Synergies of Urban Adaptation to Flood Risk, Public Open Space and Solid Waste Management

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Urbanizing World and Asia

CHART 2.1: **GLOBAL URBANIZATION RATES, 1990-2030**

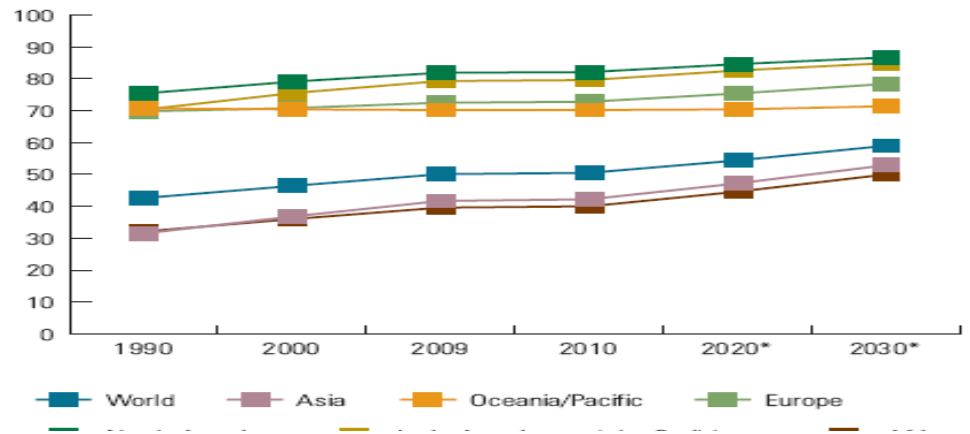
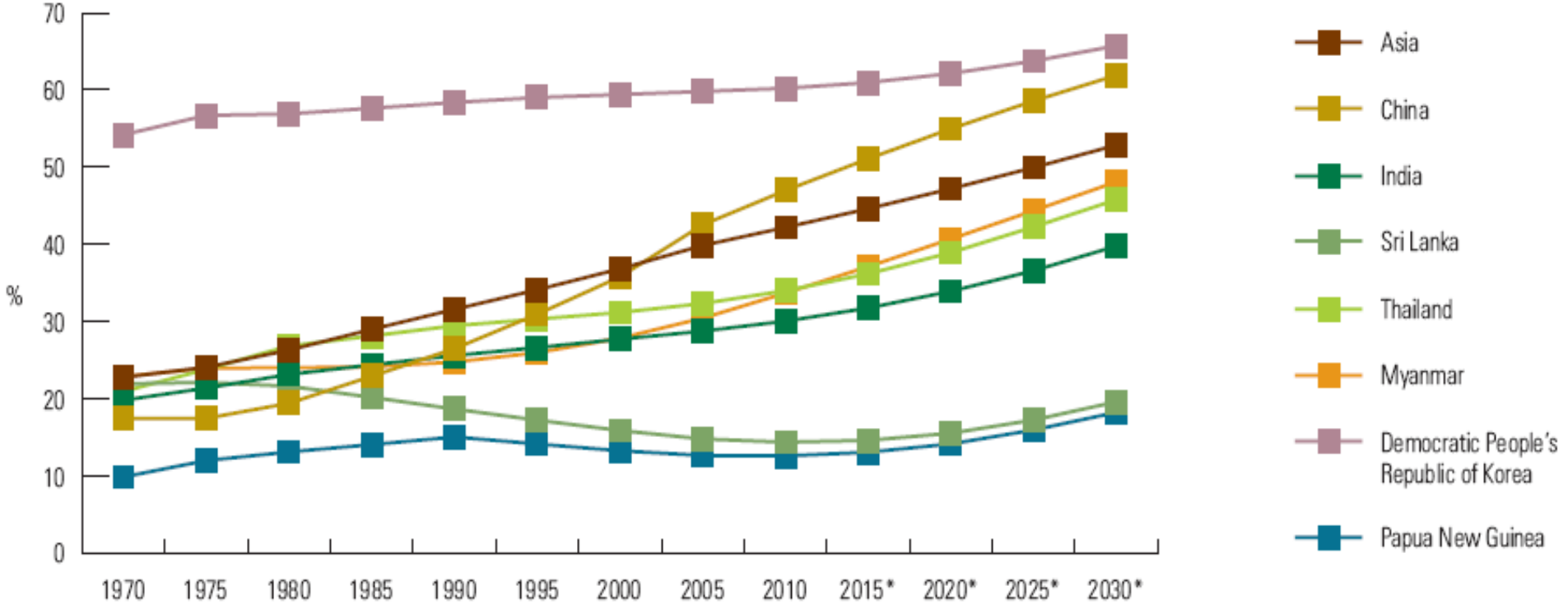
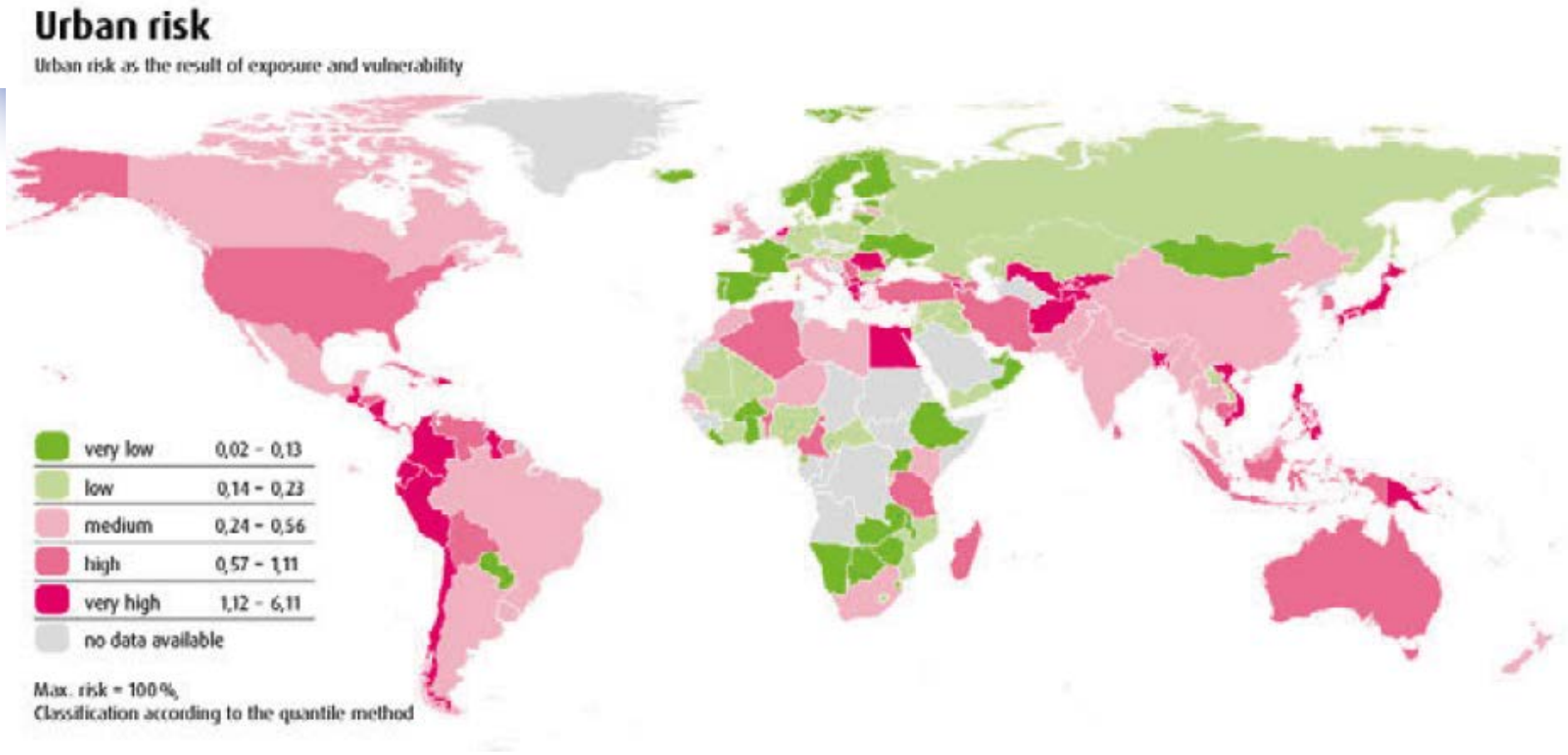


