



Coastal
City



Impacts of Flood Risk on Land Use Change in Coastal Urban Areas: The Case Study of Kaohsiung, Taiwan

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Outline

1. Introduction
2. Method
3. Results
4. Conclusion

Introduction

We are here now!



The Case Study of Kaohsiung City, Taiwan

Kaohsiung Harbor is a world-class international port, the largest deep-water port in Taiwan, and the 13th most comprehensive cargo port in the world.

Basic information

Area: 724.16 km²

Population : 2.6 million

Length of coastline : 94 km

Kaohsiung view



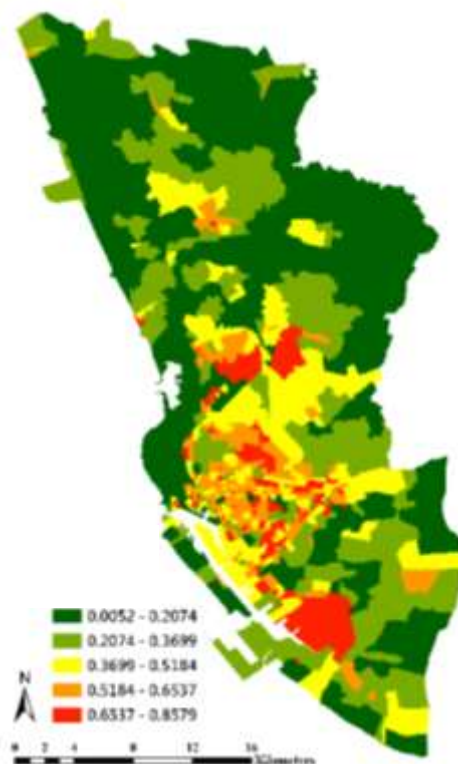
Introduction

Impact of sea level rise on Kaohsiung City

There are 2.6 million people near the coastline and have important facilities



Population density



Land use intensity



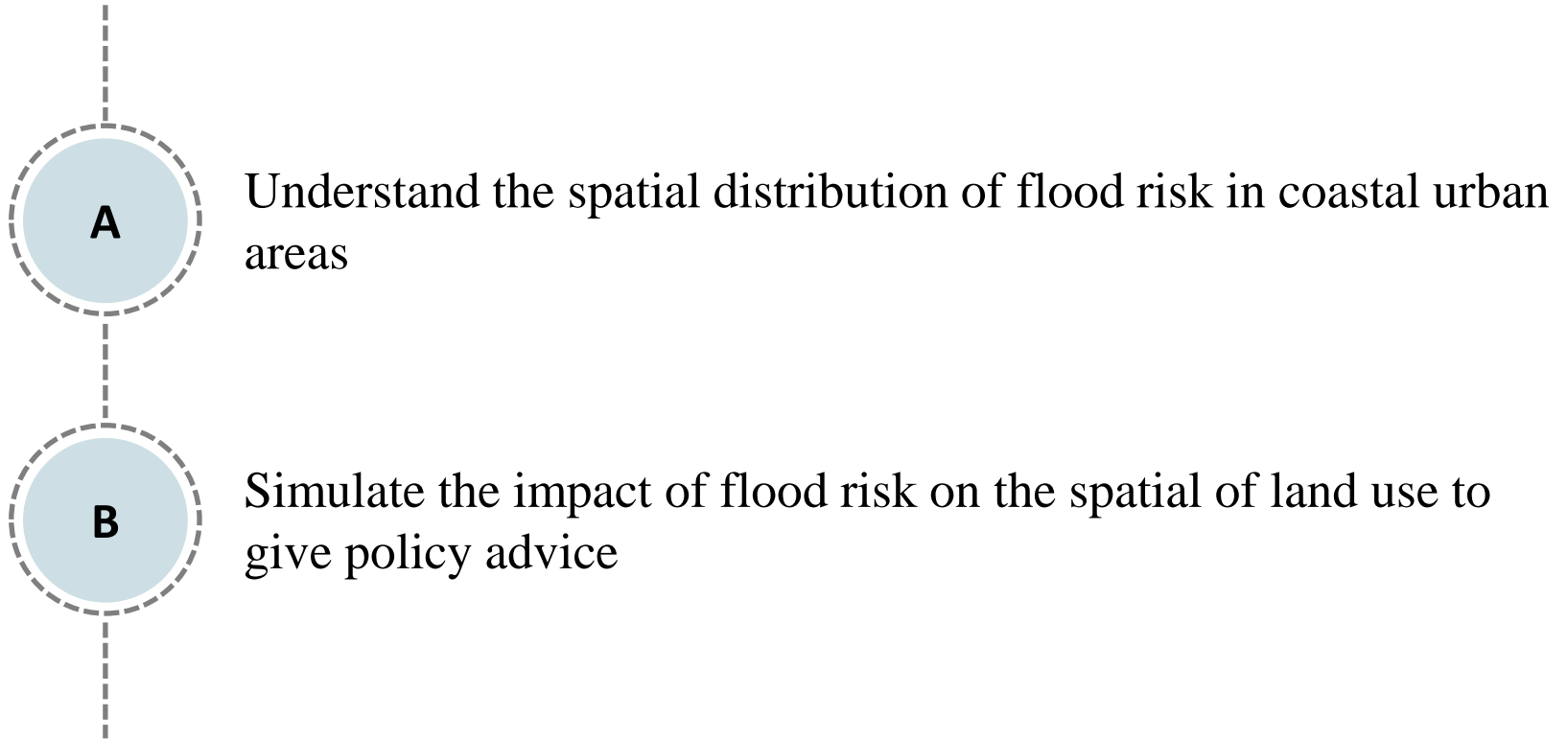
The impact of SLR

Impact of sea level rise in the world

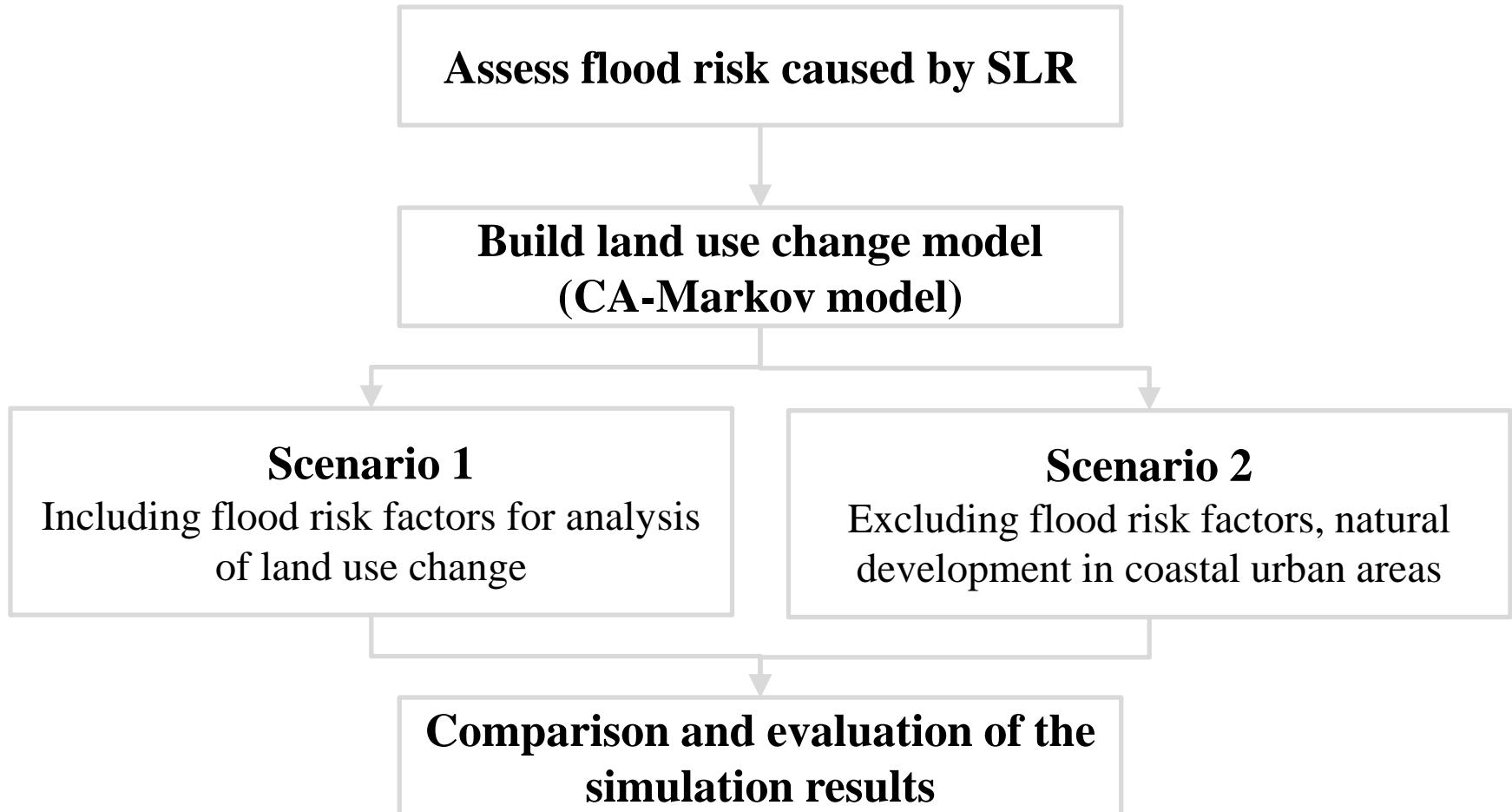
- One of the major challenge in coastal cities
- The disaster-oriented land use and management programs are one of the important issues at local government



