

# PI344: Environmental Management and Policy

## *Urban Climate Resilience:* **Climate Change Adaptation in Asian cities**

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17 April 2012



# Urban climate resilience programme Thailand Environment Institute

[www.tei.or.th](http://www.tei.or.th)



## Projects – Action research

[www.thaicity-climate.org](http://www.thaicity-climate.org)

### • ACCCRN

Asian Cities Climate Change Resilience Network  
*Funded by Rockefeller Foundation*

4 countries – 10 cities

[www.acccrn.org](http://www.acccrn.org)

Facebook page – ACCCRN-Thailand



### • M-BRACE

Mekong-Building Climate Resilient Asian Cities  
*Funded by USAID*

2 countries – 4 cities

In collaboration with ISET

Facebook page – M-BRACE Thailand



## **Urban climate resilience**

### **Goal**

- Building climate resilience in Thai cities

### **Key objective**

- Application of scientific knowledge and practices in building resilience efforts

### **Activities**

- Strengthening capacity of key city stakeholder
- Shared learning dialogue
- Vulnerability assessment
- Resilience strategy planning
- Intervention planning and implementation

# Urban climate resilience

City



People



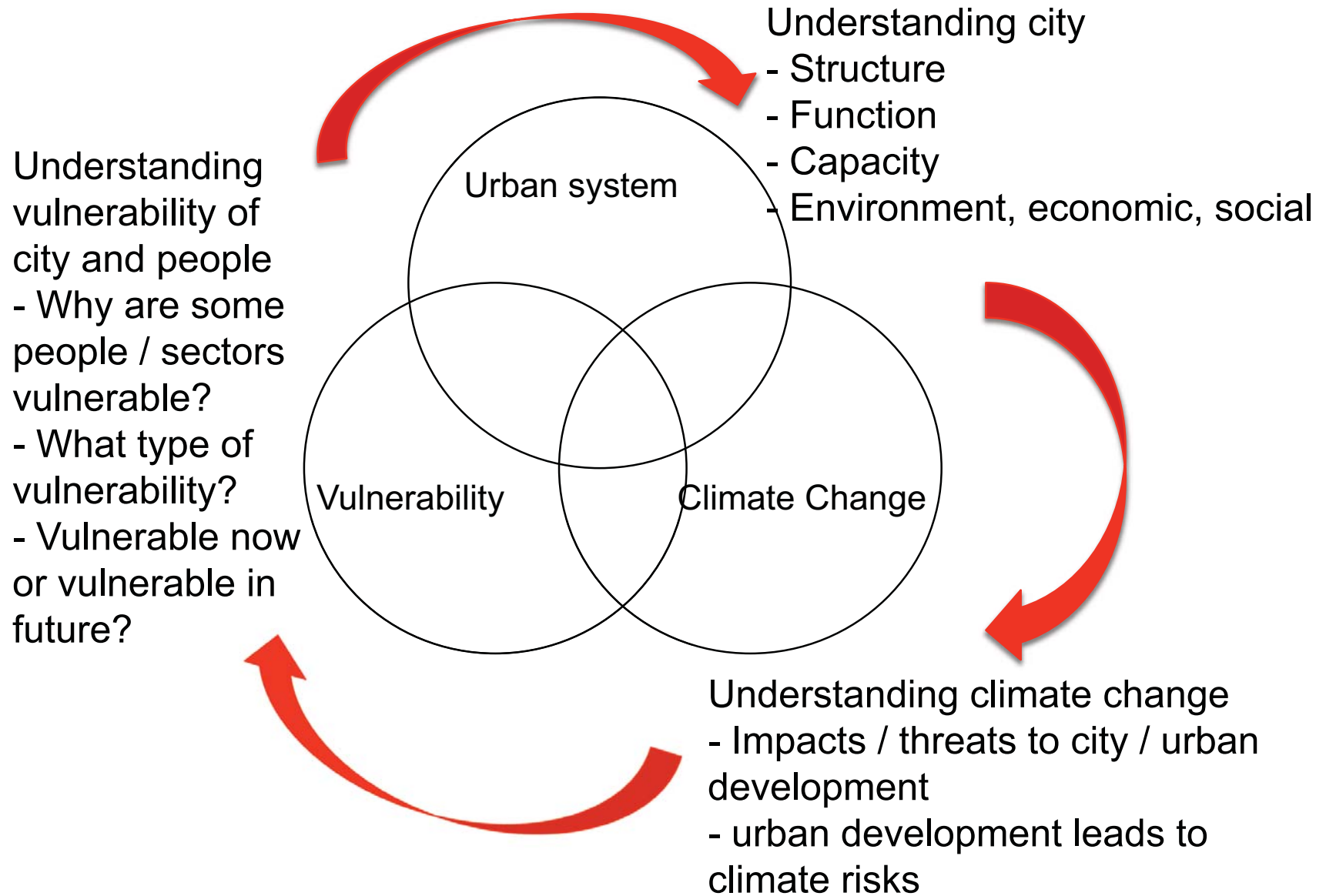
Climate change



Adaptation



# Urban Climate Resilience



# Urban Climate Resilience

## Climate Change Adaptation in Asian Cities

### Urban / City ?

- Why urban / city?
- What is an urban / a city?



# Climate Change Adaptation in Asian Cities

## Why urban / city?

### Cities

- > 50% of population live in cities
- World's urban population 3.3 billion
- By 2050 – increase to 6.4 billion
- 60% of increase will live in Asia