CHART 2.2: **ASIA'S URBANIZATION TRENDS, 1970-2030***



*Projections

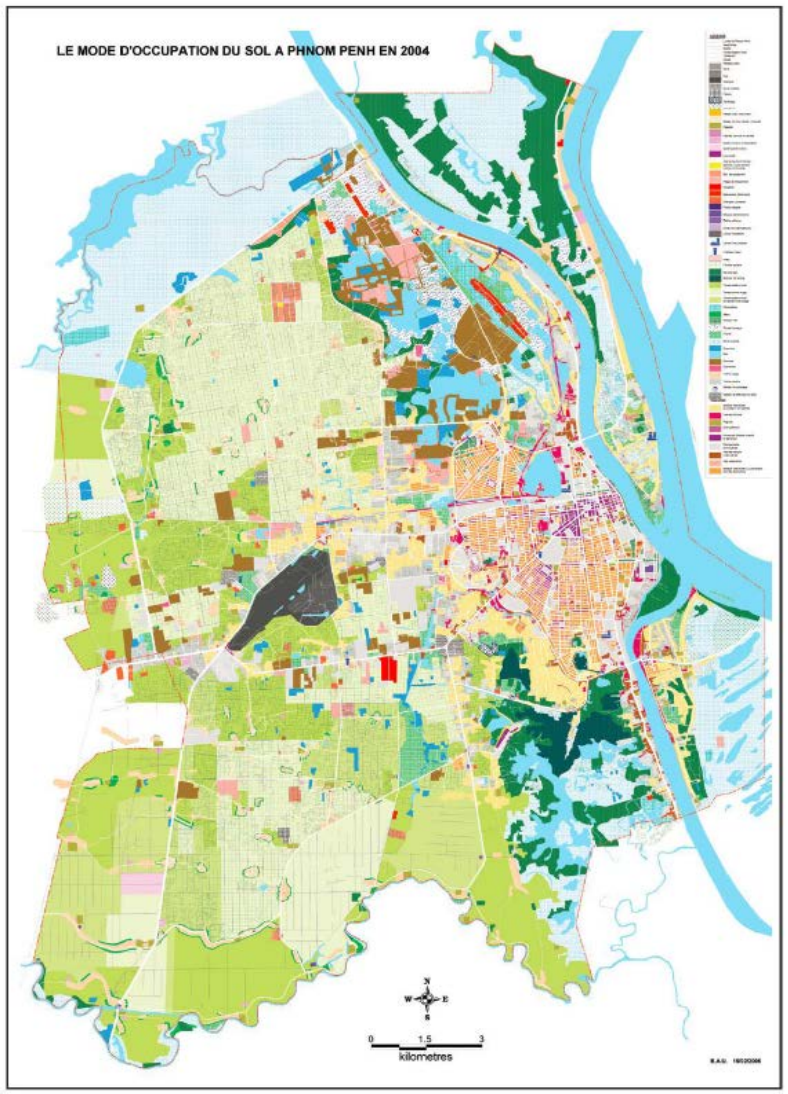
Source: United Nations (2010)



Risk is subject to hazards, exposure, vulnerability and adaptive capacity

UNU-EHS (2014)