The purpose of this study



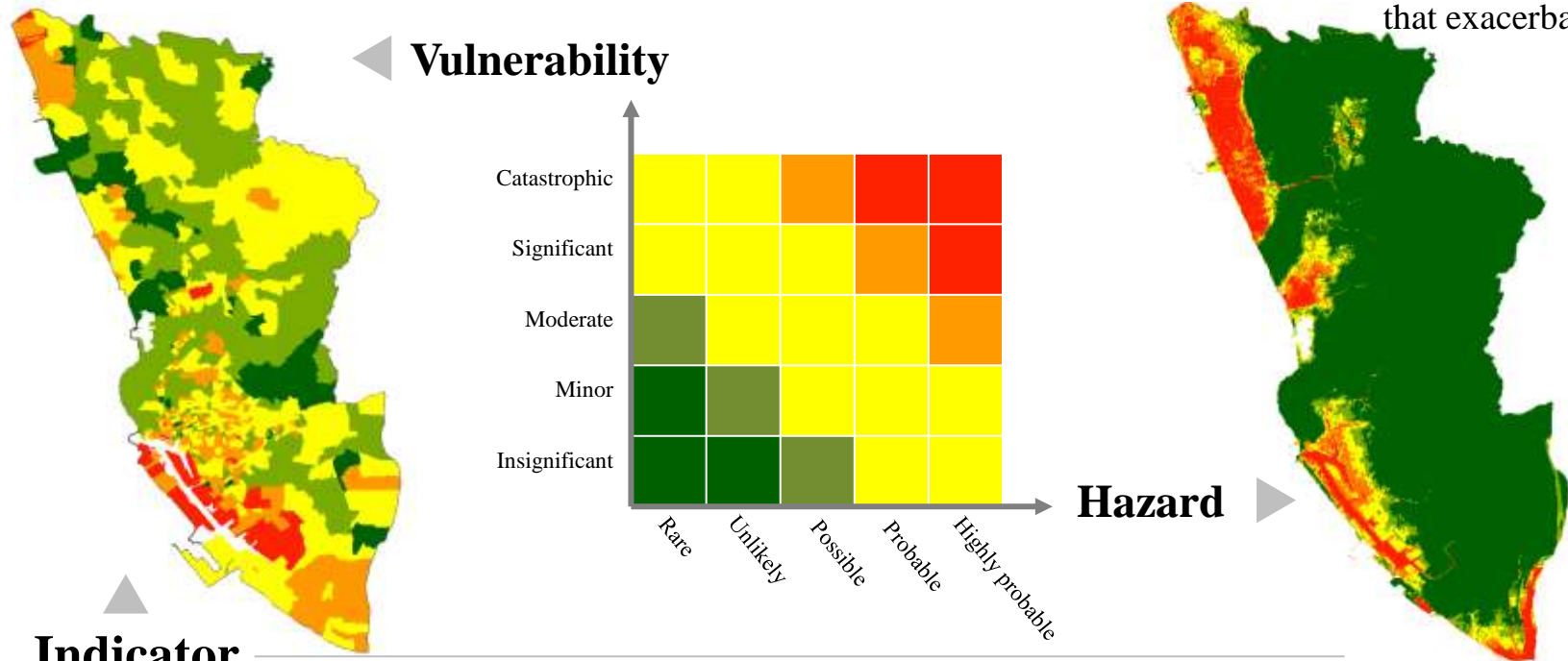
- **Flood Risk and Land Use Simulation Framework**



