IPCC AR5 WGII report and its implications for Southeast Asia

The 2nd Southeast Asia Regional Climate Downscaling (SEACLID)/CORDEX Southeast Asia Workshop

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Dr Poh Poh Wong
University of Adelaide
wong3921@gmail.com

Outline

- IPCC (Intergovernmental Panel on Climate Change), WGII (Working Group II), AR5 (Fifth Assessment Report)
- Coastal systems
- Freshwater resources
- Food security
- Human settlements

IPCC

IPCC

- Created in 1988 by WMO and UNEP. Has 195 governments that commission assessments performed by the international community on the state of human knowledge of climate and climate change.
- Role : to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.
- IPCC assessments : scientific basis for governments at all levels to develop climate related policies, and they underlie negotiations at the UN Climate Conference (UNFCCC, United Nations Framework Convention on Climate Change).

AR5 WGII highlights

- Scoping meeting in July 2009 to outline 30 chapters : involving climate change experts from relevant disciplines, users, govt reps.
- 1217 author nominations from 92 countries.
- 242 Lead Authors (about 60 are CLAs) and 66 Review Editors from 70 countries : selection criteria include expertise, differing viewpoints and perspectives, geographic balance, gender balance, and ensuring involvement of new experts in accordance to agreed-upon IPCC guidelines. Supplemented by 436 Contributing Authors from 54 countries.
- Undergone two extensive reviews : totaling over 50,000 comments from 1729 expert reviewers from 84 countries and 49 governments.
- Over 12,000 scientific references.

WGII objective

Objective of WGII AR5, Climate Change 2014 : Impacts, Adaptation and Vulnerability is to consider the

- Vulnerability and exposure of human and natural systems
- Observed impacts and future risks of climate change
- Potential for and limits to adaptation.

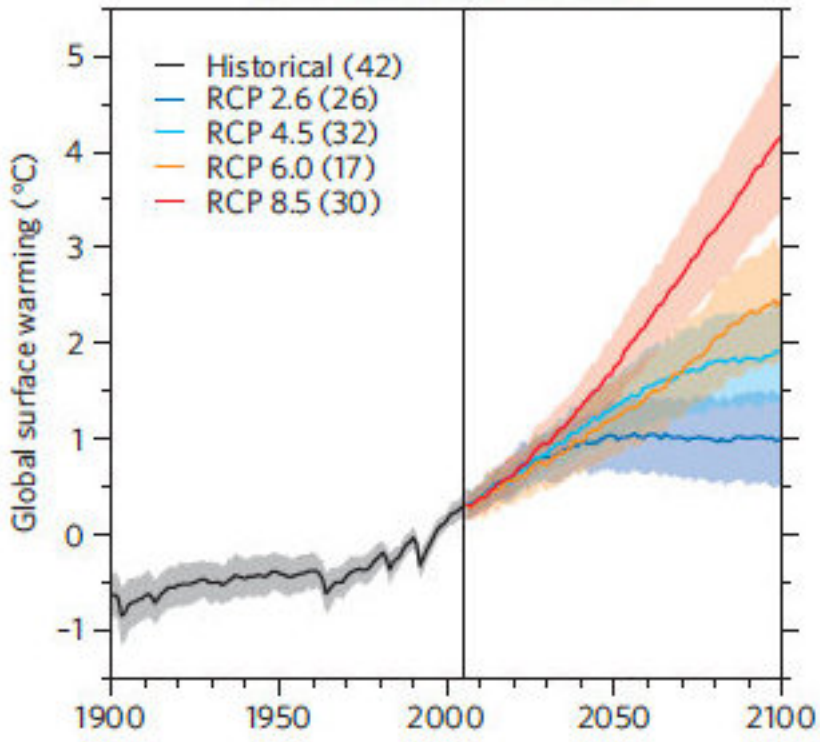
WGII report

- Chapters of the report assess risks and opportunities for societies, economies, and ecosystems around the world.
- 30 chapters in two volumes :
  - Vol. 1 focuses on global and sectoral aspects.
  - Vol. 2 provides chapters on assessments of regions.

