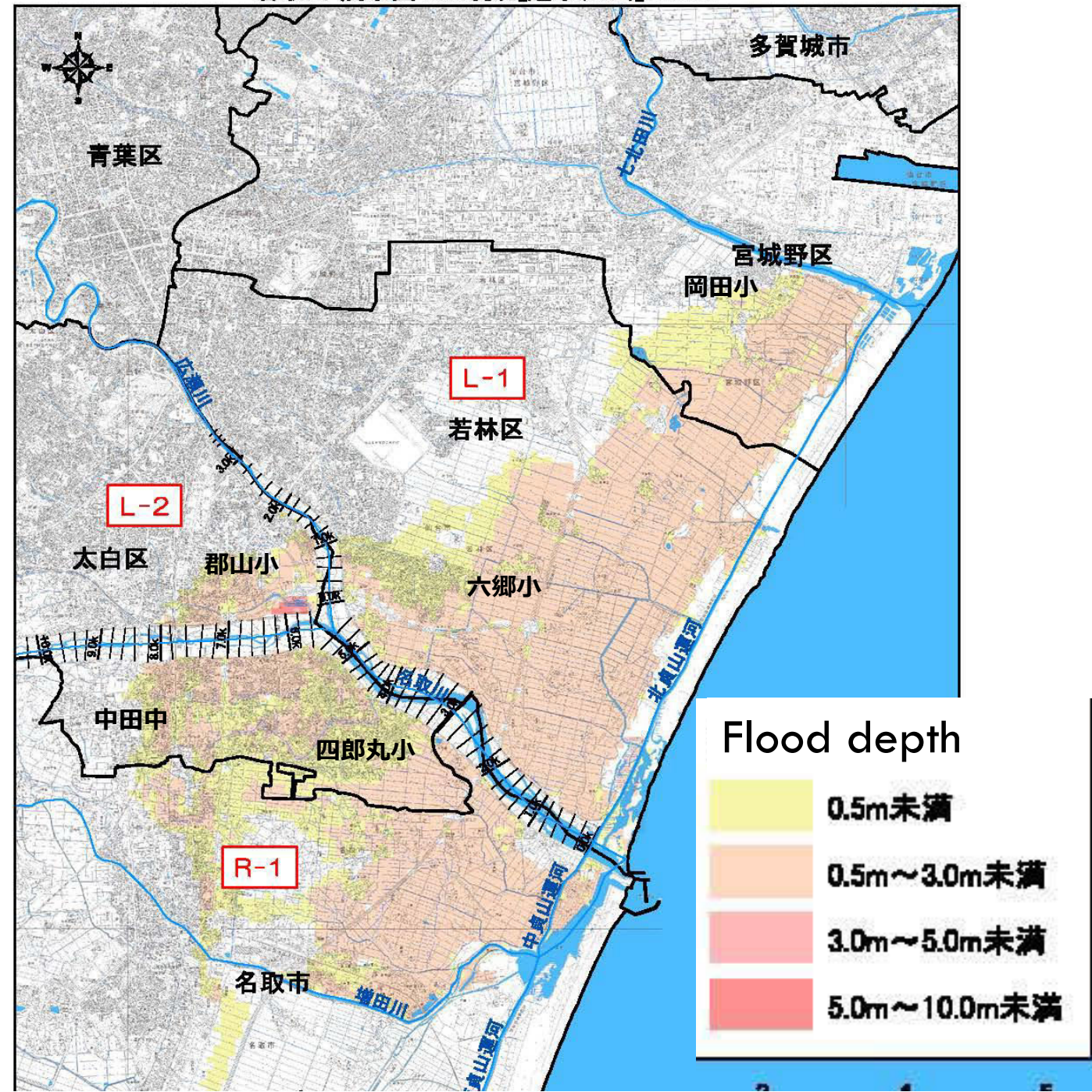
Estimated damage

350billion JPY