- Urban inhabitants experiencing problems



# Climate Change Adaptation in Asian Cities

Capital city  
Mega-city



Second tier city



## What is an urban / a city?

- Built environment
- Economic activities
- Dense population
- Social structure
- Institutional capacity



# Climate Change Adaptation in Asian Cities

Peri-urban



Rural



## What is an urban / a city?

Urban – peri-urban – rural linkage

Food system

- Where does food come from?
- How is it transported?

Water system

- Water sources
- River basin

Social system

- Migration
- Jobs

Environmental system

- Ecosystem services and goods

Economic activities

- Agricultural – manufacturing

## Climate Change Adaptation in Asian Cities

### Resilience building Asian cities

*India:* Surat, Gorakhpur, Indore

*Indonesia:* Bandar Lampung,  
Semarang

*Vietnam:* Danang, Can Tho,  
Quy Nhon, Hue, Lao Cai

*Thailand:* Chiang Rai, Hat Yai,  
Udon, Phuket



History

Geographical location

Population – reg., unreg.

Population density

Government structure

Centralised / Decentralised

Politics

Governance

Economic activities

Social structure

Cultural

Environmental conditions

# Climate Change Adaptation in Asian Cities

## Thai cities

Decentralisation

Deconcentration

Local government

- PAO (Provincial Administrative Organisation)
- Municipality (3 levels – Nakorn, Muang, Tambon)
- TAO (Sub-district Administrative Organisation) – Rural

Hub

- Tourism
- Commercial, trade, services



# Climate Change Adaptation in Asian Cities

## **Climate change**

What is climate change?

What is global warming?

What is?

- Mitigation
- Adaptation
- Resilience

## **Climate Change**

What is the difference between 'climate' and 'weather'?