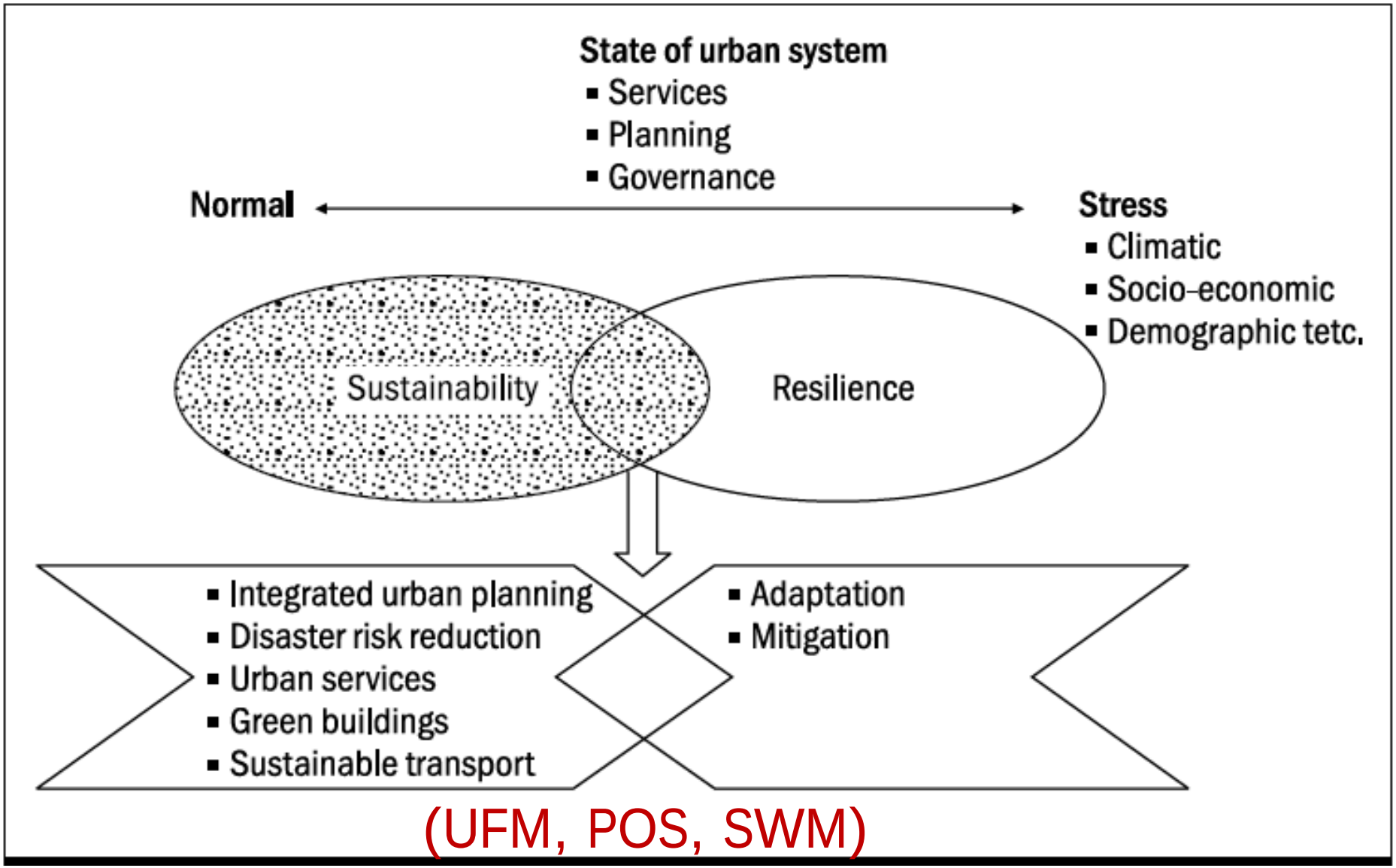
Urbanization and risks



2004

2035

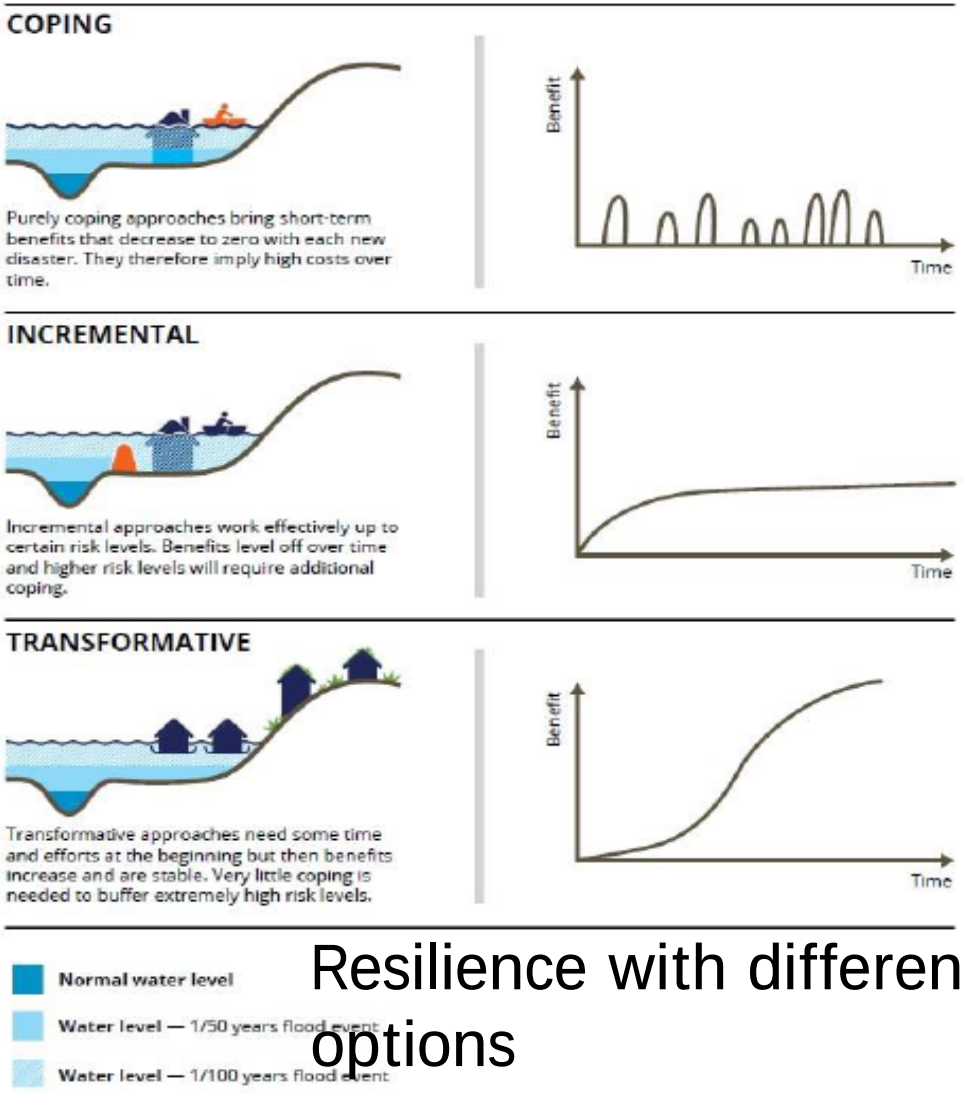
A system for urban sustainability and resilience



DFID

Synergies for enhancing urban resilience

- Systems approach to utilizing and enhance urban systems resilience
  - Multi-hazards
  - Multi-stakeholder and users
  - Multi-benefits
  - Multi-scales
- Analysis for understanding natural, anthropogenic and other hazards interactions
- Measurement and evaluation of the interactions, synergies and constraints of the urban systems resilience



Resilience with different options

EEA (2016)

(A) (B)

PHOTOS 2A AND 2B
Autonomous adaptation by an individual household damaged the public road surface (A) and drained water out to an adjacent vacant plot (B)

Localized flooding and autonomous adaptation in peri-urban Bangkok

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1–18. DOI: 10.1177/0956247816683854 www.sagepublications.com