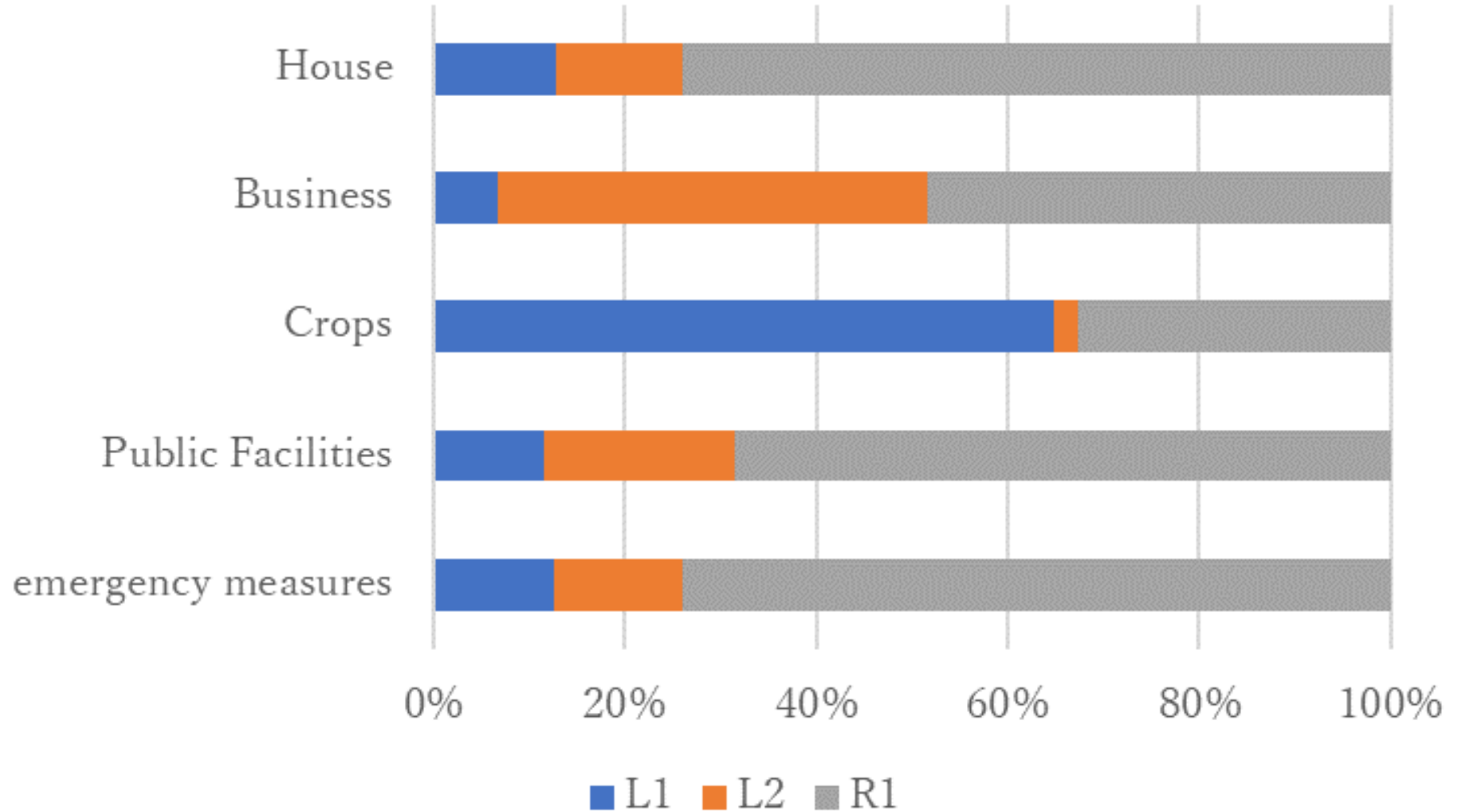
(2.5 billion USD)