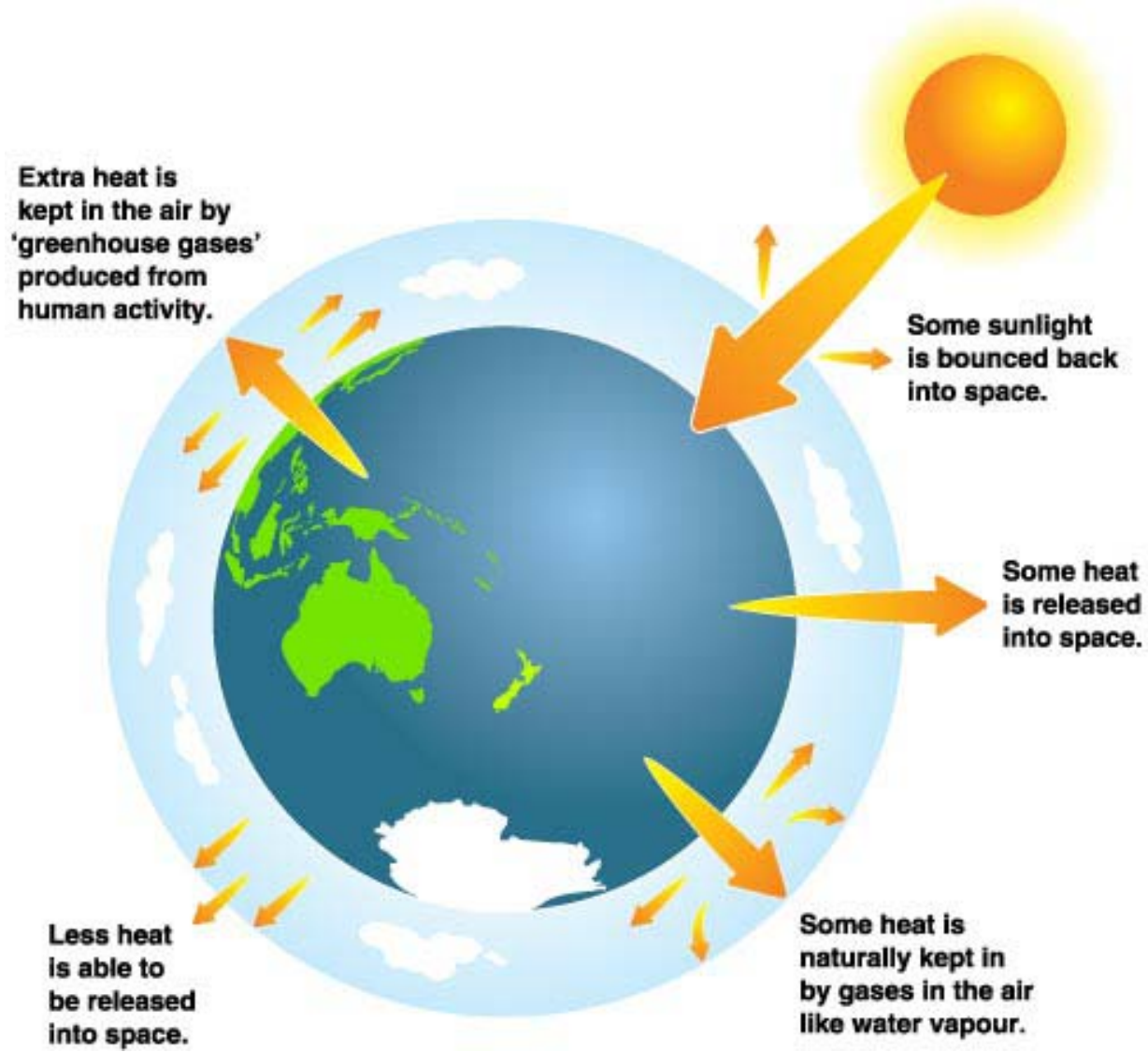
## Climate Change

What is the difference between 'climate' and 'weather'?

**Weather** – the physical properties of the atmosphere at a particular location (rainfall, cloud cover etc.)

**Climate** – the average weather experienced by a particular location over a certain period of time (months, years, decades)

# Global Warming



Human development activities



Global Warming



Climate Change



# Climate Change

## Definitions

**UFCCC** – a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods

**IPCC** – a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external drivers, or to persistent anthropogenic changes in the composition of the atmosphere or in land use

# Climate Change



Unpredictability  
Uncertainty



## Climate change

- Mitigation
- Adaptation
- Resilience

## Climate mitigation

Action to decrease impacts of global warming effects, including greenhouse gas emission reduction



## **Climate change**

- **Mitigation**
- **Adaptation**
- **Resilience**

### **Climate adaptation**

The process of adjusting to new conditions, stresses and natural hazards that result from climate change. Adaptation can be spontaneous (in response to impacts experienced already) or autonomous (in anticipation of expected impacts).



