Resilient Cities 2018

Impacts of Flood Risk on Land Use Change in Coastal Urban Areas:

The Case Study of Kaohsiung, Taiwan

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Outline

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2. Method
3. Results
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Introduction

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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 km^2

Population : 2.6 million

Length of coastline : 94 km

Kaohsiung view

Introduction

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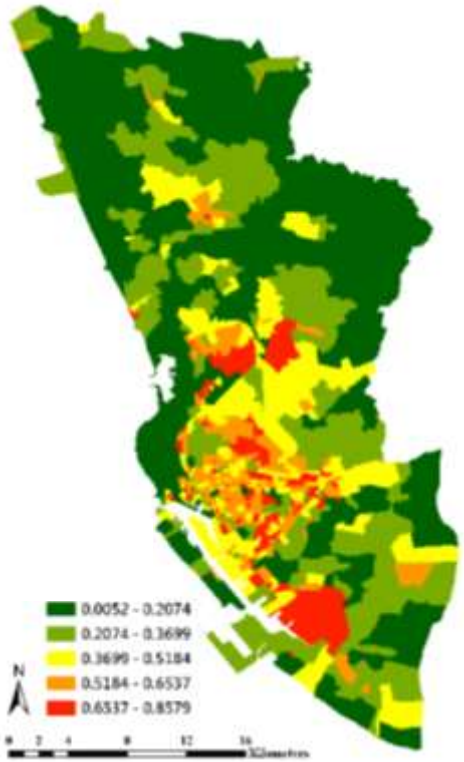
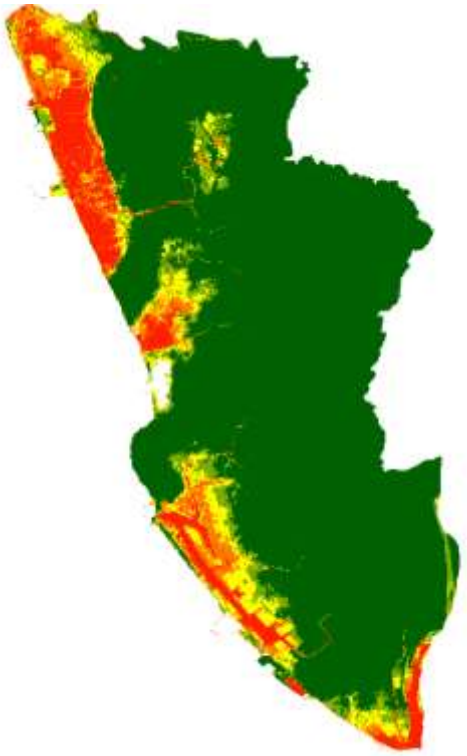
Impact of sea level rise on Kaohsiung City

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

Population density



Land use intensity



The impact of SLR

Introduction

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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