Assessment of flood risk caused by SLR

Flood risk = F (Hazard, Vulnerability)

Considering "storms, subsidence, and coastal erosion" as factors that exacerbate SLR



Indicator

Exposure

- Land use intensity
- Important infrastructure and public facilities
- Population density

Socioeconomic

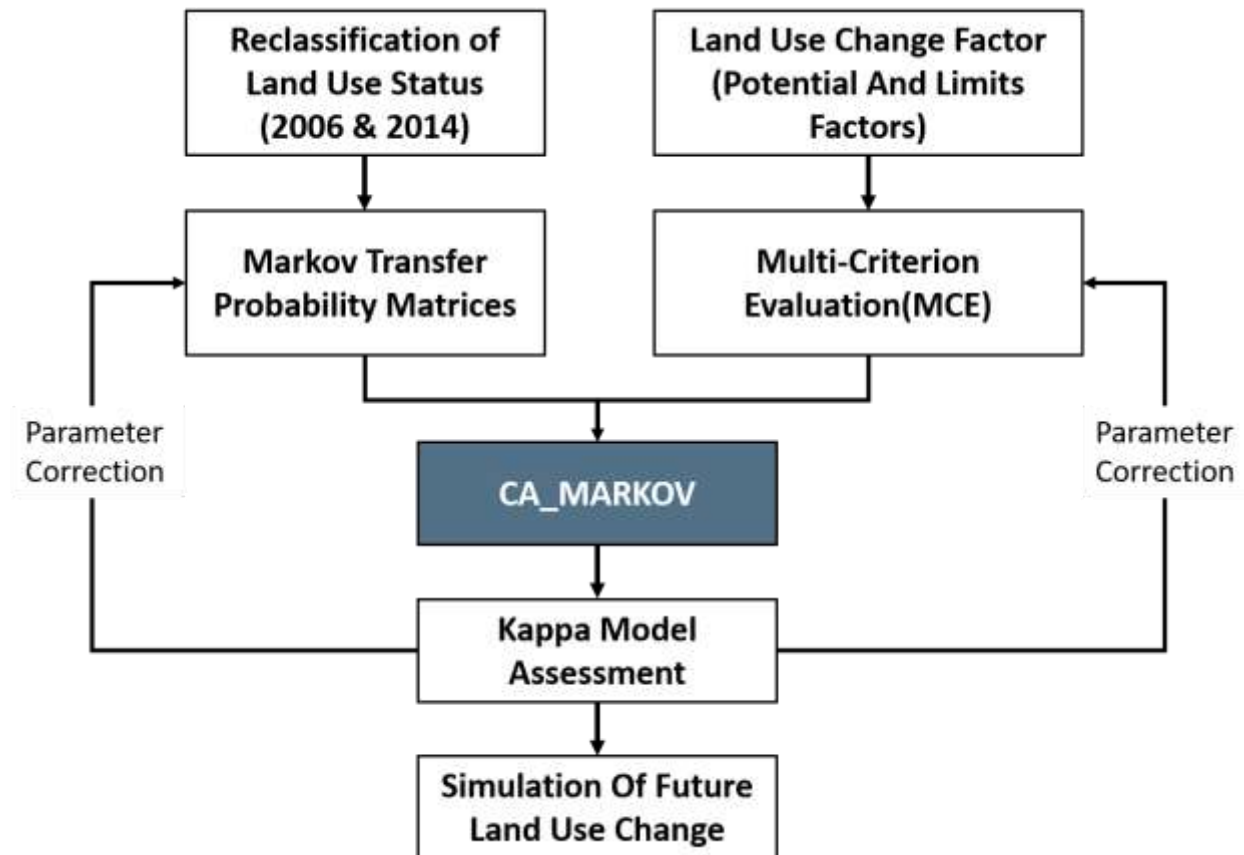
- Low-income households ratio
- Disability ratio
- Industrial output value