SANI LIMTHONGSAKUL, VILAS NITIVATTANANON AND SIGIT DWIANANTO ARIFWIDODO

Local risk and response

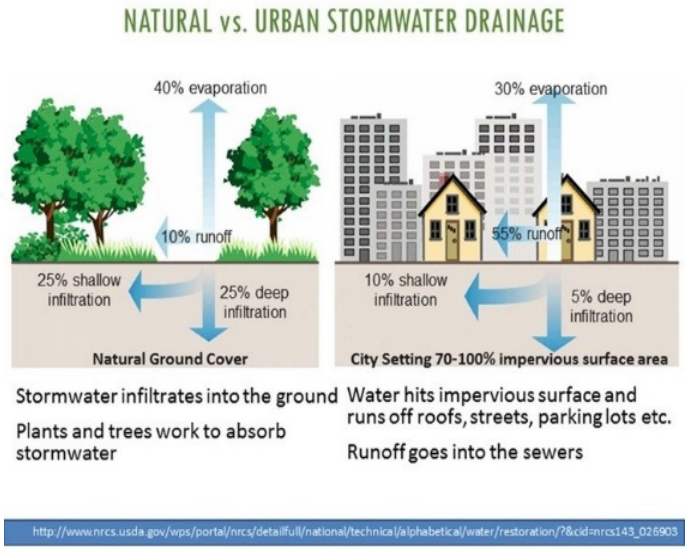
ABSTRACT Peri-urban areas of mega-cities in lower-middle income countries face many environmental management challenges, including localized flooding caused by inefficient management and inadequate stormwater infrastructure. A case study analysis was conducted in Bangkok's rapidly developing urban fringe, where residents have been experiencing localized flooding after normal rainfall. This paper explores the drivers of this flooding and its impacts for local communities, and explains how autonomous adaptation affects community stormwater drainage systems. The study found a mismatch between limited authority and transboundary problems of stormwater management, and calls for an integrated urban stormwater management approach. The findings imply the need to address autonomous adaptation as an integral part of adaptation measures at the broader scale of Thailand's urban climate governance under the current threat of climate change.

KEYWORDS autonomous adaptation / Bangkok / extended mega-urban region / localized flooding / peri-urban drainage / stormwater drainage management / stormwater governance / urban floods

FIGURE 2
Land filling by new developments imposes localized floods on neighbours

Limthongsakul, Nitivattananon and Arifwidodo (2016)

Urban Flood Management (UFM)