Introduction

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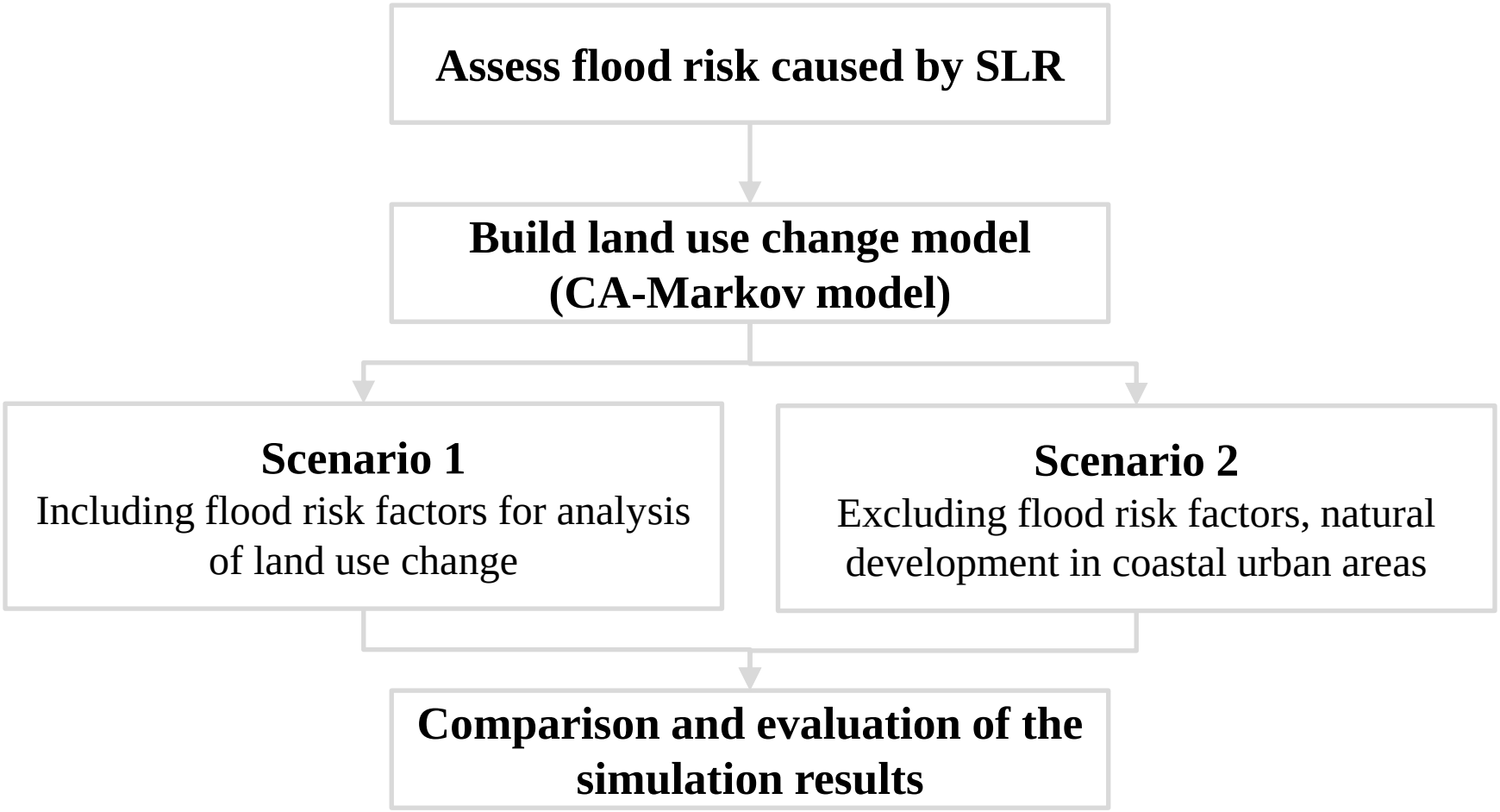
The purpose of this study

A Understand the spatial distribution of flood risk in coastal urban areas

B Simulate the impact of flood risk on the spatial of land use to give policy advice

Method

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



Method

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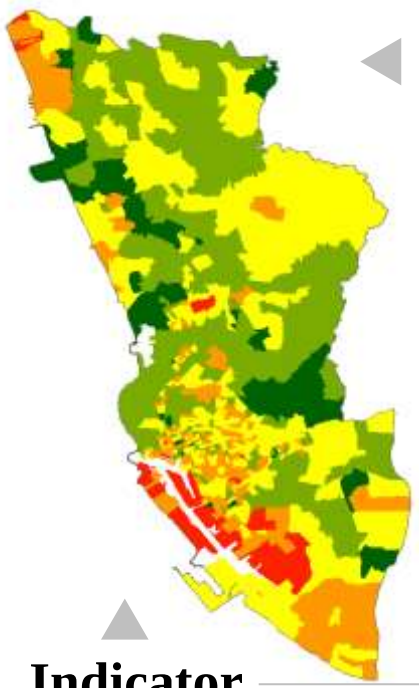
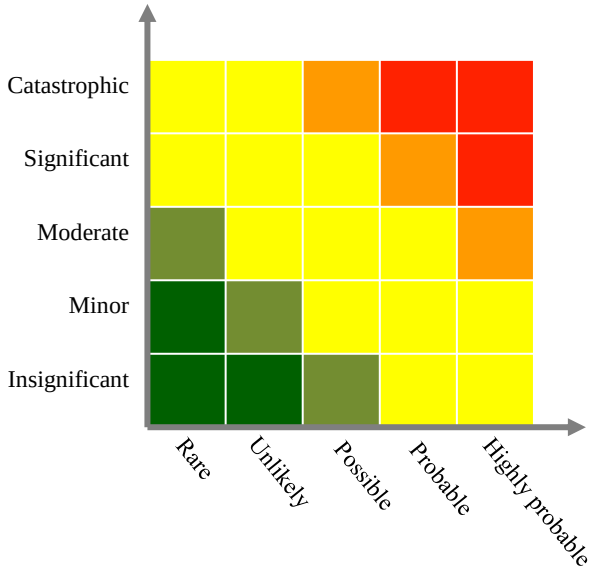
Assessment of flood risk caused by SLR