Adaptive capability

- Flood disaster experience
- Flood-prevention and disaster-prevention community
- Refuge
- Average income

CA-Markov model

Combined Cellular Automata / Markov Chain / Multi-Criteria



Method

8 factors of land use change

Including or excluding
flood risk factors



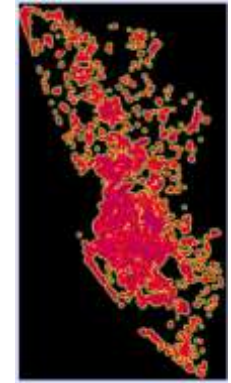
Flood risk
caused by SLR



Distance to
railway and subway

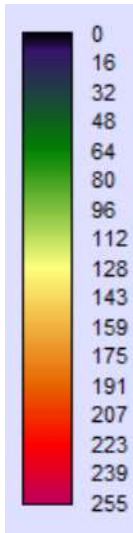


Distance to
road

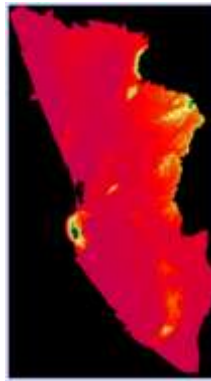


Distance to
public facility

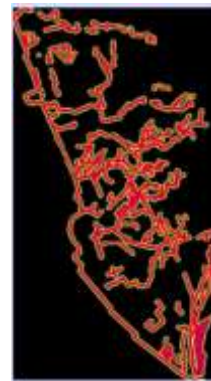
Low potential
develop area



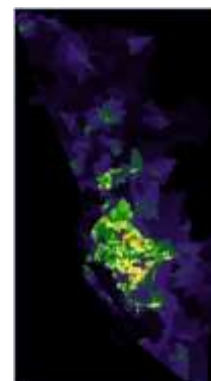
High potential
develop area



Elevation



Distance to
coast and river



Population density



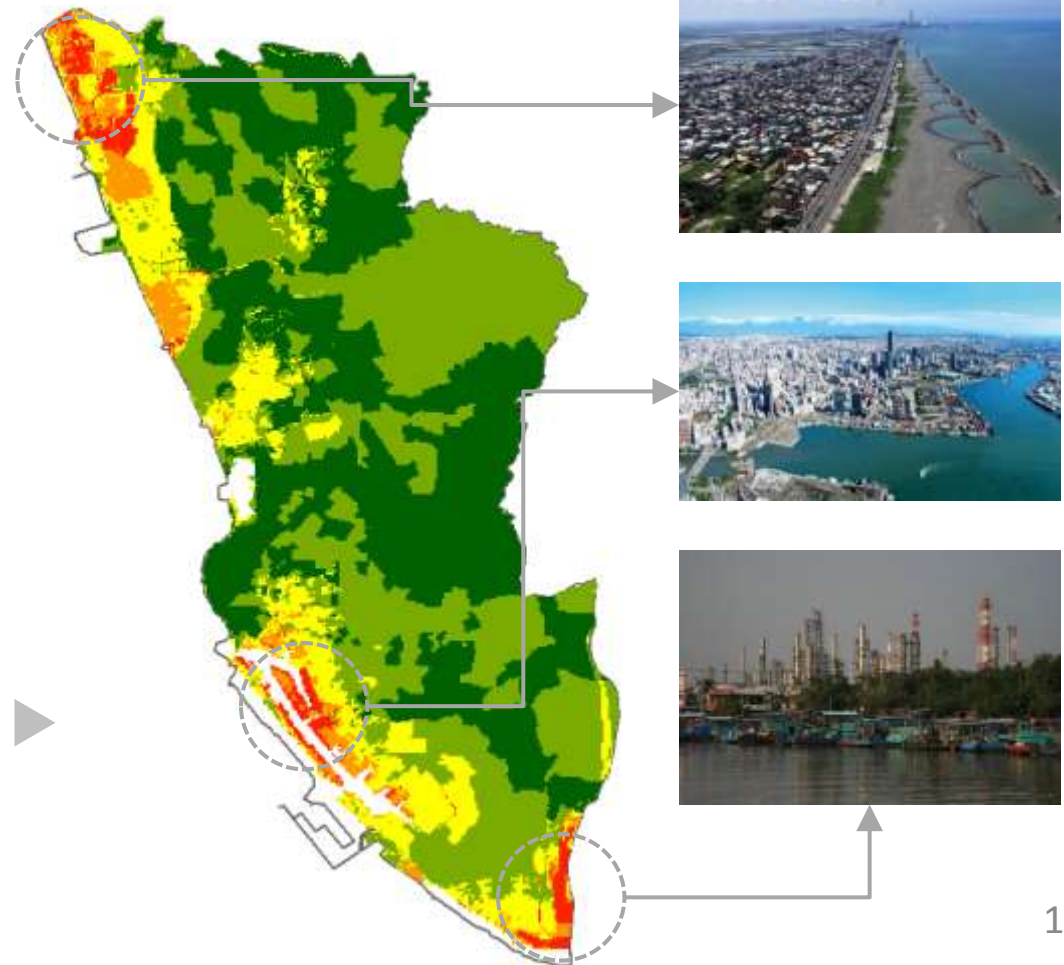
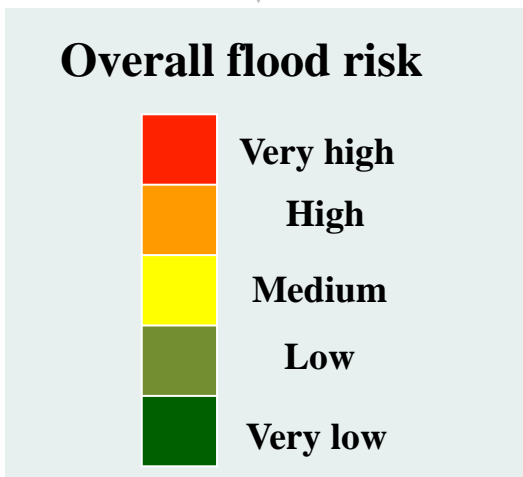
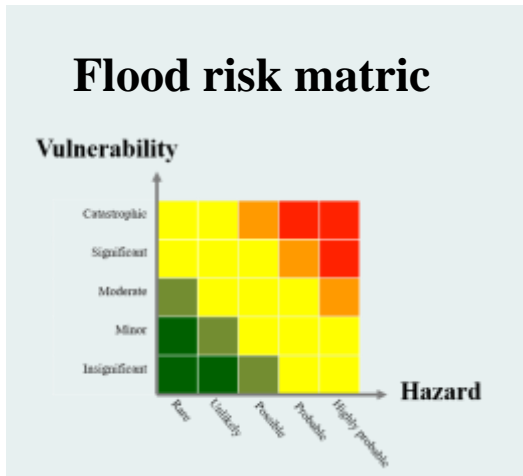
Distance to
existing building

Results

Assessment of flood risk caused by SLR

Flood risk = F (Hazard, Vulnerability)