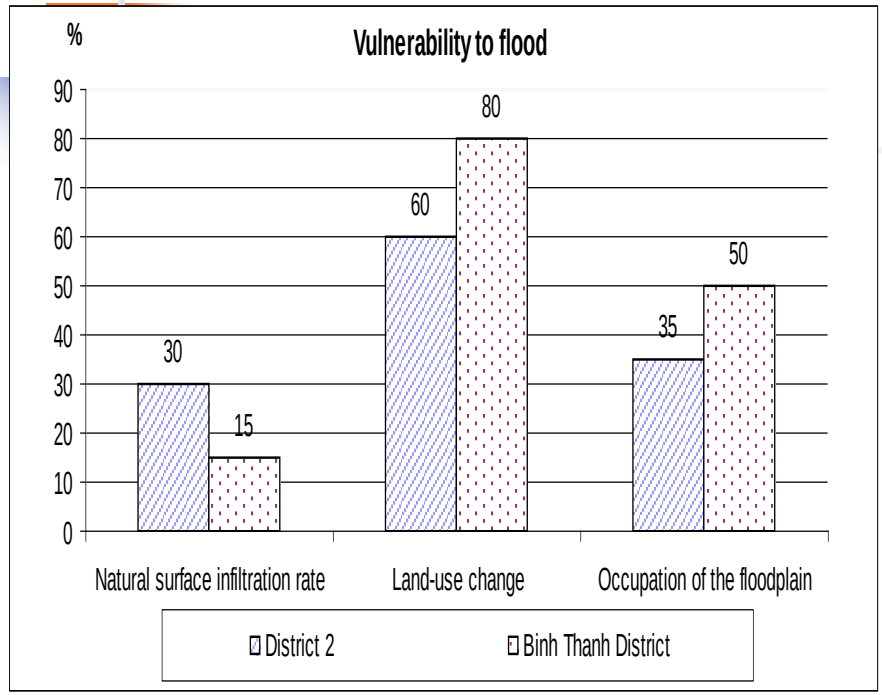
$$Q = CIA$$

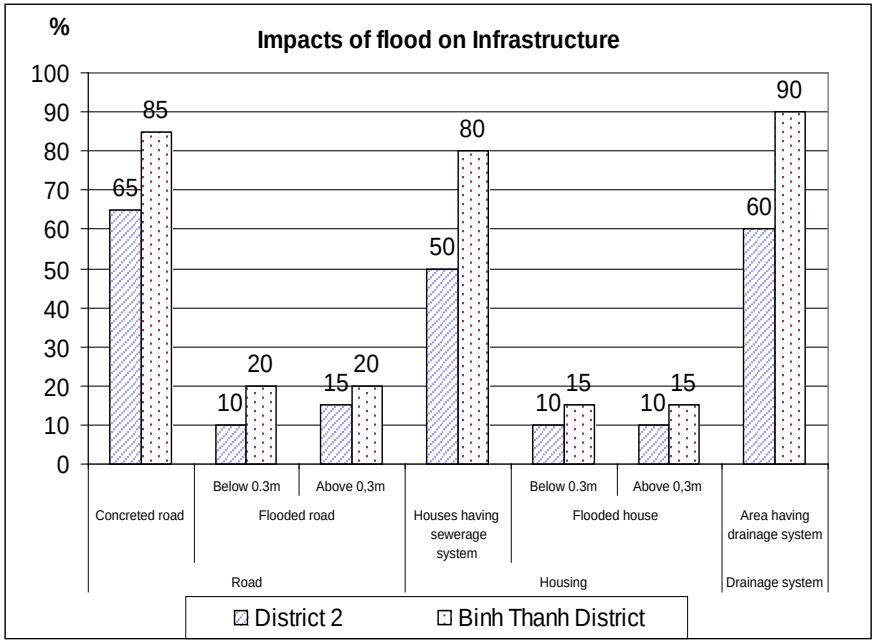
Q – peak flow

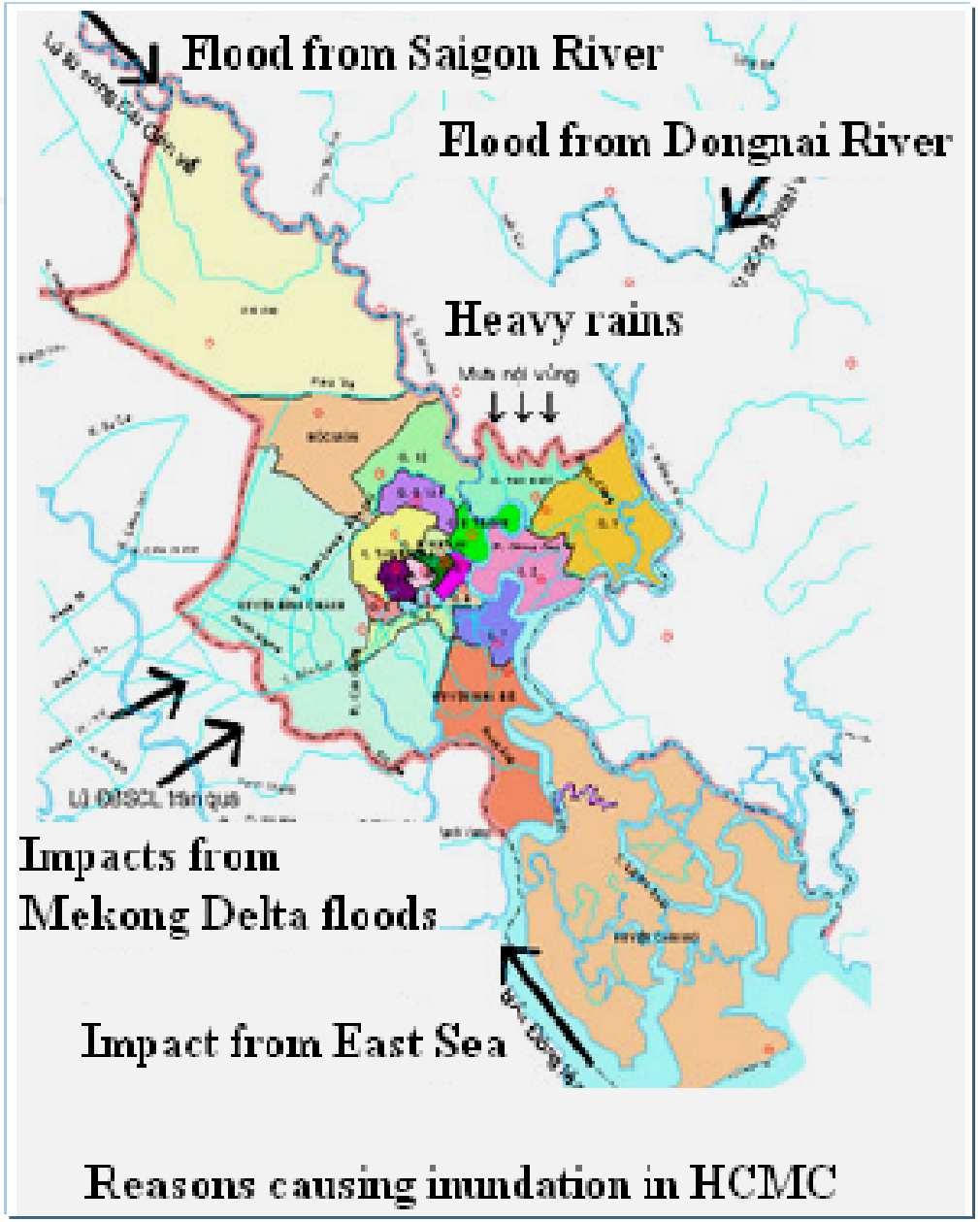
I – natural factors incl. climate, etc

C and A – anthropogenic factors incl. urban expansion, open space, solid waste, etc

Comparison between 2 districts







Source: HFSPA (2008)

Tu and Nitivattananon (2011)