Flood risk = F (Hazard, Vulnerability)

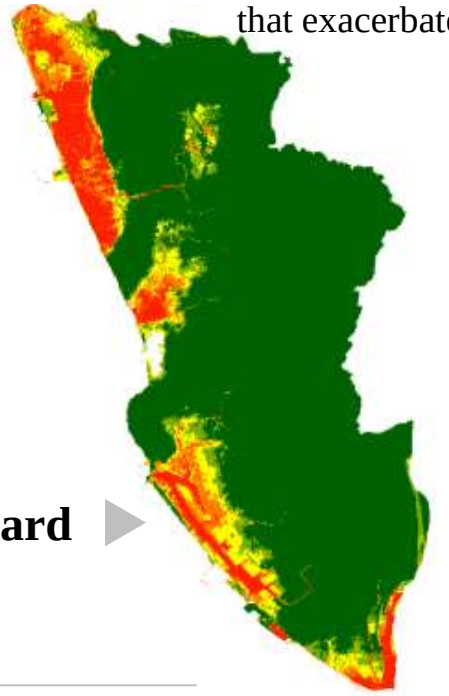
Considering "storms, subsidence, and coastal erosion" as factors that exacerbate SLR



Vulnerability



Hazard



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

Method

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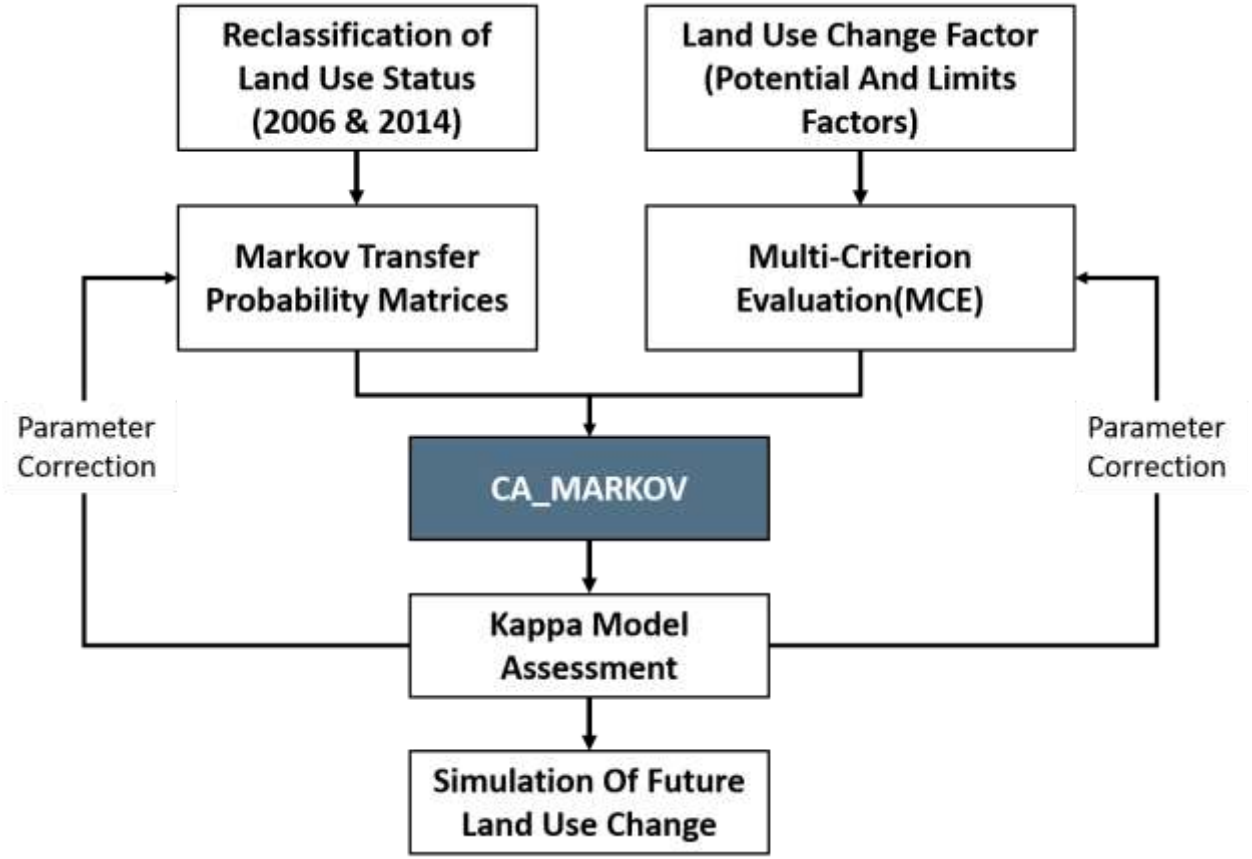
CA-Markov model