3 flood risk hotspots



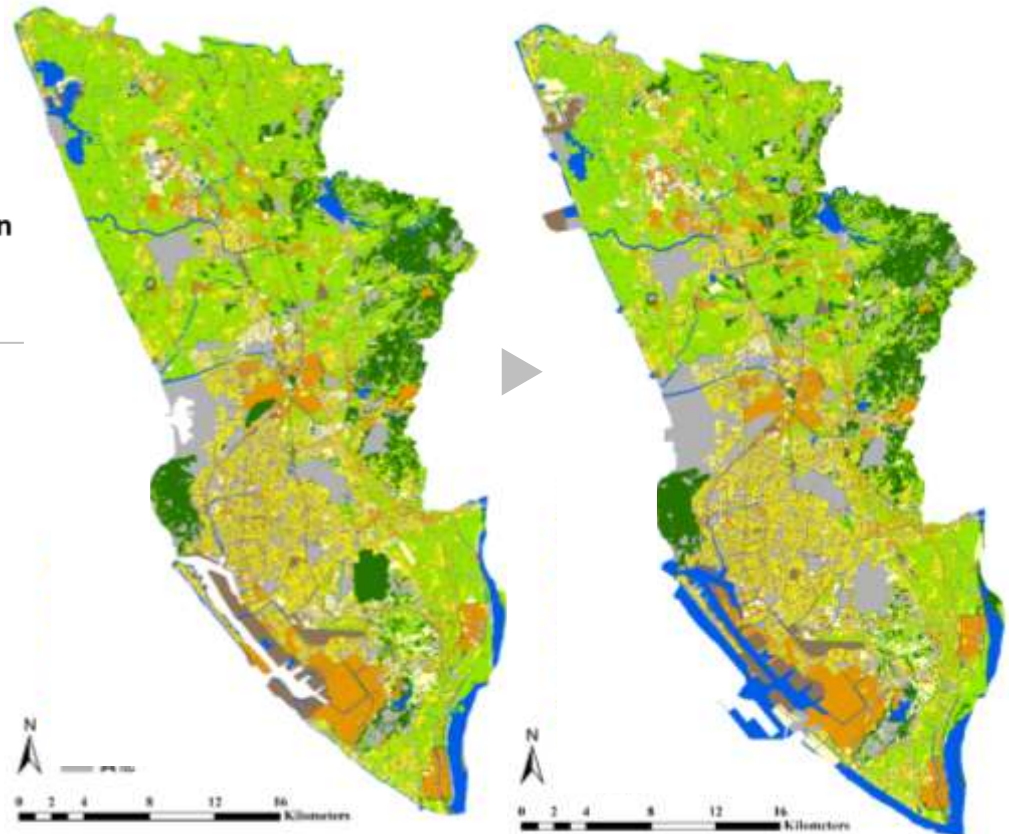
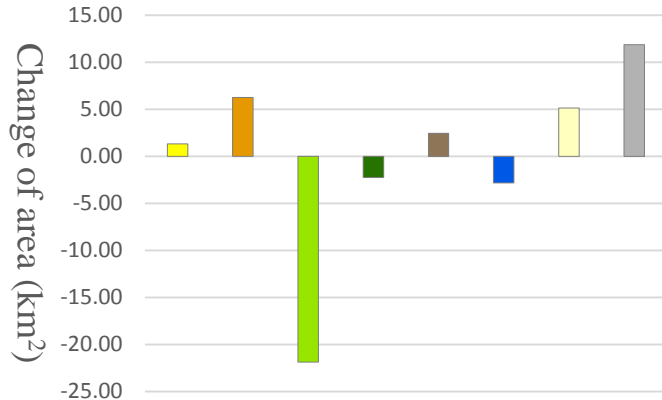
Results

Land use change analysis

A great deal of reduction in agriculture (-21.59 km²)

Built areas show increasing trend

Legend



Change in area of each type of land

2006

2014

12

Simulation of land use change in 2030

- Accuracy assessment
 - $K_{no} = 0.8676$
 - $K_{location} = 0.8386$
 - $K_{standard} = 0.8339$
- There are still many built areas close the coastline
- The coastal location is still suitable for urban development



Including flood risk
(Scenario 1)