## **Climate change**

- Mitigation**
- Adaptation**
- Resilience**

## **Climate adaptation**

IPCC – in human system, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities

Smit and Wandel 2006 – a process, action or outcome in a system (household, community, sector, country) in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity

Burton 1992 – the process through which people reduce the adverse effects of climate on their health and well-being and take advantage of the opportunities that their climatic environment provides

## **Climate change**

- **Mitigation**
- **Adaptation**
- **Resilience**

## **Climate resilience**

Resilience – from ecology

- the extent to which a system is able to absorb adverse effects of a hazard
- the recovery time for returning after a disturbance

*Mitigation and adaptation measures lead to increasing resilience*

## **Climate change**

- Mitigation**
- Adaptation**
- Resilience**

## **Climate resilience**

IPCC – the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions

# Climate Change Adaptation in Asian Cities

## Capturing Urban - Climate Change concept

### **Growing city**

- Urbanisation
- Urban development
- Socio-economic activities
- Population growth, migration
- Housing, settlements
- Land use change
- Using natural resources
- Water demands
- Waste problems
- Pollution

### **Climate Change**

- Average temperature
- Average rainfall
- Distribution of rainfall
- Seasonal shifts
- Extreme weather events
- Intensity and frequency of weather events
- Sea level rise