one-third budget of Sendai

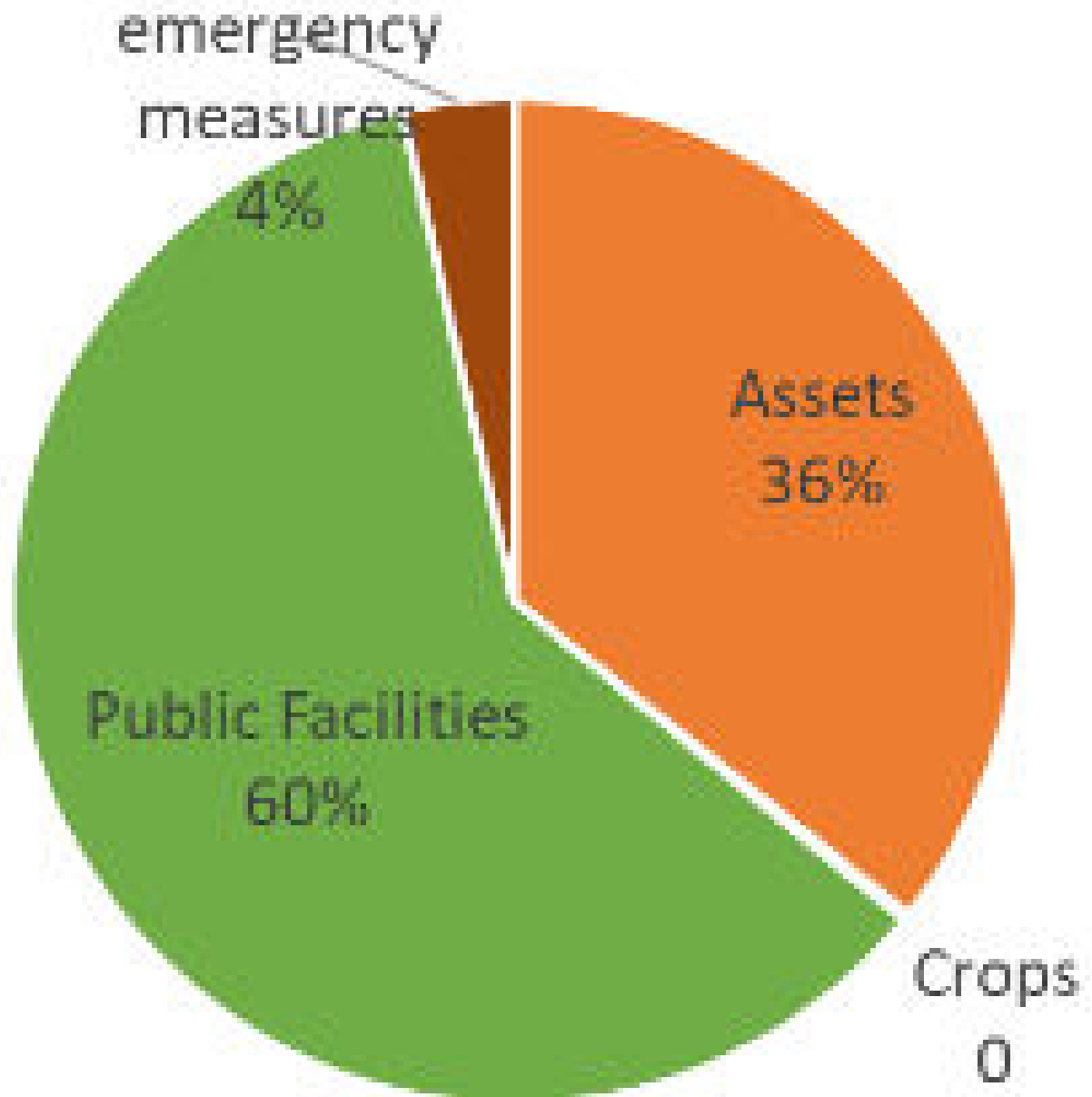
Inundated houses 150,000

