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Jayawardena, H. M. I. D. P., van Roon, M. R., & Knight-Lenihan, S. (2014). Resilience Planning: an Innovative Approach in Dealing with Urban Vulnerabilities and Adaptation to Prioritise Opportunities for Uncertain Urban Futures. In *New Zealand Planning Institute Mountains to the Sea*. Queenstown, New Zealand: New Zealand Planning Institute. Retrieved from http://www.planning.org.nz/Attachment?Action=Download&Attachment_id=3113

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New Zealand Planning Institute Annual Conference 2014– “Mountains to the Sea”

April 2-7, Queenstown

Resilience Planning: an Innovative Approach in Dealing with Urban Vulnerabilities and Adaptation to Prioritise Opportunities for Uncertain Urban Futures



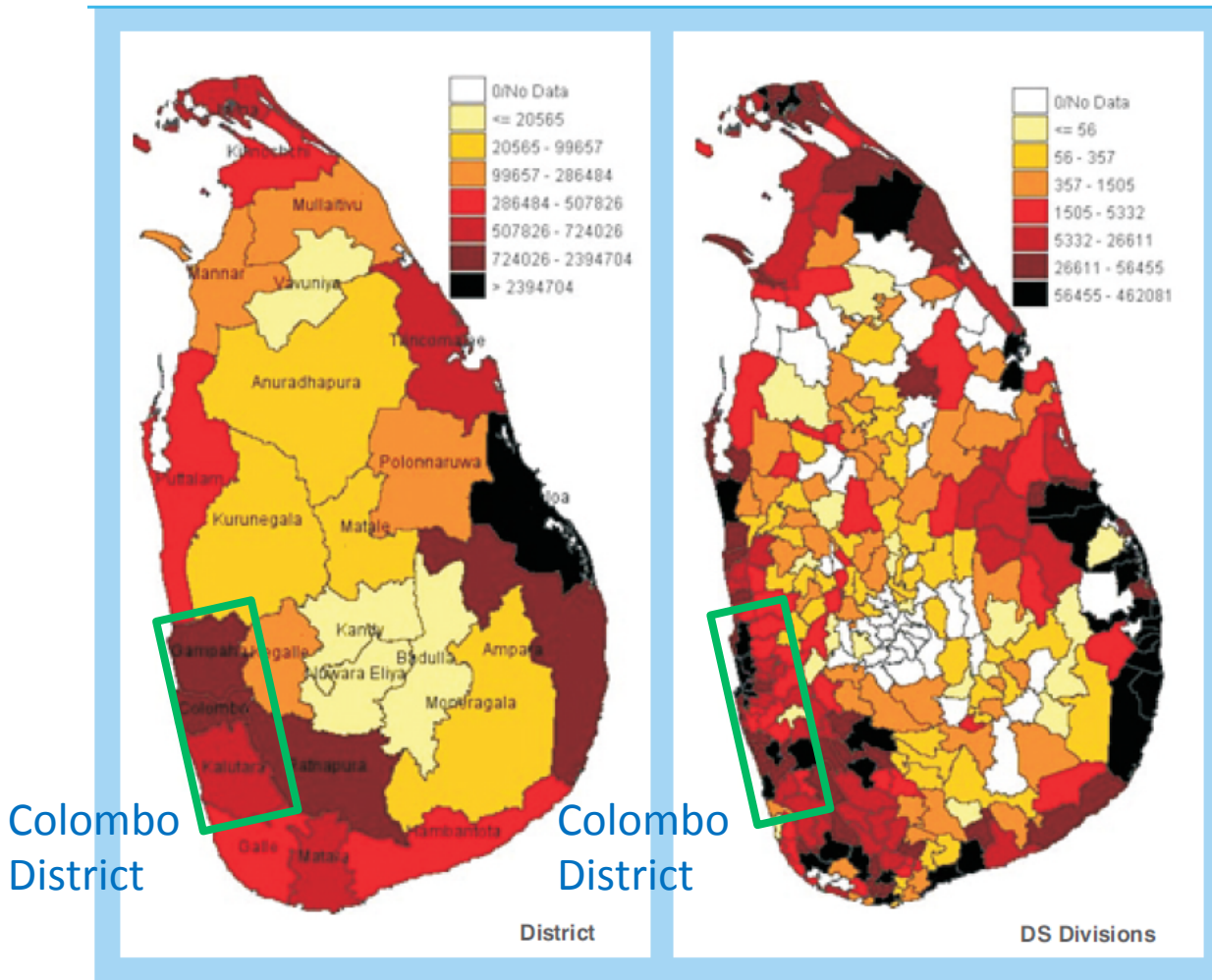
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University of Auckland