What is new?

- 10 new chapters added in WGII AR5 to cover additional relevant topics :
  - 4 chapters on adaptation to include needs and options, experience in planning and implementation, opportunities, constraints and limits, and economics of adaptation.
  - 4 chapters on livelihoods and poverty, human security, urban and rural areas to cover socioeconomic, cultural, and regional planning aspects
  - 2 chapters on oceans for a more extensive coverage.

RCPs



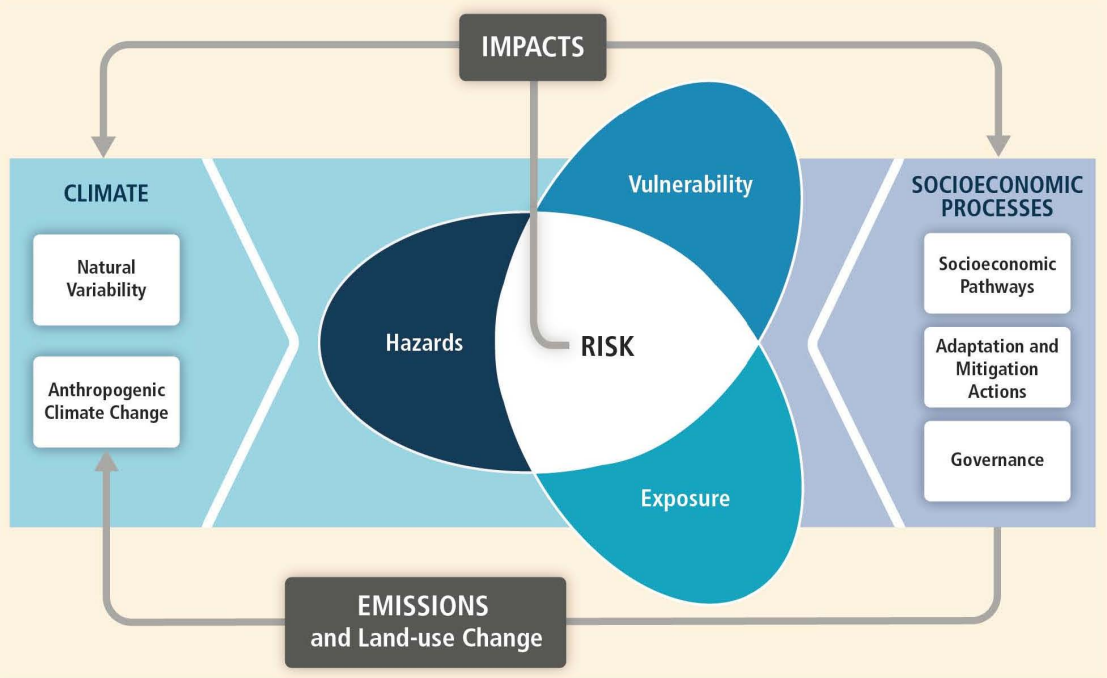
- Representative concentration pathways are scenarios that include time series of emissions and concentrations of the full suite of GHGs and aerosols and chemically active gases, as well as land use/ land cover. *Representative* signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics.
- 4 RCPs used in WGII : RCP8.5 (high), RCP6.5 and RCP4 (intermediate), RCP2.6 (low) – named after level of radiative forcing reached or stabilized in 2100.