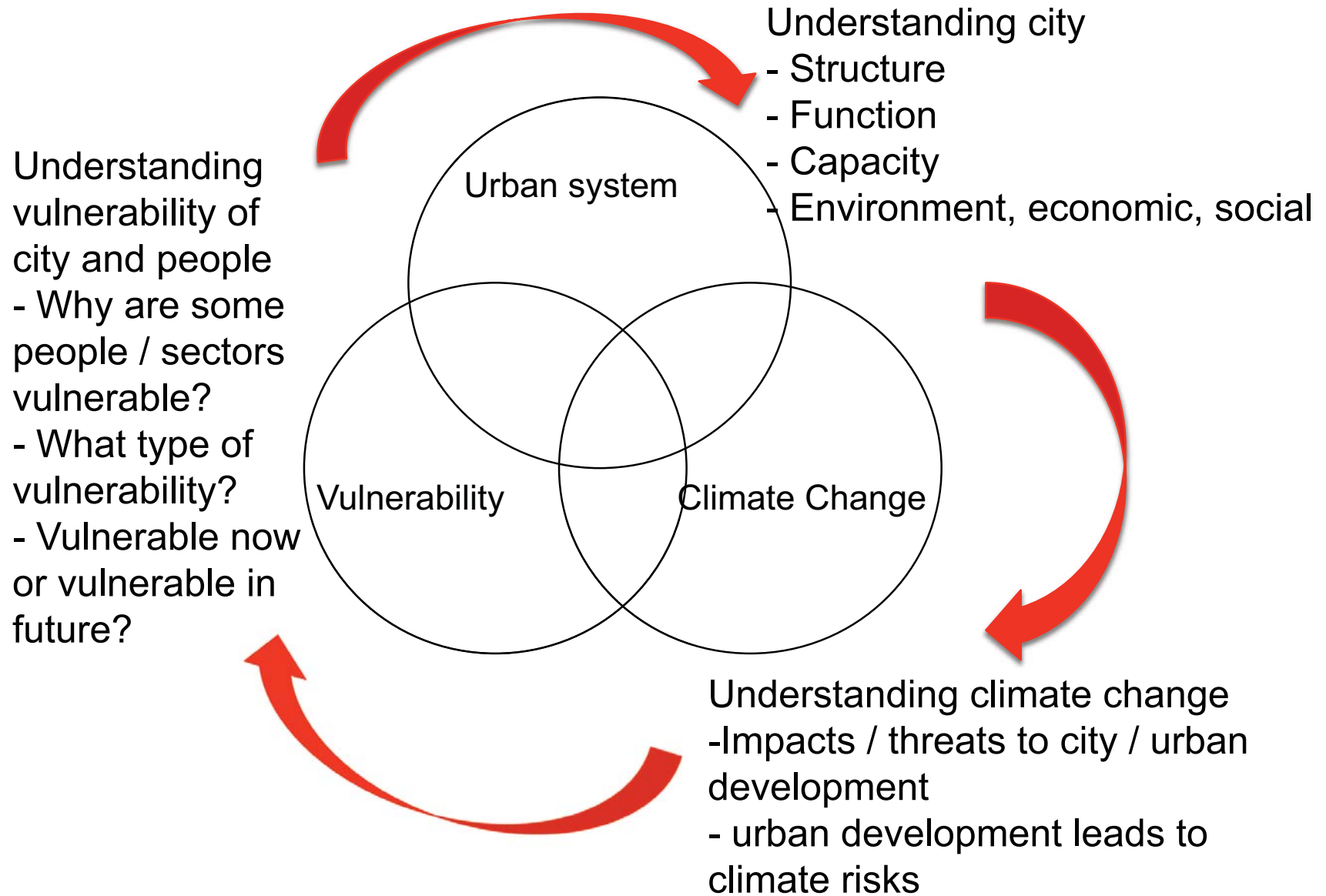


## Climate Change Adaptation in Asian Cities

### **Urban – Climate implications**

- Is climate change disrupting urban development and economic activity of the city?
  - Is the city facing more natural hazards?
  - If the city keeps development direction as 'business as usual' – what are future climate risks?
  - Is there enough water resource for everyone?
  - Is land use change affecting watershed area?
  - Is urbanisation causing more floods / droughts?
- Etc..

# Urban Climate Resilience



# Climate Change Adaptation in Asian Cities

## Vulnerability

### Definition by IPCC

Vulnerability – the degree to which a system or individual is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity



## Vulnerability to climate change

$$\text{Vulnerability} = \frac{\text{Exposure} \times \text{Sensitivity}}{\text{Adaptive capacity}}$$

*Vulnerability describes how sensitive an individual or system is to a specific hazard*

Definitions by IPCC

**Exposure** – the presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected

**Sensitivity** – the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli

**Adaptive capacity** – the ability of a system or an individual to adjust to climate change (including climate variability, extremes), to moderate damages, to take advantage of opportunities, or to cope with the consequences

## Vulnerability to climate change

$$\text{Vulnerability} = \frac{\text{Exposure} \times \text{Sensitivity}}{\text{Adaptive capacity}}$$

Factors determining vulnerability include

- Geographical location
  - Gender
  - Age
  - Livelihood
  - Access to resources
  - Wealth / Poverty
  - Entitlements
  - Governance
- Etc.