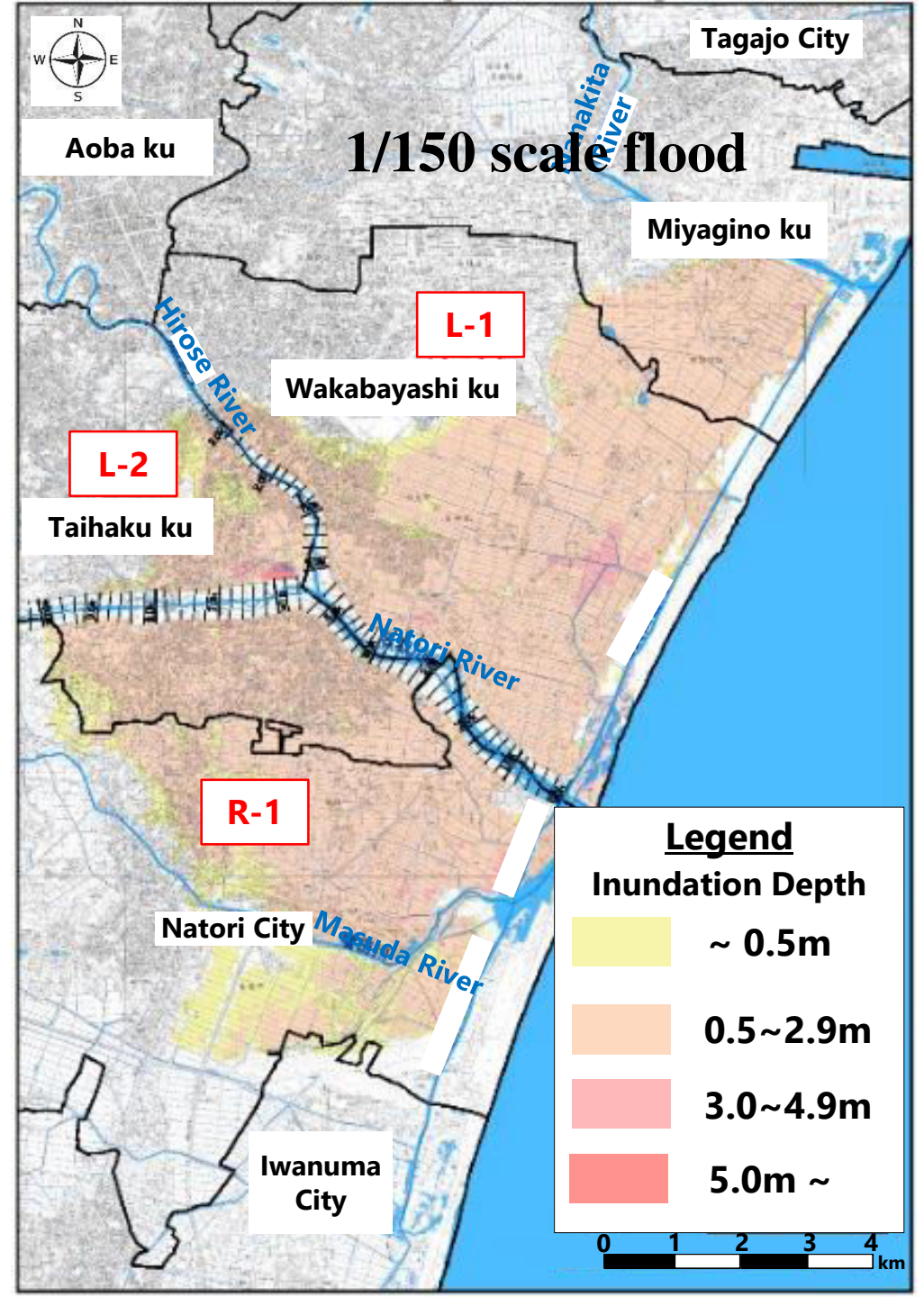
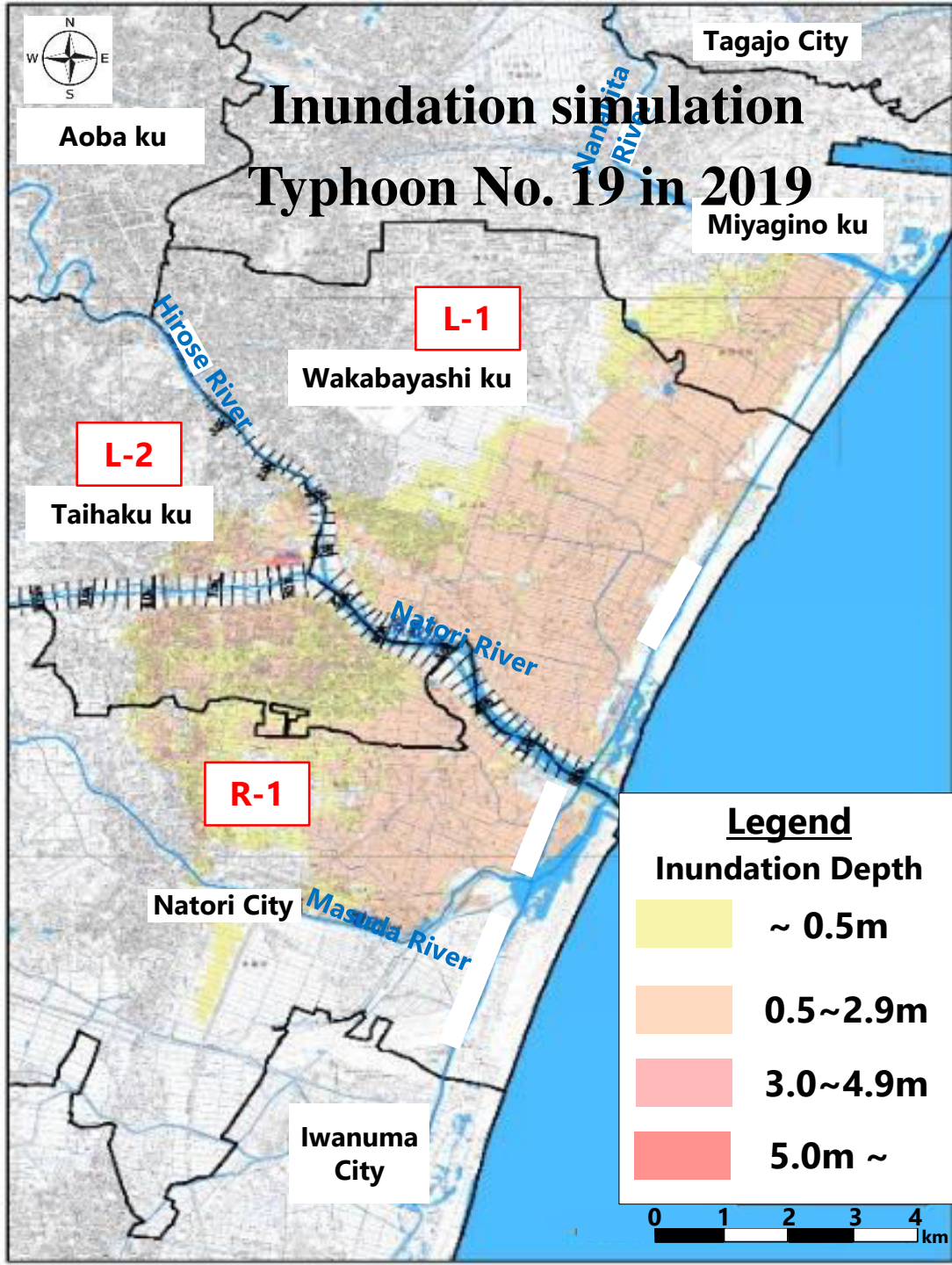