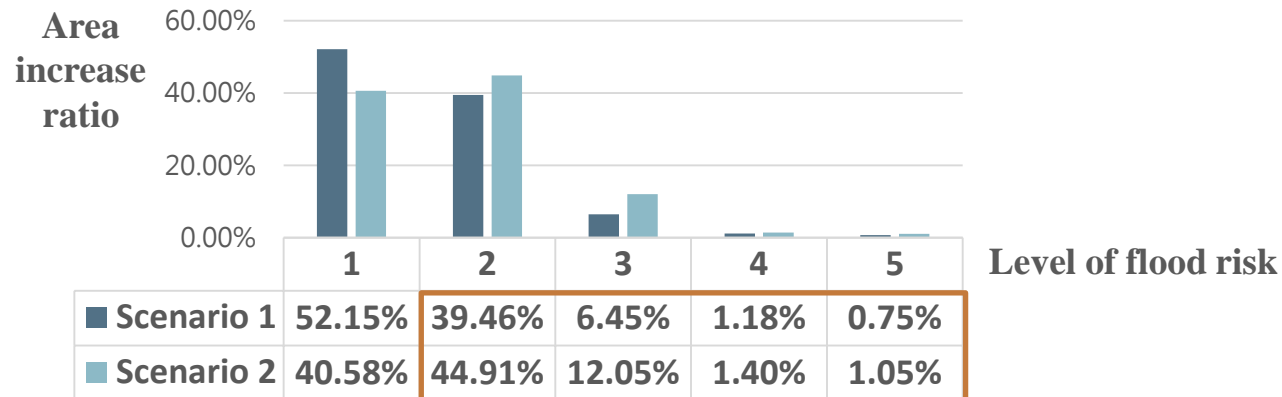


Excluding flood risk
(Scenario 2)

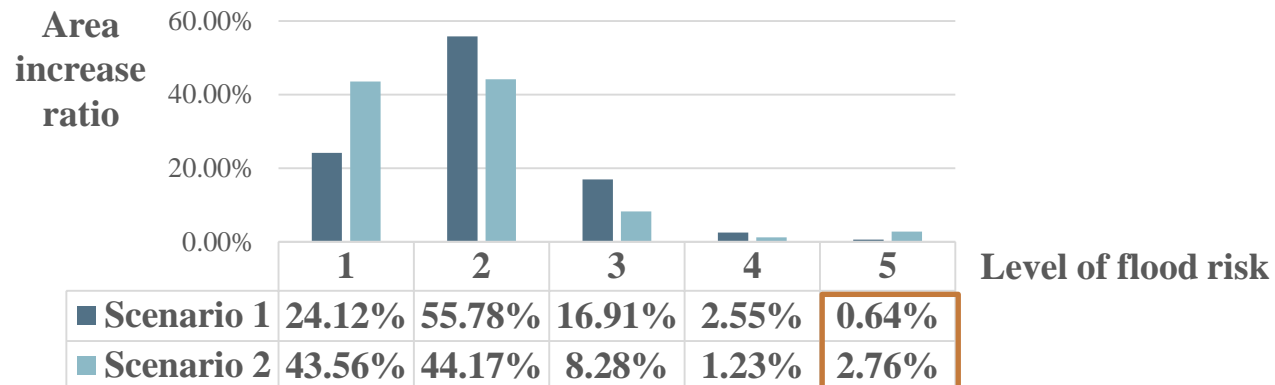
Simulation of land use change in 2030

Area increase ratio between two scenarios

- Industrial land use**



- Residential and commercial land use**



Conclusion & Discussion



A

Establishing a dynamic simulation framework for assessment of how the impact of flood risk on land use change

B

Through the comparison of two scenarios, grasp the trend of land use change and flood risk in 2030

C

we recommend more robust policy and adaptations, like **National Land Use Planning Act**, should be carried out as soon as possible in the future

Conclusion & Discussion

- Taiwan government faces challenges



2012 Adaptation Strategy to Climate Change in Taiwan

2015 Coastal Management Act

2016 **National Land Use Planning Act**

- Serve as the supreme guiding principle of national land use
- Detailed plans are currently being worked out



- Kaohsiung government faces challenges

- The first city in Taiwan to join ICLEI**
- Formulate adaption plans and set up related websites
<https://goo.gl/raHHi2>
- ICLEI Kaohsiung Environmental Sustainability Training Center** is the only competence training center outside the German headquarters in Bonn
<http://kcc.iclei.org/kcc/iclei-kcc.html>





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The End

Thanks for your attention

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