New Zealand

Case of Sri Lanka - Floods



Source: Disaster Information Management System Sri Lanka

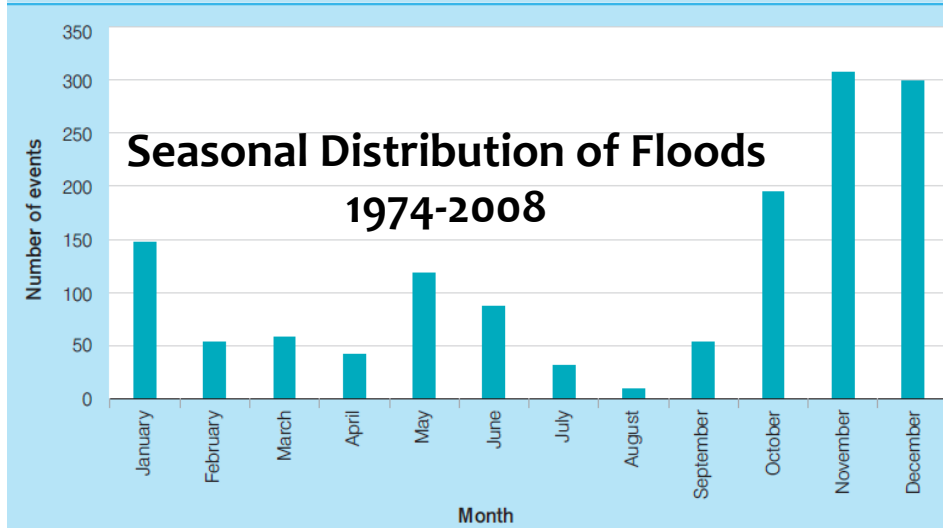
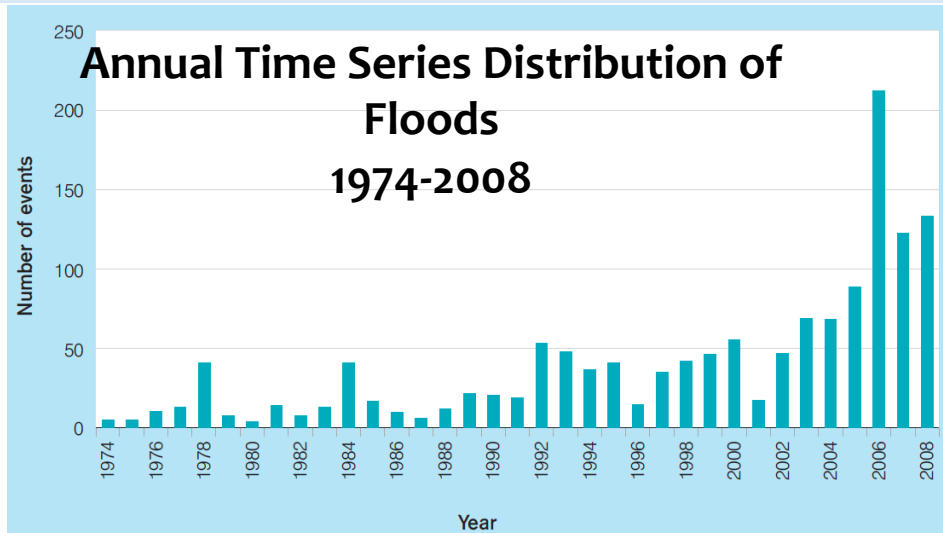
People Affected Due to Floods – Spatial Distribution: 1974 -2008

DS Division level the highest incidents of flood appears to occur in the Western part of the Island