SHARE OF DAMAGE BY BLOCK



ESTIMATED DAMAGE BY TYPHOON HAGIBIS





Total past Benefit: 3.7 trillion JPY (26.4 billion USD)

	Flow volume (m³/s)	Ratio of volume to Typ. Hagibis	Ratio of residential land to 2019	Benefit (With urbanization) (present value) (Million JPY)
August 1986	2,690	0.82	0.76	754,952
August 1989	3,280	0.99	0.84	903,576
September 1994	2,270	0.69	0.89	544,042
July 2002	2,920	0.88	0.92	531,950
September 2011	2,180	0.66	1.00	302,755
September 2007	2,740	0.83	1.00	325,276
October 2019	3,300	1.00	1.00	348,269
Base case				
Total	-	-	-	3,710,819

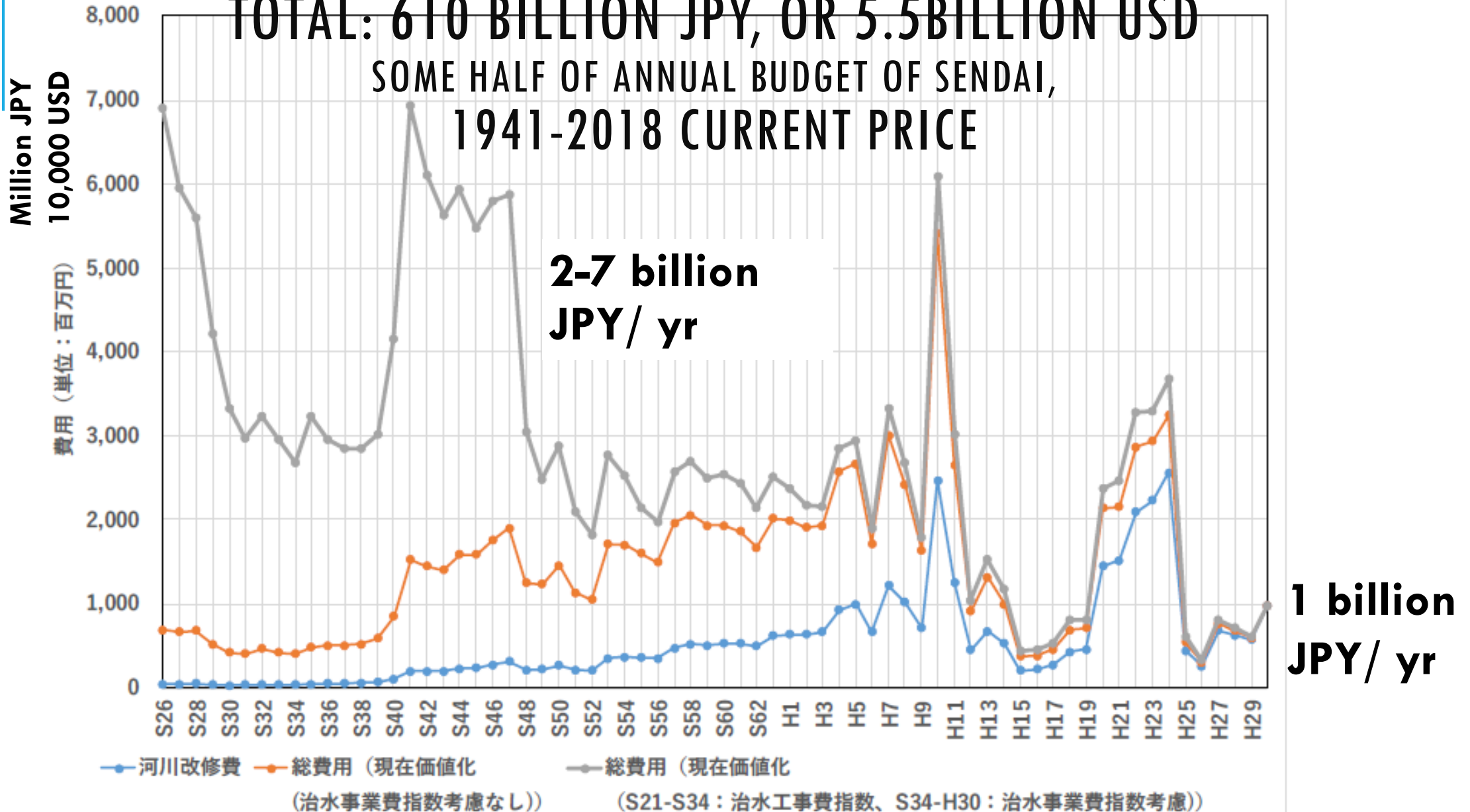
Future benefits: 112 billion JPY (8 billion USD)