# Urban Climate Vulnerability



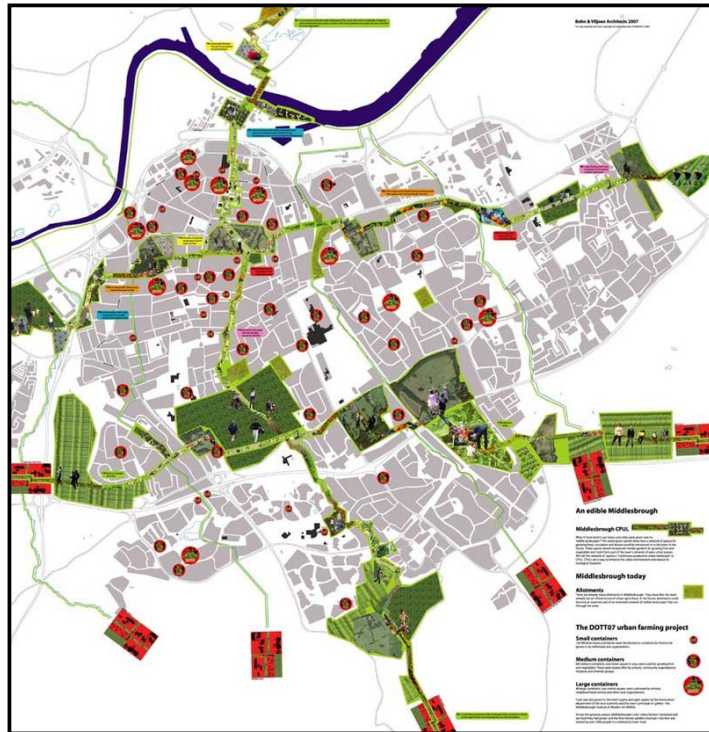
## City

- Is the city vulnerable to climate threats?
- Is the city vulnerable to natural disasters
- How does the city cope with disasters?

## People

- How do people cope with disasters?
- Why are they vulnerable?
- What degree of vulnerability?

# Urban Climate Vulnerability



## Urban context

-Is urban development increasing climate risks?

e.g. encroaching watershed area, settlements in floodways, industrial estate located in floodplains

- Can a city keep developing and growing in the face of climate change?

# Urban Climate Vulnerability

## Vulnerability assessment

- Who is vulnerable?
- Why?
- What degree of vulnerability?
- Which urban system / sector is vulnerable?
- Why?
- What degree of vulnerability?