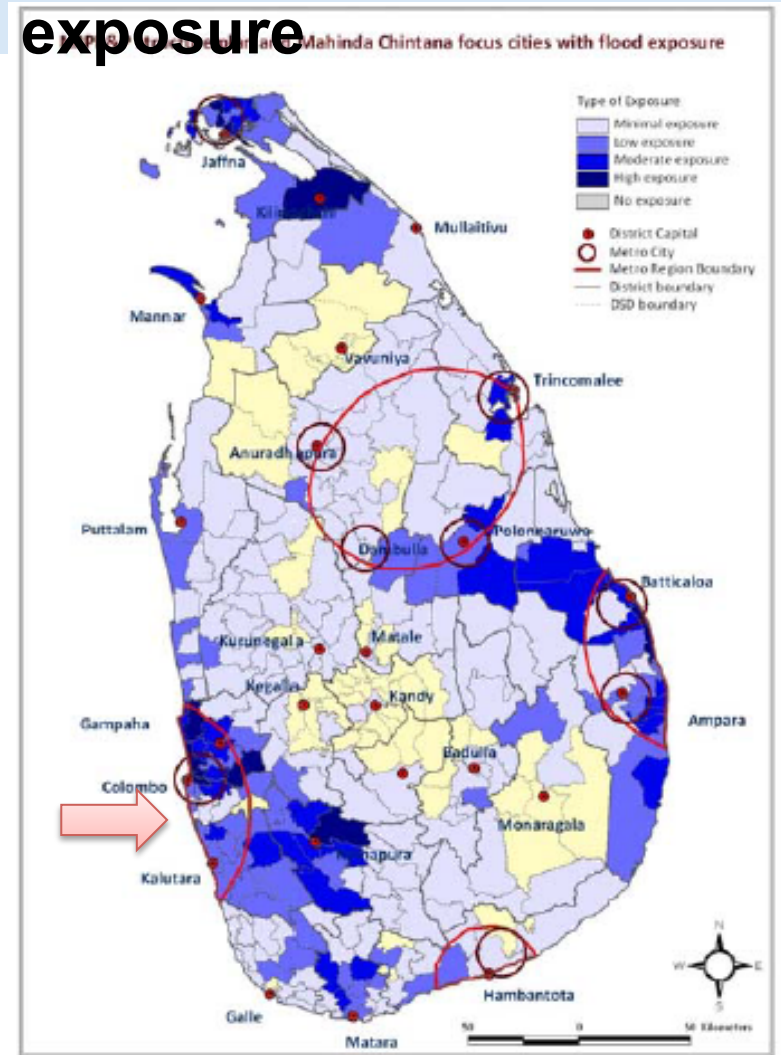
- Total Pop 20,263,723 (2012 census)
- 29% of total population living in the Western Province (WP)
- 3 Districts of Colombo, Gampaha, Kalutara comprised in WP
- Colombo- the highest urbanized city (40% from WP)

Case of Sri Lanka - Floods

Cities focus to flood exposure



Source: Disaster Information Management System Sri Lanka



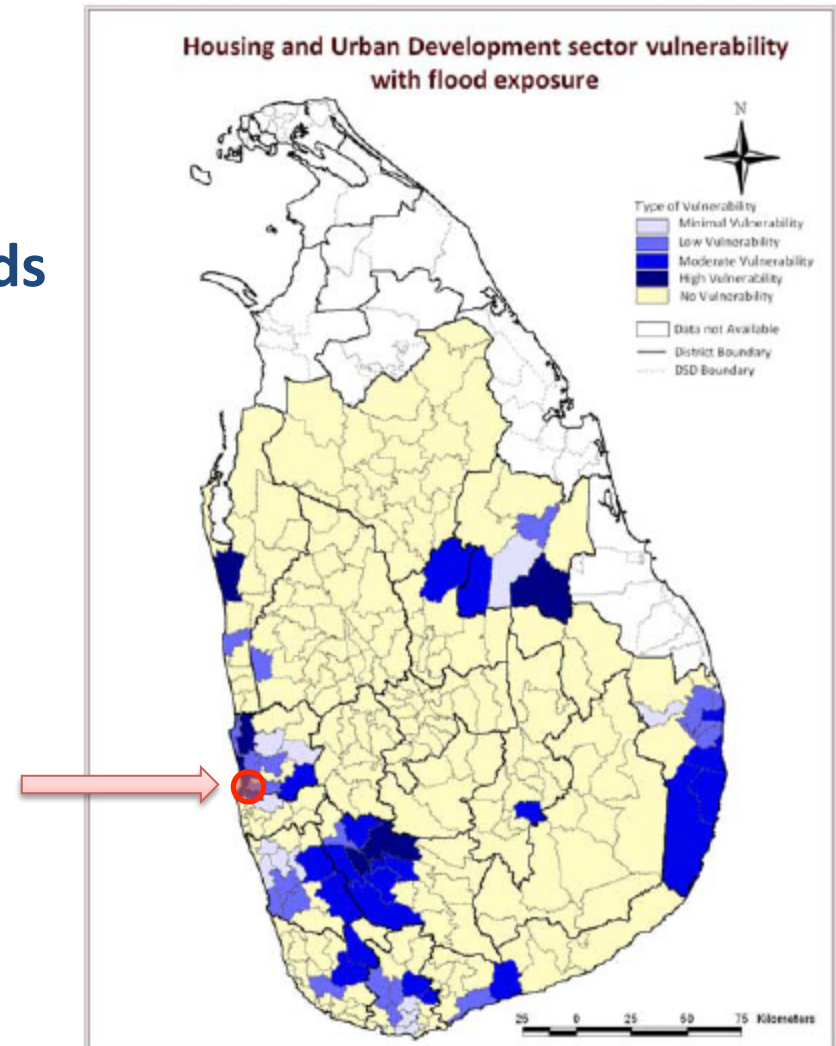
Adopted from Sector Vulnerability Profile: Urban Development, Human Settlements and Economic

Case of Sri Lanka – Exposure, Sensitivity and need of Adaptive capacities in Colombo

- Colombo (Colombo District) and Katana (Gampaha District) emerge as the two most vulnerable DSDs. These DSDs are home to 603,629 people living in 113,848 housing units
- Colombo, the most vulnerable DSD, has the highest population density in the country.