- average expected annual damage (EAD) reduction for 50 yrs
- base case: Flood protection works with the safety level of 1/150 yr flood
- The amount of EAD reduction for 10 flood scales based on 10 probability years selected
- multiplied by interval probability to obtain annual EAD reduction.

2. COSTS: LONG-TERM INVESTMENT IN FLOOD PROTECTION

TOTAL: 610 BILLION JPY, OR 5.5 BILLION USD

**SOME HALF OF ANNUAL BUDGET OF SENDAI,
1941-2018 CURRENT PRICE**

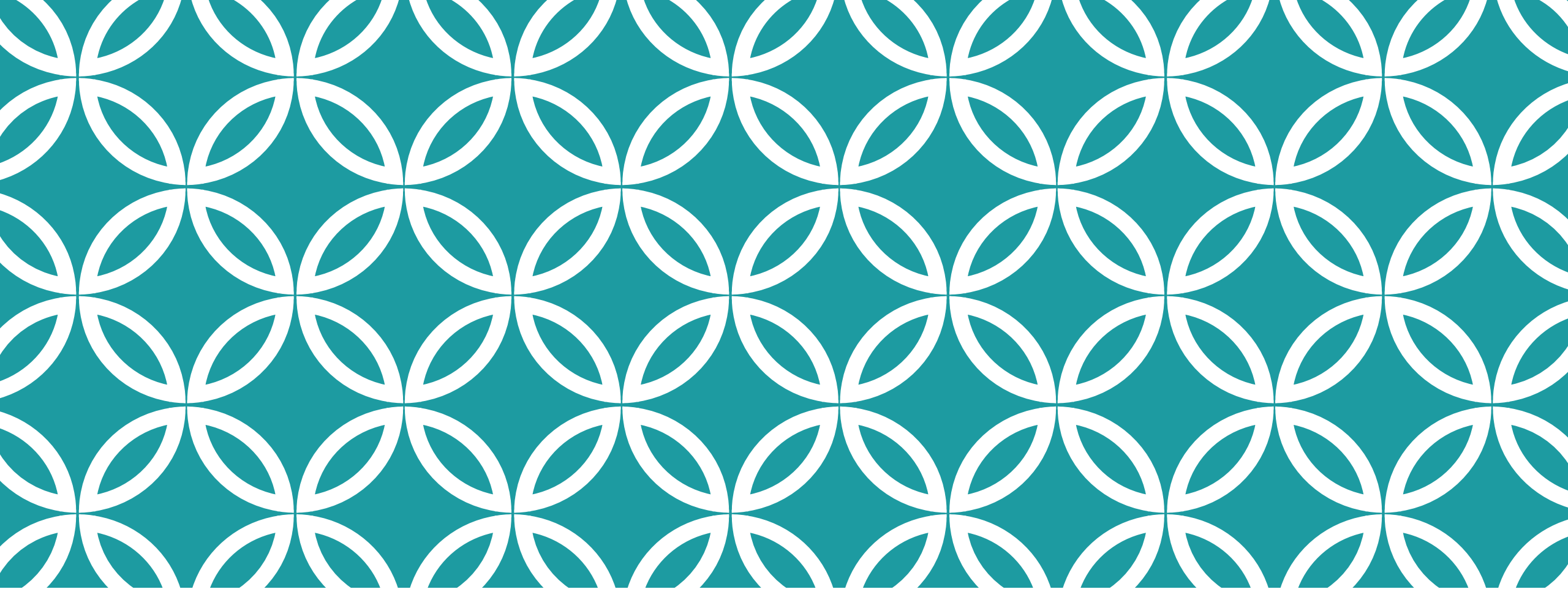


Total benefits	3.81 trillion JPY (26.4 billion USD)
Total costs	626 billion yen (4.4 billion USD)
Cost-benefit ratio B/C	6.1