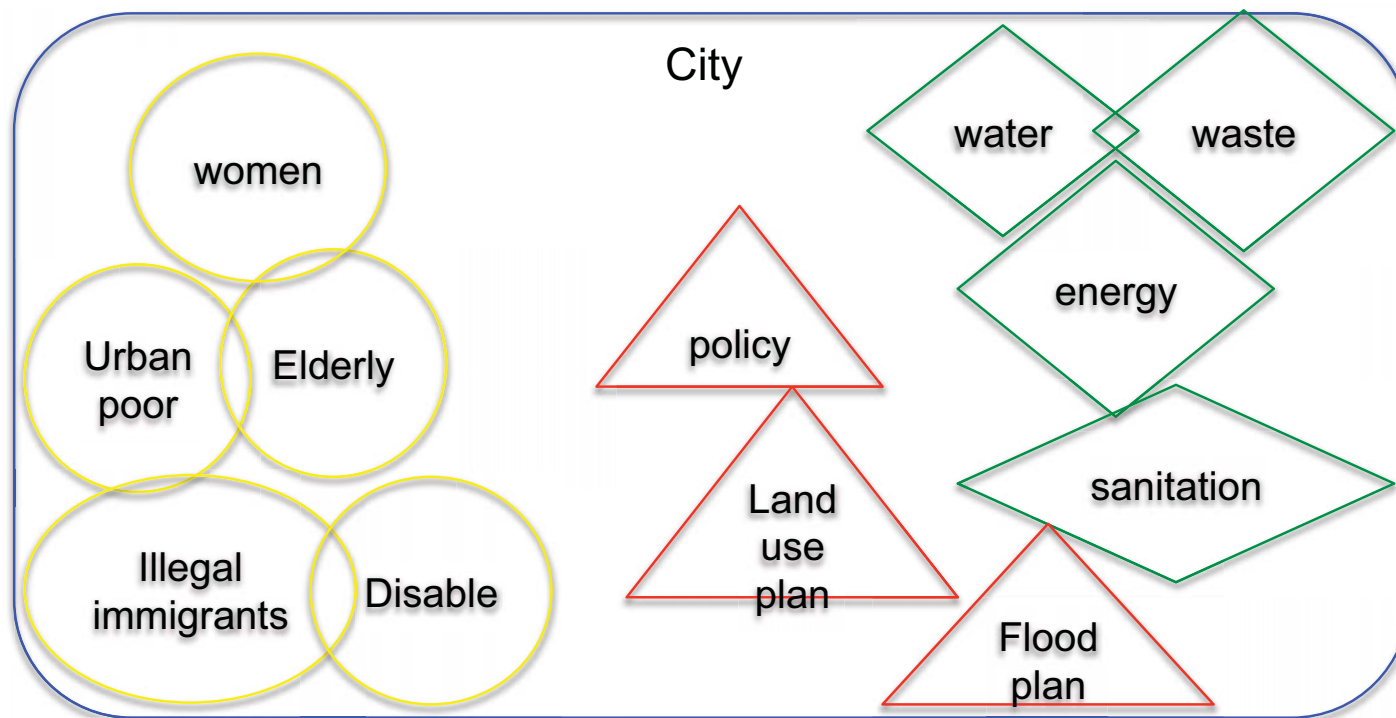
# Urban Climate Vulnerability

Vulnerable community group

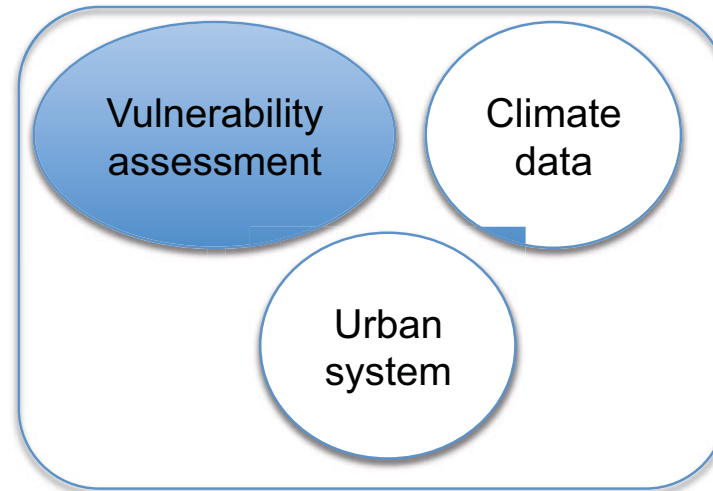
- Why vulnerable?
- Type of vulnerability
- Vulnerable now, what about in the future?

City – how does it function?