Pictures taken at study area in District 2

Under-constructed buildings

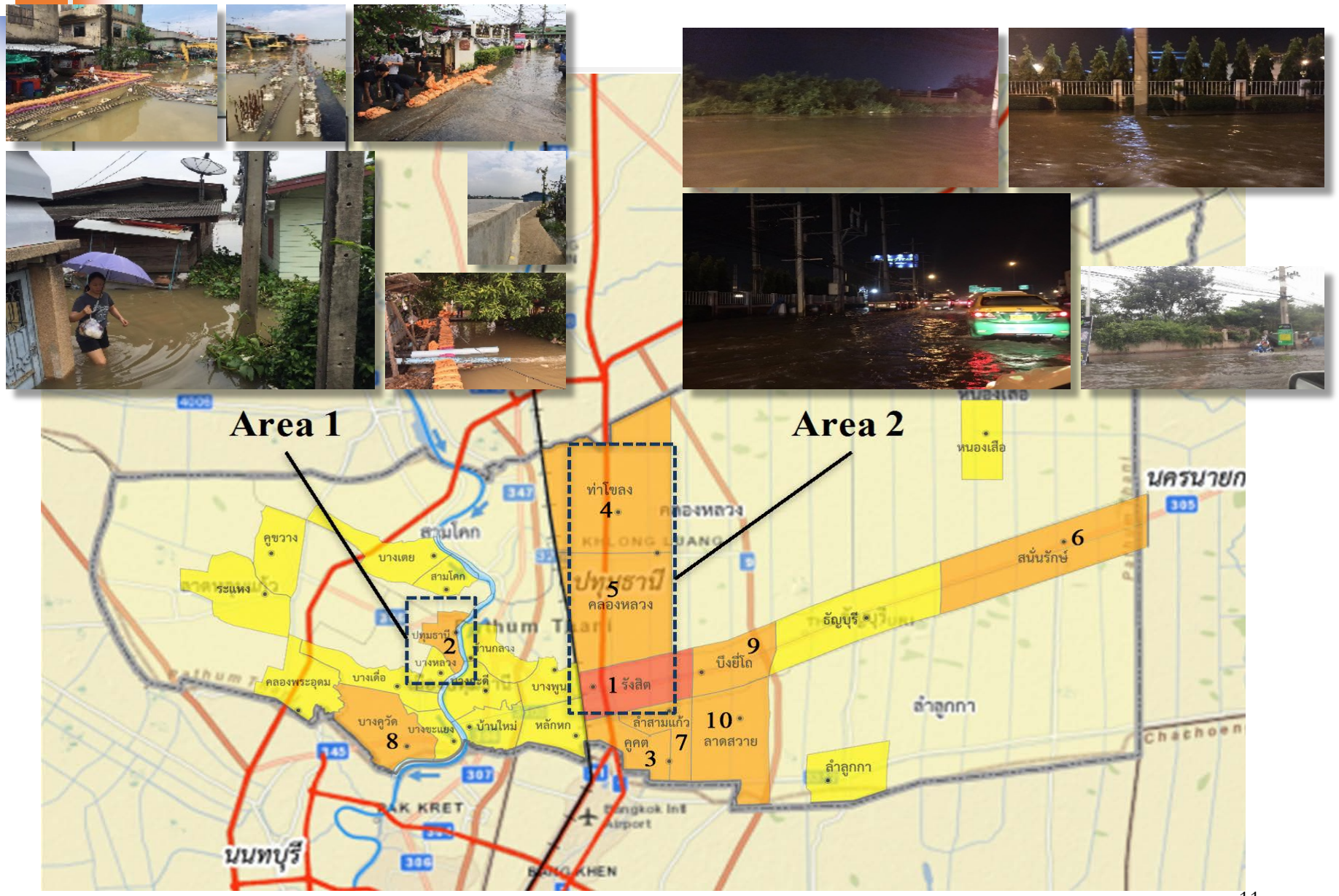
Polluted canal

Pictures taken at study area in Binh Thanh District

Under-constructed activities

Flooded street

Case of Peri-Urban Study



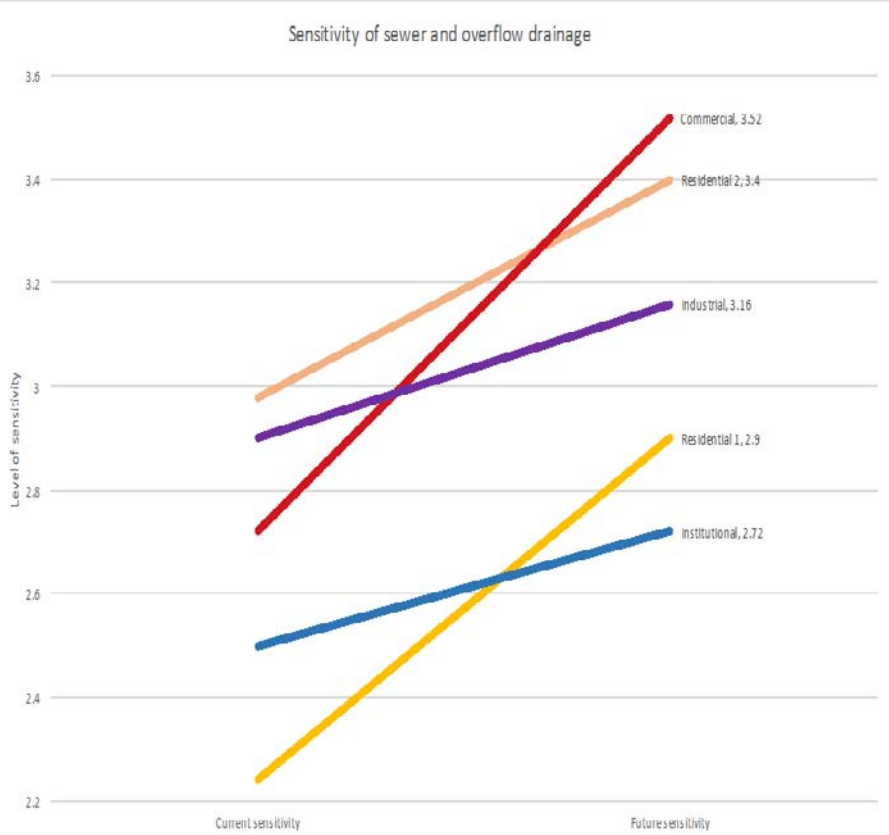
Case – Sensitivity (physical…)

Sensitivity to hydrological risks in study areas

Dominant land use	Hazard: Severity	Hazard: Increasing in future	Exposure: Frequency to expose	Exposure: Population to expose	Sensitivity: Short term: Physical: elevation from river	Sensitivity: Short term: Physical: drainage system	Sensitivity: Short term: Physical: natural resource	Sensitivity: Short term: Socio-economic: mobility	Sensitivity: Short term: Socio-economic: economic stability	Sensitivity: Short term: Socio-economic: information	Sensitivity: Long term: Physical: land subsidence	Sensitivity: Long term: Physical: drainage system under future climate change	Sensitivity: Long term: Physical: natural resource under future development	Sensitivity: Long term: Socio-economic: awareness of flood risk	Sensitivity: Long term: Socio-economic: readiness for information receiving	Sensitivity: Long term: Socio-economic: readiness for autonomous preparedness	Sensitivity to flood risk in average in average
Study area 1																	
Residential	3.42	3.46	3.02	2.6	2.94	2.24	2.8	1.98	2.64	2.3	2.2	2.9	2.86	1.86	1.7	1.82	2.35
Study area 1																	
Residential	3.5	3.54	3.08	2.74	2.94	2.98	3.2	2.06	2.7	2.78	2.48	3.4	3.24	2.06	1.9	2.04	2.79
Commercial	3.46	3.42	3.18	2.78	2.96	2.72	3.74	2.2	3.28	2.84	2.42	3.52	3.82	2	1.9	2.22	2.8
Industrial	3.54	3.36	2.96	3.86	2.54	2.5	2.66	1.88	2.3	1.92	1.54	2.72	2.54	1.88	1.98	1.4	2.16
Institutional	3.98	3.66	3	4.14	3.6	2.9	1.74	2.16	2.16	2.36	2.42	3.16	2.48	2.42	2.56	1.86	2.49

1.00 to 1.50	Very low
1.51 to 2.00	Low
2.01 to 2.50	Guarded
2.51 to 3.00	Elevated
3.01 to 3.50	High
3.51 to 4.00	Severe
4.01 to 5.00	Very severe

Questionnaire survey of people in study areas, 2018



Questionnaire survey of people in study area, 2018

Sensitivity of drainage system

Trend of increase in sensitivity, especially in residential areas in study area 1 and residential and commercial areas in study area 2

Public Open Spaces (POSs) – Multiple benefits and stakeholders

People's perception → Existing utilization of POSs ← Problems and challenges

Enhanced utilization of POSs

Benefits

Investments

Multiple Benefits

- Social
- Health
- Environmental
- Cultural
- Economic
- Disaster mitigation
- Tourism attractiveness