Floods

Source: Sector Vulnerability Profile: Urban Development, Human Settlements and Economic Infrastructure (2011 – 2016)



Case of Sri Lanka – Climate Change

Increasing temperature

- Air temperature in Sri Lanka has increased by 0.64°C over the past 40 years and 0.97°C over the last 72 years, which revealed a trend of 0.14°C per decade. However, the assessment of a more recent time band of 22 years has shown a 0.45°C increase over the last 22 years, suggesting a rate of 0.2°C per decade.
- Consecutive dry days are increasing in the Dry and Intermediate Zones.
- Ambient temperature (both minimum and maximum) has increased.
- The number of warm days and warm nights has increased, while the number of cold days and cold nights has decreased.

Rainfall variability

- The precipitation patterns have changed, but conclusive trends are difficult to establish.
- A trend for rainfall decrease has been observed historically over the past 30-40 years, but this is not statistically significant.
- There is a trend for the increase of one day heavy rainfall events.
- An increase in the frequency of extreme rainfall events are anticipated, which would lead to more floods.

Drought

- The increased frequency of dry periods and droughts are expected.
- The general warming trend is expected to increase the frequency of extreme hot days.

Source: Department of Meteorology, Sri Lanka, provided for preparation of this report (2010).

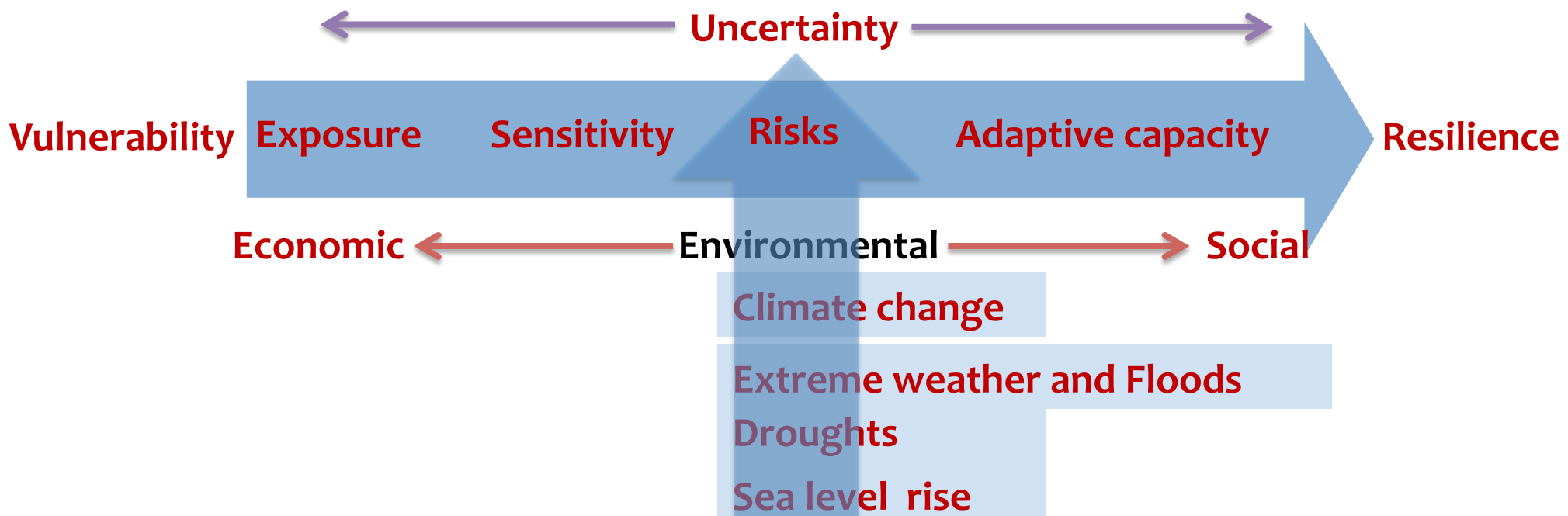
“Planning for adaptation, climate change related issues and vulnerability need to be considered at two levels:

- The potential impacts on existing urban areas and infrastructure that need to be understood and addressed
- The potential climate change vulnerability of planned future urban development and human settlements that needs to be considered and addressed. ”

Adopted from Sector Vulnerability Profile: Urban Development, Human Settlements and Economic

Urban systems– Vulnerability to Resilience

Exposure, Sensitivity, Risk and Adaptive capacities



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Resilience

Surjan, Sharma, & Shaw, 2011

Amdal, 2012

Bogunovich, 2012

Beraud, Barroca, & Hubert, 2012

Walker et al., 2006

Leach, 2008

Gunderson, 2010

Evans, 2011

Gotts, 2007

Folke et al., 2002, 2010

Crichton, 2007

Hamnett & Forbes, 2011

Coaffee, 2008

Olazabal & Chelleri, 2012

Pike, Dawley, & Tomaney,

2010
Wiman & Short, 2008

Christopherson, Michie, & Tyler, 2010

Cimellaro & Arcidiacono, 2013

Adaptation

Folke et al., 2002

Folke, 2006

Evans, 2011

Crichton, 2007

Pike, Dawley, & Tomaney, 2010

Tanner, Mitchell, Polack, & Guenther, 2009

**Socio-ecological
and Urban
systems**

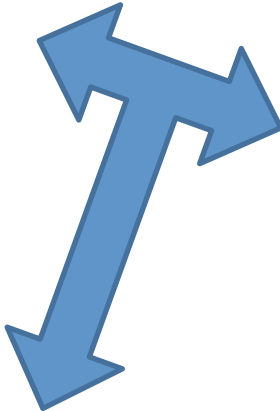
**“achieving sustainable
futures of cities, with
positive outcomes for
the city and
communities”**

Resilience planning

Resilience planning involves the identification of urban vulnerabilities and the development of adaptive capacities appropriate to each of those vulnerabilities (Eraydin & Taşan-Kok, 2013; Muller, 2011).

Water sensitive cities

WSCs viewed within the lens of resilience planning provides opportunities to develop an environmentally responsive planning system to perceive environmental consequences happening at multiple scales. This approach can be framed-up within the socio-ecological systems (SES) perspective extending multiple opportunities to cities that cope with change while sustaining their main functions



Transitioning to water sensitive cities as a resilience planning approach to dealing with extreme weather events and climate change impacts of contemporary cities

Transitioning to water sensitive cities adopting resilience planning

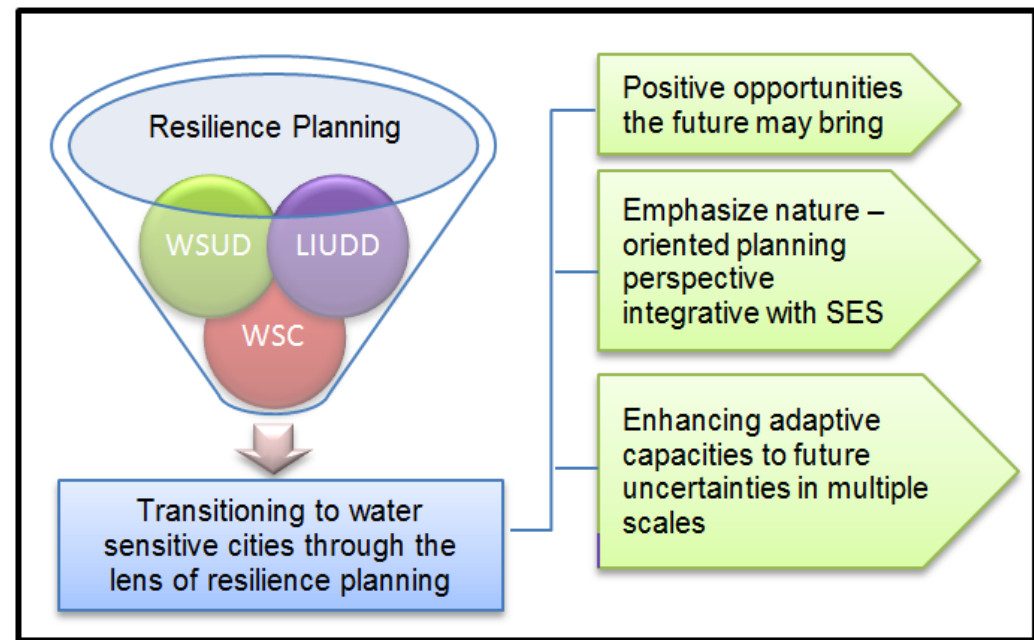
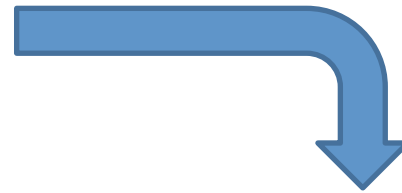
The approach will strengthen spatial planning for future developments in Sri Lanka.