Combined Cellular Automata / Markov Chain / Multi-Criteria



Method

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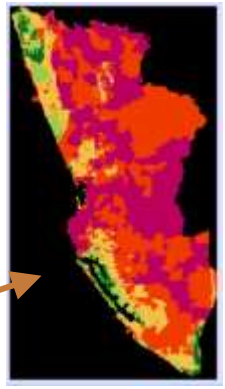
8 factors of land use change

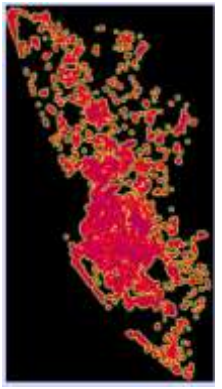
Including or excluding flood risk factors



Flood risk caused by SLR

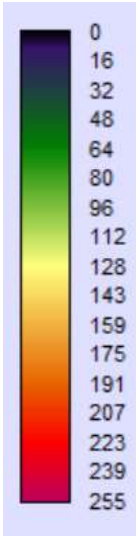
Distance to railway and subway

Distance to road

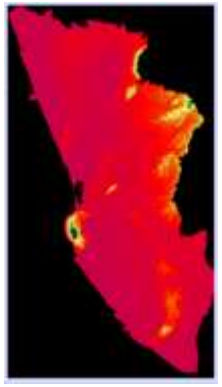


Distance to public facility

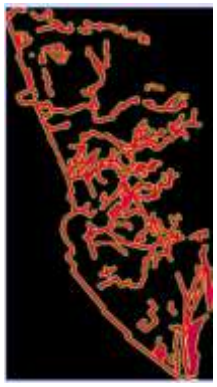
Low potential develop area



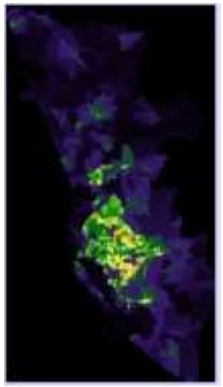
High potential develop area



Elevation



Distance to coast and river



Population density

Distance to existing building

Results

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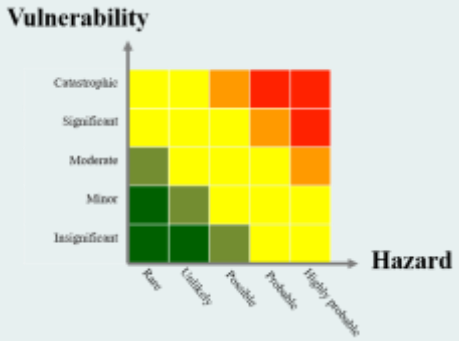
Assessment of flood risk caused by SLR

Flood risk = F (Hazard, Vulnerability)