summary

It was found

- investments in flood protection over 70 years in river basin were efficient, with an estimated benefit-cost ratio of 6.1.
- Structures have prevented Sendai City from flooding several times and will continue to do so in the future.
- Due to reduction in flood damage, investments in flood protection promoted development activities and enhanced growth at regional level.



III. HOW TO SHARE BENEFITS AND COSTS AMONG MULTI-STAKEHOLDERS



1. WHOLE-A-SOCIETY FOR INVESTING IN DRR

Local community

Local government

National government

ROLE OF LOCAL COMMUNITY IN SENDAI OPERATING GATE



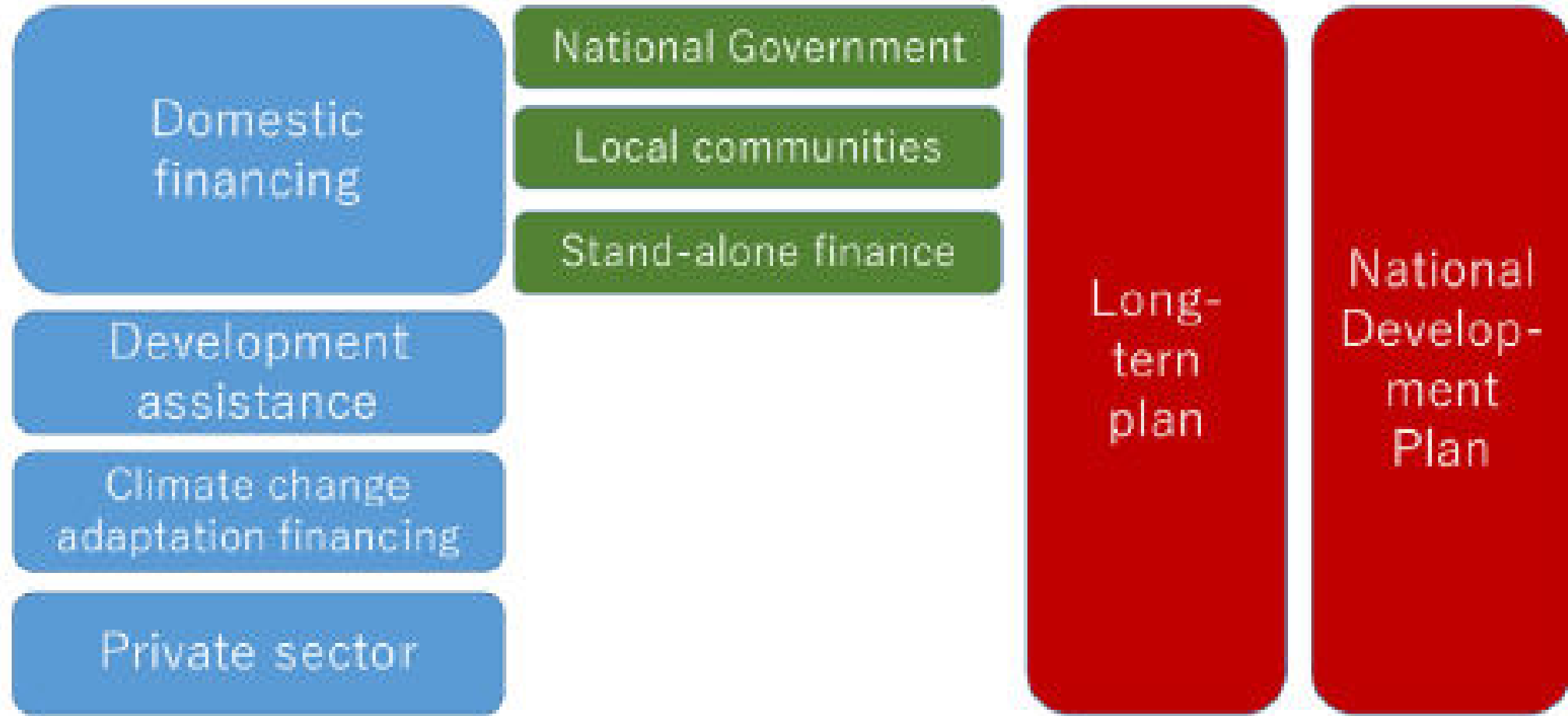
**WOMEN LEADER
SENDAI IWAKIRI ELEMENTARY SHOOOL**