This approach should enhance adaptive capacities to cope with urban vulnerabilities to extreme weather events (EWE) and climate change.

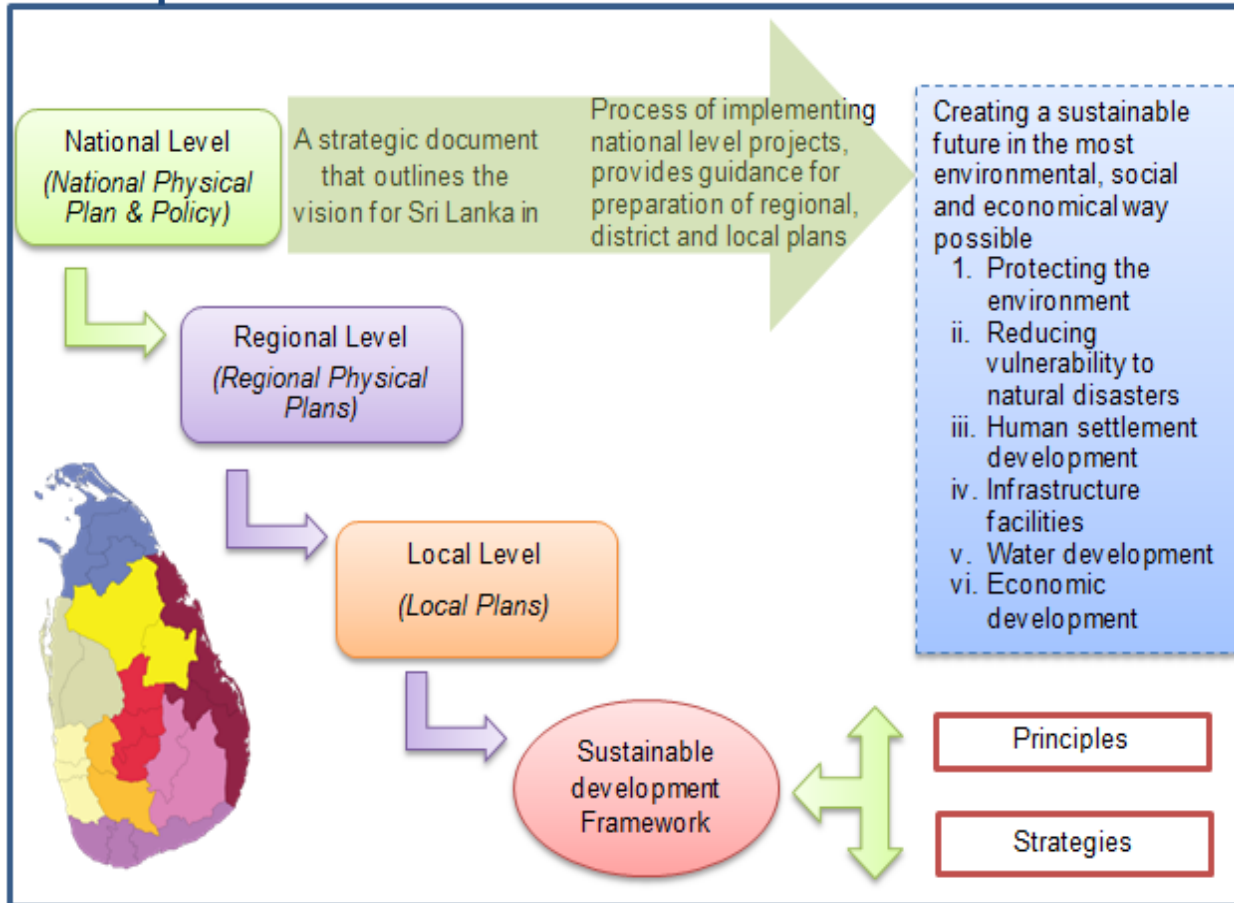


water sensitive design as a driver for the adoption of resilience planning



Resilience thinking in planning practices: The spatial planning context in Sri Lanka

Planning documentation hierarchy: Sustainable Development context in Sri Lanka



How planning responses have been adopted to effectively create sustainable futures?

What strategic instruments are going to be implemented to ensure these futures?