Incentives

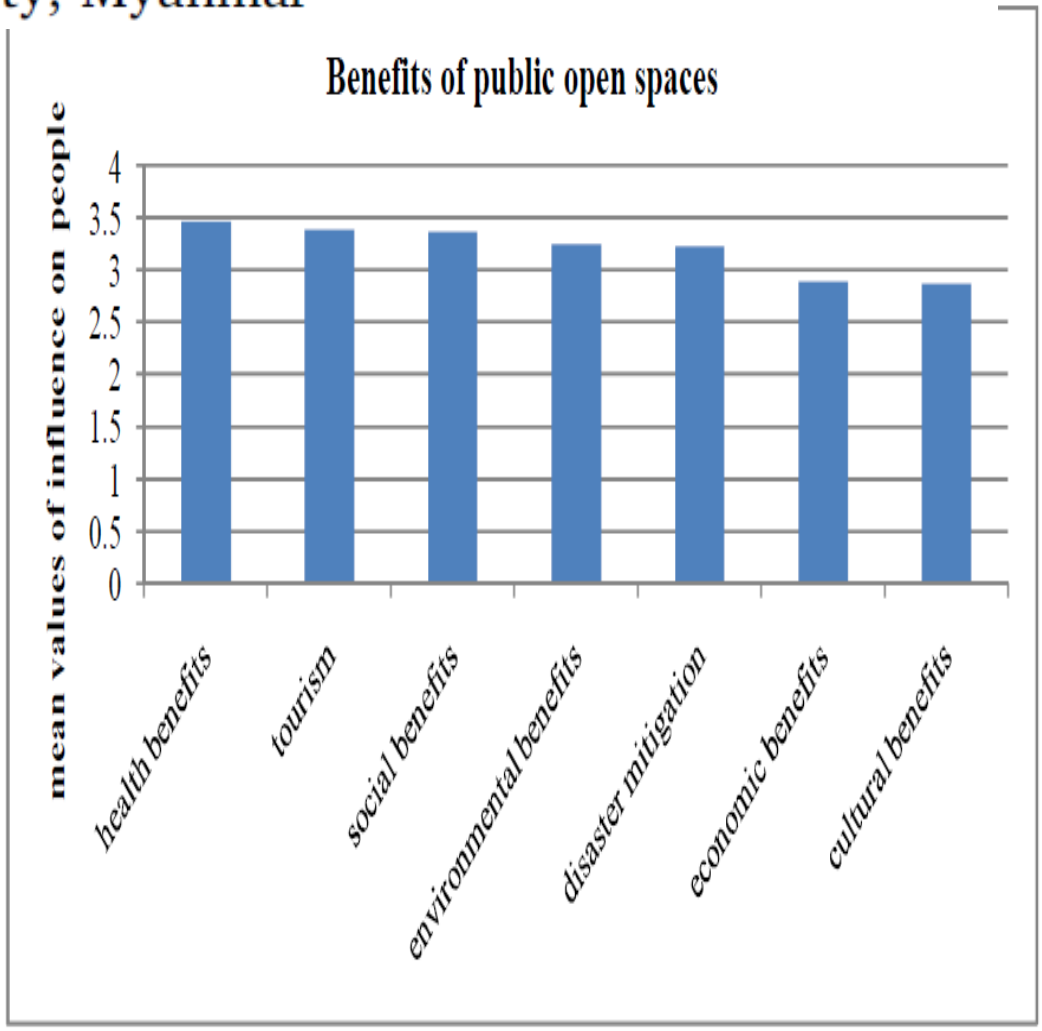
Benefits

Multiple Stakeholders

- Local Government
- NGOs
- Professionals/experts
- Private companies
- Local community

Adapted from: (Chiesura, 2004; UDA, 2015)

Multi-stakeholder and multi-benefit approaches for enhanced utilization of public open spaces in Mandalay city, Myanmar



Source: questionnarie survey, December 2015

Mean values of benefits influence people to utilize POSs

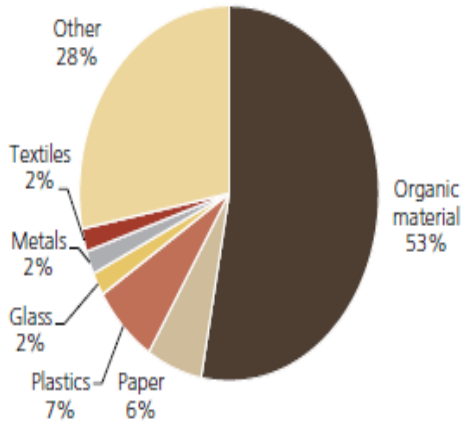
Wai, Nitivattananon and Kim (2018)

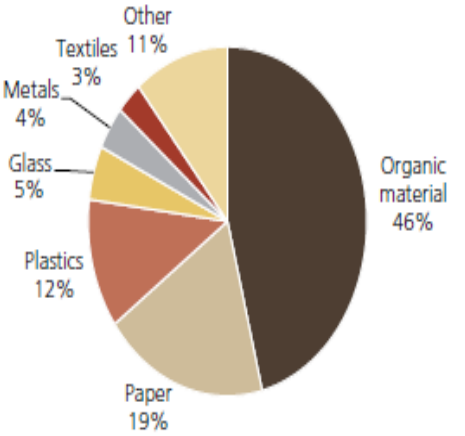
Solid Waste Management (SWM) – before and after disasters

- An effective integrated SWM system creates win–win situations (co-benefits)
  - where innovative waste management would be supplemented by social benefits (provide services to the public, etc), environmental benefits (avoid local pollution, etc), and economic benefits (income generation and cost reduction, etc).
- **With respect to flood risk management:**
- Allow drainage systems to operate effectively, with improved waste management
- Significant amount of waste due to flooding, with improper waste management system
- Potential to generate savings, reducing maintenance costs (i.e. drainage clearance) and averting catastrophic disasters.