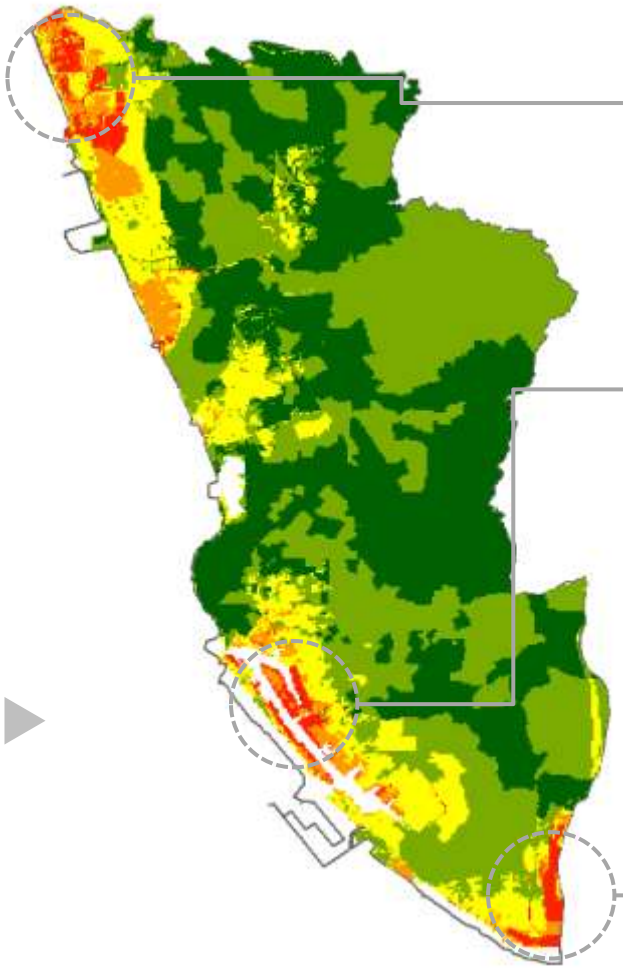
3 flood risk hotspots

Flood risk matric



Overall flood risk

- Very high
- High
- Medium
- Low
- Very low



Results

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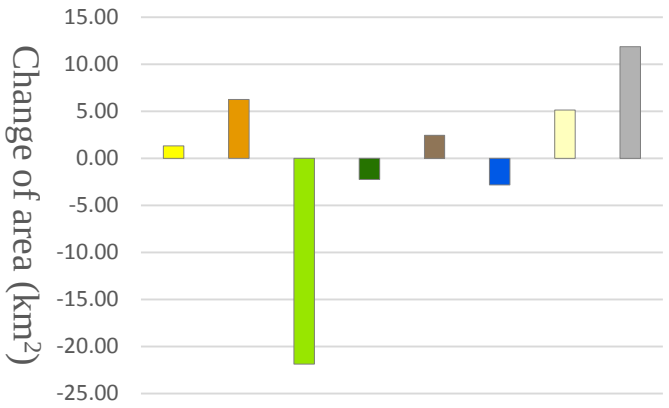
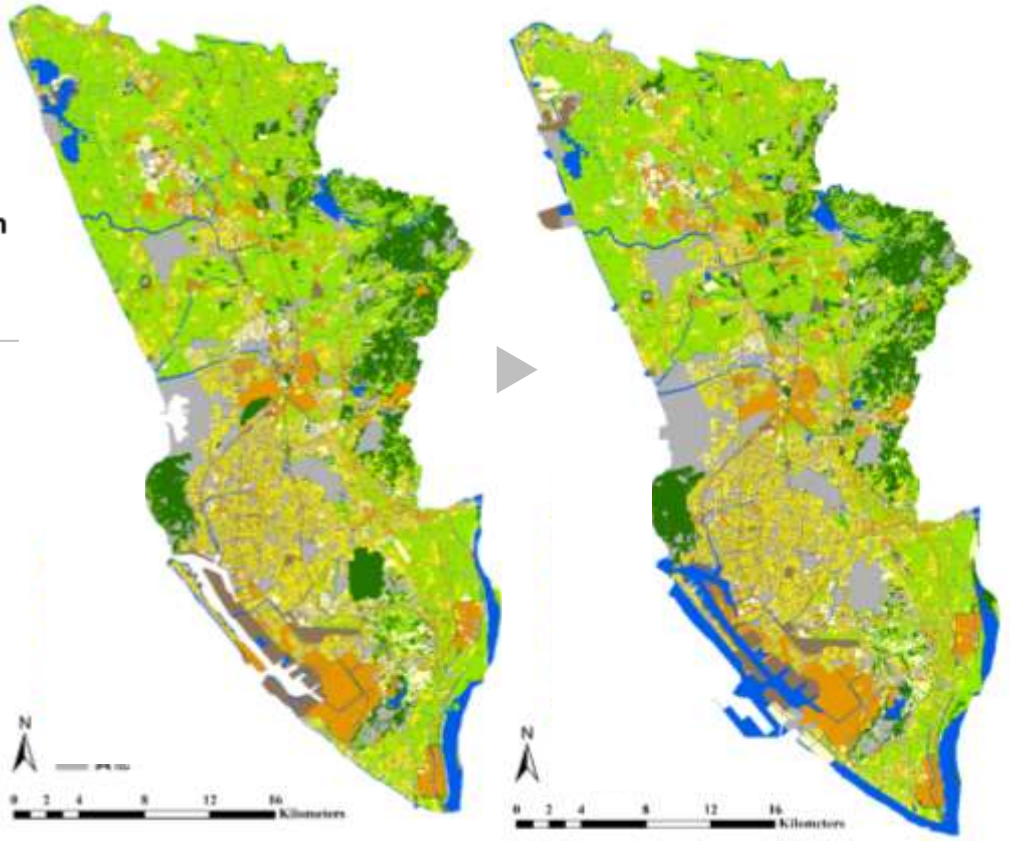
Land use change analysis