ANY CHANCE OF INVOLVING PRIVATE FINANCE? KAWAMACHI TERRACE IN NATORI CITY



2. Concept: financing investment in DRR

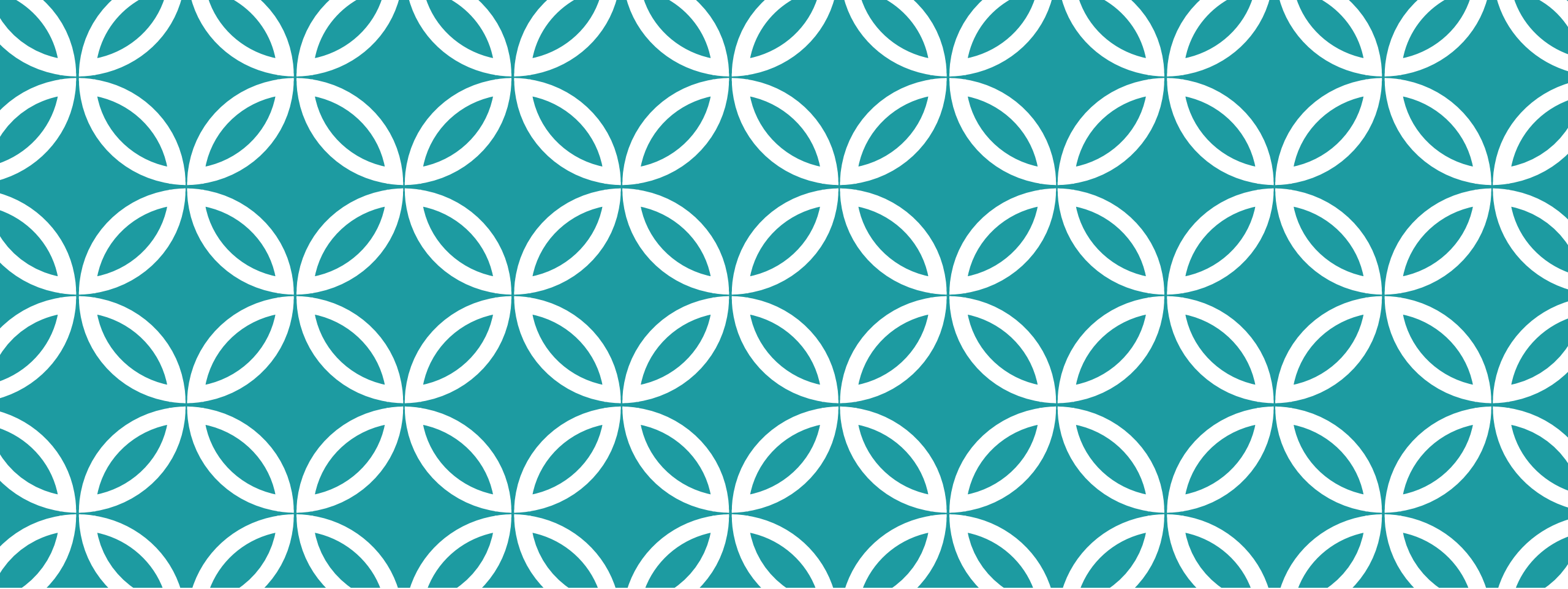


Progress in Disaster Science

journal homepage: www.elsevier.com/locate/pdisas



Ishiwatari, M., & Surjan, A. (2019). Good enough today is not enough tomorrow: Challenges of increasing investments in disaster risk reduction and climate change adaptation. *Progress in Disaster Science*,²⁸ 1,



IV CONCLUSION



consideration

Issues to apply developing countries

- Simplified methods computer resources using satellite data and simple flood simulations
- datasets of hydrology, geography, and socio-economy.

Limitation

- Replacing cost
- Attracting investment
- Climate change

CONCLUSION

proposed methodology of economic analysis for long-term investment in flood protection in the past at river basin scale.

for assessing the past and future benefits

consider effects of past urbanization and inflation.

Natorigawa River basin including Sendai City, Japan

70 years investment was efficient with cost-benefit ratio of 6.1

谢谢大家 THANKYOU
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