Waste composition and treatment options

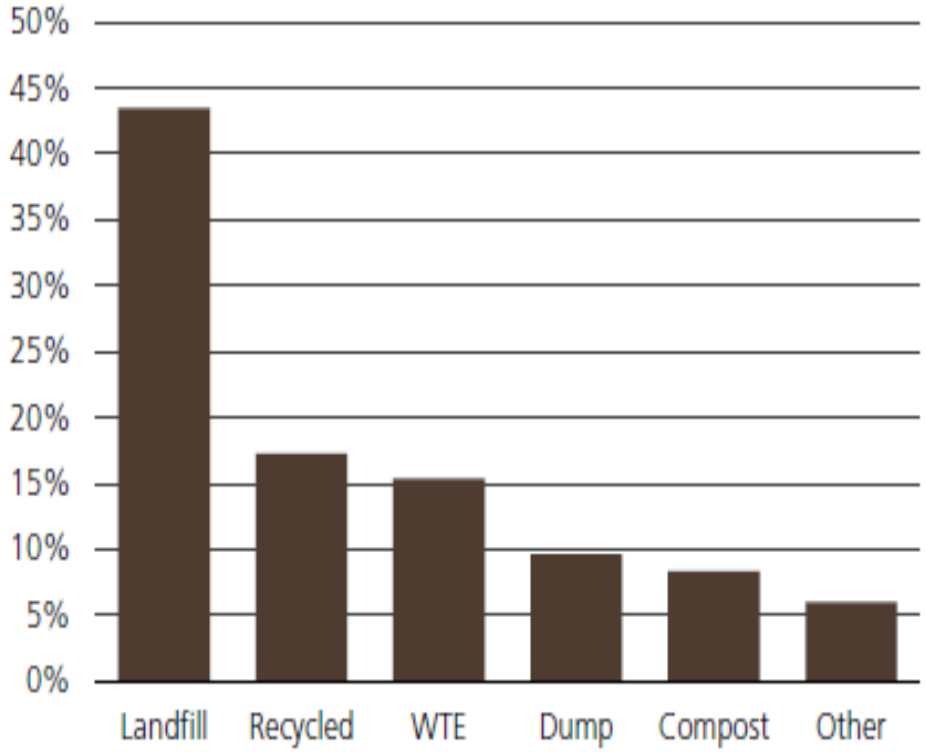
Waste composition by region





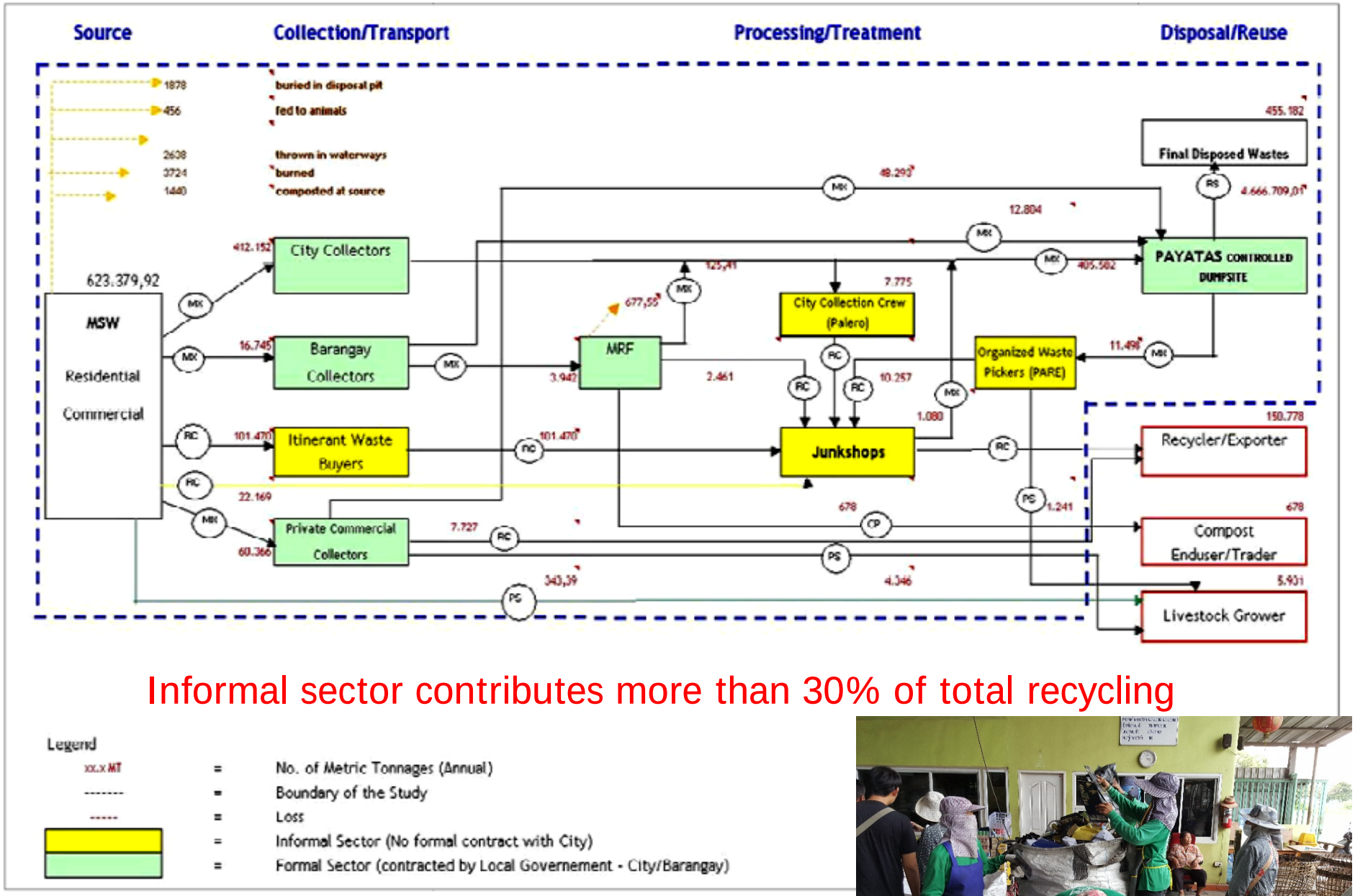
Total MSW disposed of worldwide

In millions tons/year



Note: WTE= Waste-to-Energy Source: The World Bank (WHAT A WASTE: A Global Review of Solid Waste Management), as of June 2012

Source: United Nations Environmental Program 2015: Global Waste Management Outlook



Informal sector contributes more than 30% of total recycling

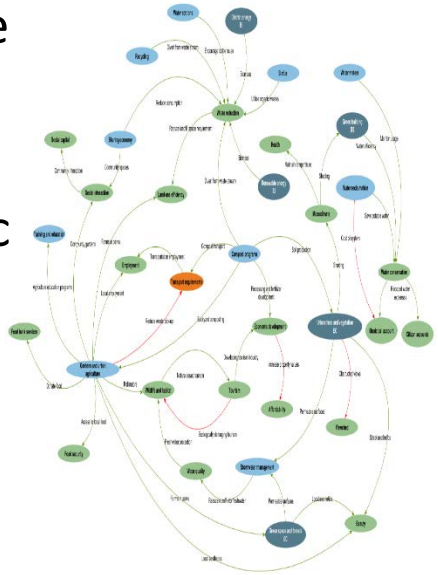
Materials flow in Quezon City,

Nitivattananon and Gabinete (2012)

Ways forward

Research questions:

1. How and to what extent anthropogenic factors influence urban resilience, with respect to natural hazards?
2. How to practically assess the resilience based on the synergies of urban functions - flood management, public open spaces, and solid waste management?
3. What can be enabling conditions with supporting measures/actions, for enhancing the synergies?



Thank you!