A great deal of reduction in agriculture (-21.59 km^2)

Built areas show increasing trend



Change in area of each type of land



2006 **2014**

Results

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Simulation of land use change in 2030

- Accuracy assessment
  - Kno = 0.8676
  - Klocation = 0.8386
  - Kstandard = 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)

Results

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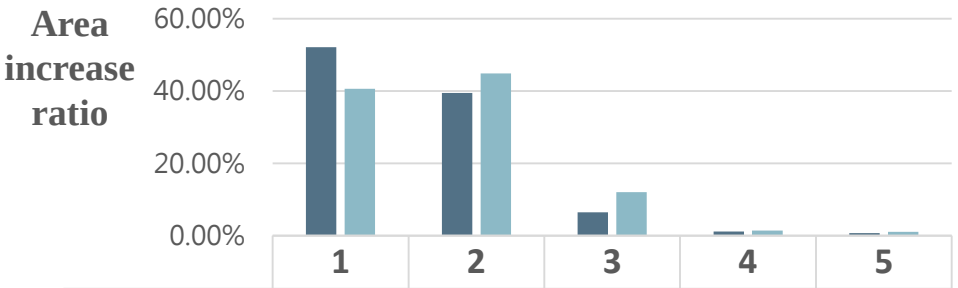
Simulation of land use change in 2030

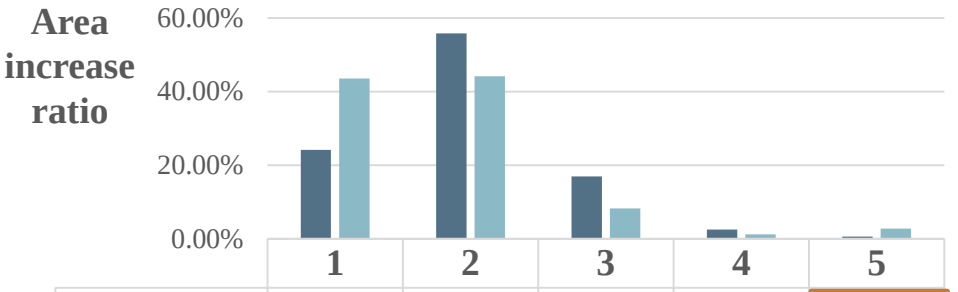
Area increase ratio between two scenarios

- **Industrial land use**



	1	2	3	4	5
Scenario 1	52.15%	39.46%	6.45%	1.18%	0.75%
Scenario 2	40.58%	44.91%	12.05%	1.40%	1.05%

- **Residential and commercial land use**



	1	2	3	4	5
Scenario 1	24.12%	55.78%	16.91%	2.55%	0.64%
Scenario 2	43.56%	44.17%	8.28%	1.23%	2.76%

Conclusion & Discussion

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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 adaptions, like **National Land Use Planning Act**, should be carried out as soon as possible in the future

Conclusion & Discussion

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- 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

Coastal City

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The End

Thanks for your attention

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