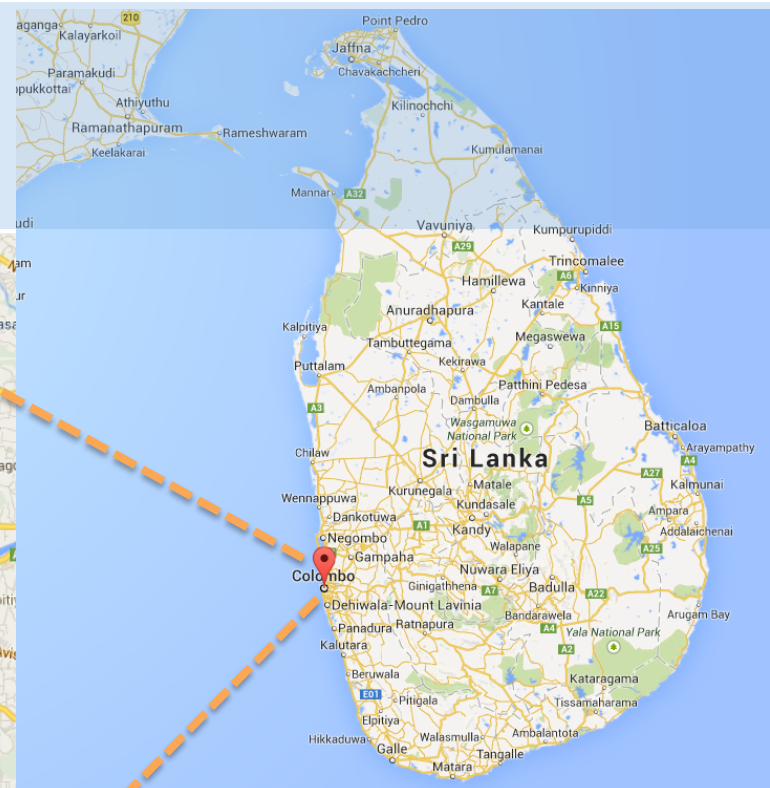
What does that mean for achieving sustainable development?

Which planning instruments would make this a reality and what are possible pathways for planning adaptive measures?

Resilience thinking in planning practices: the spatial planning context in Sri Lanka

Planning Document	Key components and Guiding principles 'Sustainable development'	Possible responses to uncertainties due to extreme weather and climate change
NPPP and the NPP	<ul style="list-style-type: none"> ▪ Economic, Social and Environmental Sustainability as the key components ▪ Framework through principles of sustainable development for addressing issues and challenges that will be faced towards 2030 ▪ Environmental protection and social integration as a key priority 	<ul style="list-style-type: none"> ▪ Strategies to reduce possible vulnerabilities to natural disasters resulting from climate change and extreme weather ▪ Provisions for water resource development and urgent need to urban water management ▪ Intention to introduce WSUD to manage flood effects, storm water and water catchment
CMRSP	<ul style="list-style-type: none"> ▪ Development of most urbanized region in Sri Lanka, known as Colombo Metropolitan Region ▪ Environmental Sensitivity Analysis determined as key principle of preserving ecologically sensitive areas as ecological zones excluding from planned development ▪ Implementation of strategies for urban agglomeration and growth centre concept in Western province ▪ Improve the quality of life of the people 	<ul style="list-style-type: none"> ▪ Plan has identified as 20% of the CMR being comprised on flood plains ▪ Threats to wetlands as garbage dumping sites ▪ Improper storm water management practices and micro level drainage issues

Colombo, Sri Lanka



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Colombo, Sri Lanka

According to the CMRSP,

A large part of the core area of Colombo regional development is comprised of environmentally sensitive areas for water such as wetlands, water bodies, and paddy lands.

The ocean forms the west boundary and the Kelani River marks the northern-boundary. Therefore, the existing spatial pattern in Colombo may enable multiple water sensitive outcomes.

In response to EWE and climate change WSCs may encourage an integrated planning approach to resilience planning.



Transitioning to water sensitive cities: The case of Colombo in Sri Lanka

This study recognizes a potential approach to planning adaptive measures through WSCs as a resilience planning approach to change the urban environment in Colombo, Sri Lanka