- Systems
- Sectors
- Institutions
- Agents



## Adaptation planning

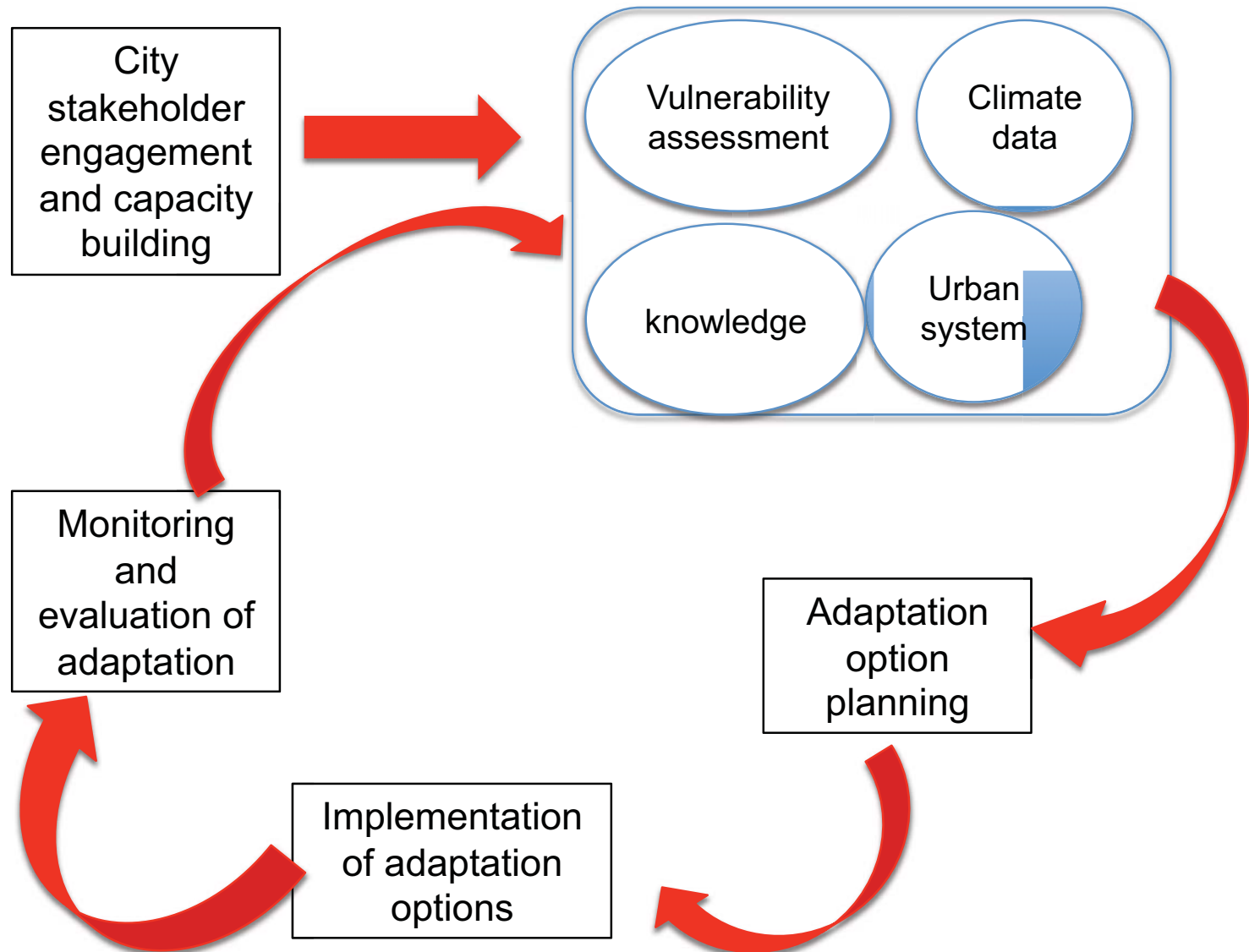


Identification of adaption options and development of adaptation strategy



Implementation of adaptation options

## Adaptation planning process



# Climate Change Adaptation in Asian Cities

## **Adaptation**

*Action at the local level is critical to adapt to changes – adjustments in ecological-social-economic systems in response to climate*

Who / what is adapting to climate change?

- Cities
- Municipality officials, mayors
- Land use planners
- Irrigation / Water Resource Department
- Urban residents
- etc.

Adapting to what?

## Climate Change Adaptation in Asian Cities

### **Hat Yai City**

- Highly urbanised
- Tourism – Malay
- Business, trade, commercial hub
- High income
  
- Significant land use change
- High pollution
- Waste management problems
  
- Low-lying / floodplain areas
- Floods
- Flood disasters in 2000, 2010



## Climate Change Adaptation in Asian Cities

### Hat Yai City

*More urban development*  
+  
*Climate change*  
=  
?

- Land use change
- More urban floods due to bad drainage, blocked floodways, filled floodplains
- if more rainfall – more flood crises?
- if less rainfall – water supply shortage?



## Climate Change Adaptation in Asian Cities

### **Hat Yai City**

- Multi-stakeholder process
- Hat Yai website for public flood monitoring
- Coordination centre, independent of municipality
- Participation of communities to plan and design flood emergency responses



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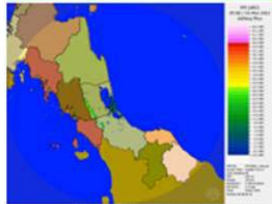
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# Climate Change Adaptation in Asian Cities

## Adaptation

### *India*

**Indore** – severe water scarcity

- Developing a comprehensive water supply system of local water sources

**Surat** – coastal flood plain, flood prone

- End-to-end warning system to reduce flood risk

### *Indonesia*

**Bandar Lampung** – floods due insufficient drainage capacity

- Developing an integrated urban solid waste management master plan to mitigate risks of urban flooding

**Semarang** – drought leads to crop failure and drinking water shortage

- Diversification of water supply sources through rainwater harvesting

### *Vietnam*

**Can Tho** – sea level rise causing saline intrusion

- Introducing real-time salinity monitoring and mapping system linked to public warning systems to enable users to adapt water uses



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