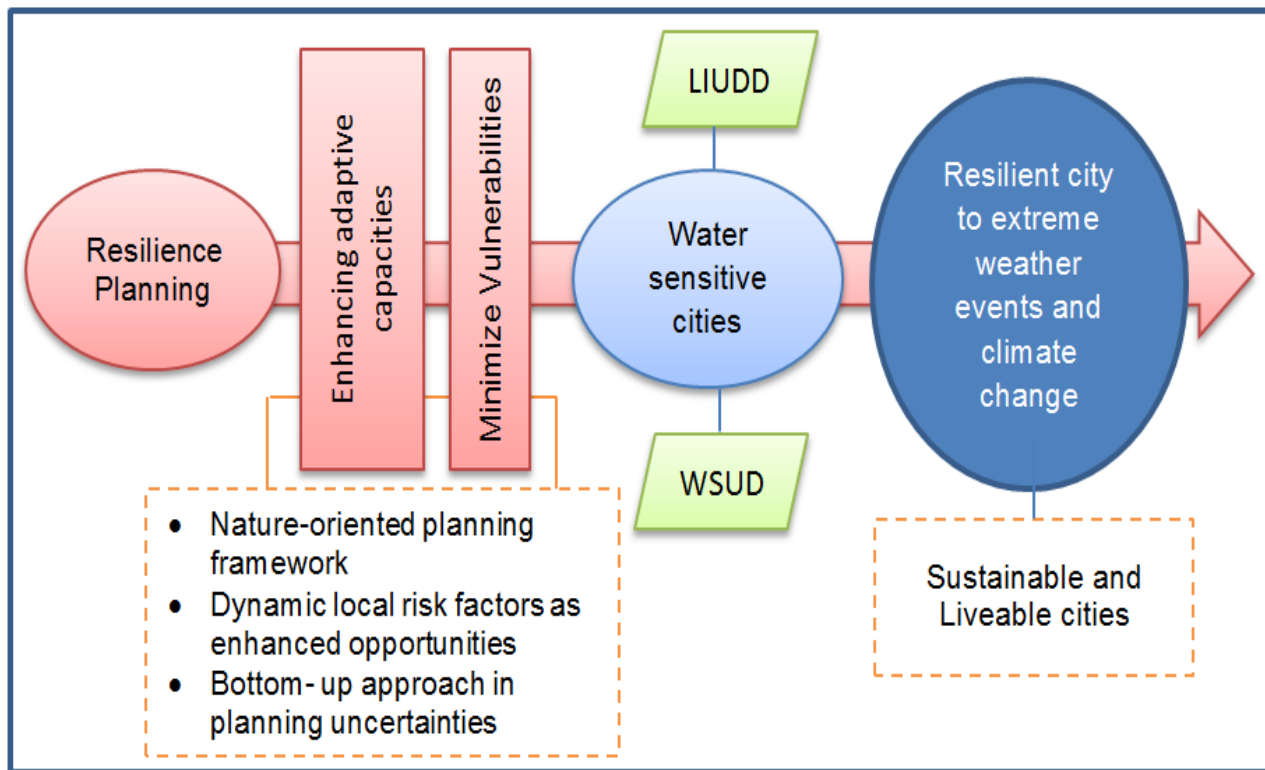


Transitioning to WSCs combined with a resilience planning approach helps to prepare urban systems for unforeseen weather disturbances and climate change effects improving adaptation capacities

In response to EWEs and climate change WSCs may encourage an integrated planning approach to resilience planning

The integration of theories and the practices for strategic implementation of the approach

Transitioning to resilience in planning based on water sensitive cities framework



Urban planning and design play a critical role in combining WSUD, LIUDD and other similar approaches into **planning water sensitive cities**

Enhance the urban water cycle while responding to many other disturbances and impacts faced by **contemporary cities through a sustainable nature-oriented planning framework**

The integration of theories and the practices for strategic implementation of the approach

LIUDD framework is an approach unique to the New Zealand urban context focuses on urban ecosystem management and community wellbeing through sustainable urban development and storm water management practices

LIUDD aims to avoid a wide range of adverse ecological effects that typically occur during urban development, and it attempts to minimize these negative effects through alternative approaches to spatial planning (van Roon & van Roon, 2009)

WSUD considers the management of the entire interconnected network of urban water systems, thereby combining the functionality of all urban water through a nature-oriented framework (Hoyer et al., 2011).

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graph TD; LIUDD[LIUDD framework] --> WSCs[WSCs searches for the best alternative to urban water management and could contribute to future resilient cities in Sri Lanka.]; WSUD[WSUD] --> WSCs;
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WSCs searches for the best alternative to urban water management and could contribute to future resilient cities in Sri Lanka.

Conclusion

- Urban systems are dynamic and vulnerable to changes and disturbances in nature, adequate attention must be paid to the loss of adaptive capacities of contemporary urban systems
- Insecurity in urban spaces and among communities, and hinders the sustainability of key planning components implemented through planning documents
- Implementation of resilience planning combined with a WSC approach could reverse these negative trends
- Directives from Strategic spatial planning as a driving force for successful implementation of this WSCs approach in the local level (Currently undertaking as a doctoral research study)