Projected SLR

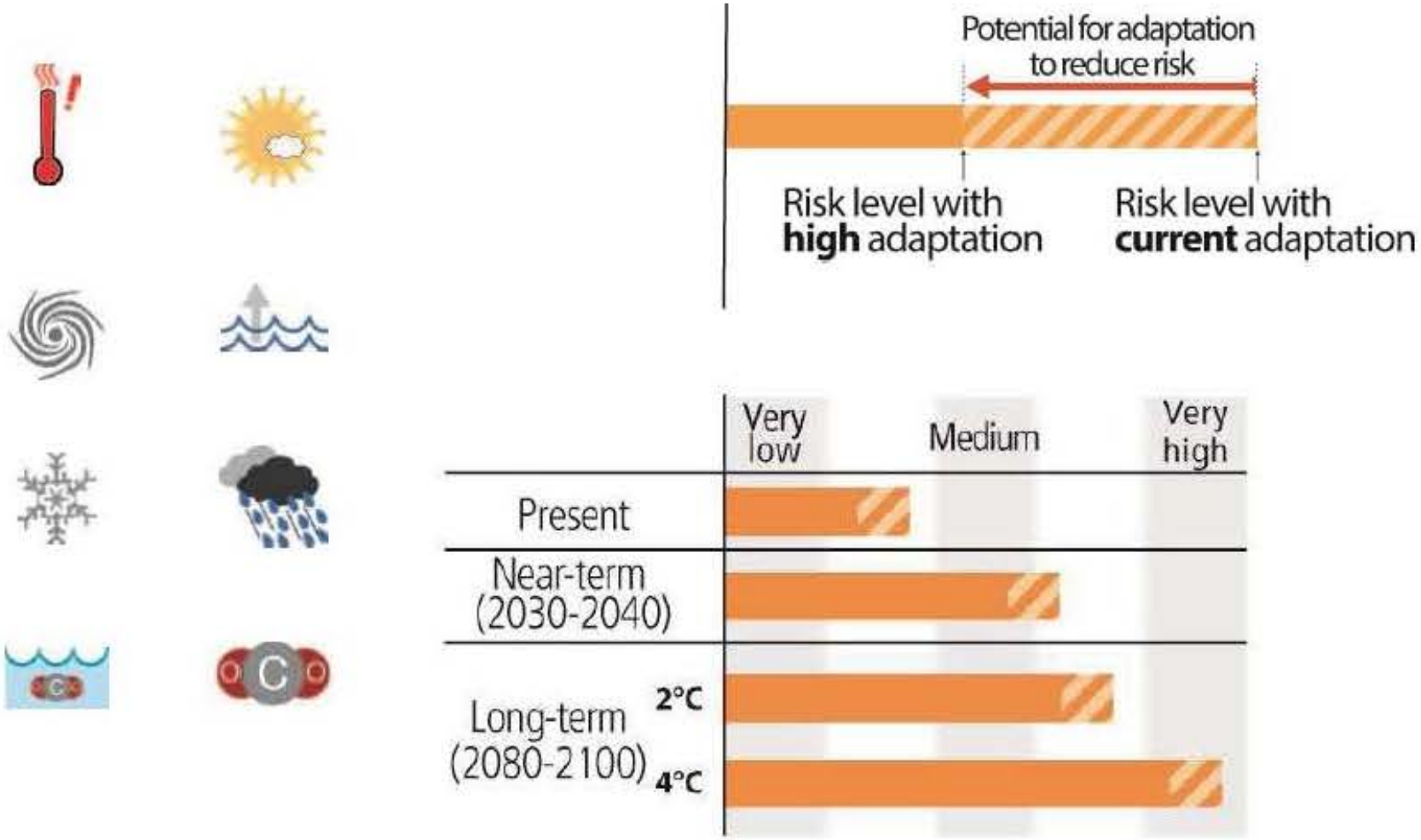
Emission scenario	Representative Concentration Pathway (RCP)	2100 CO_2 concentration (ppm)	Mean sea level rise (m)	
			2046–2065	2100
Low	2.6	421	0.24 [0.17–0.32]	0.44 [0.28–0.61]
Medium low	4.5	538	0.26 [0.19–0.33]	0.53 [0.36–0.71]
Medium high	6.0	670	0.25 [0.18–0.32]	0.55 [0.38–0.73]
High	8.5	936	0.29 [0.22–0.38]	0.74 [0.52–0.98]

Managing risks : core framing

- Risk : potential for consequences where something of human value (including humans themselves) is at stake and where the outcome is uncertain. Risk = hazard x vulnerability x exposure.
- Risk management : Plans, actions, or policies implemented to reduce the likelihood and/or consequences of risks or to respond to consequences.



Characterizing risks



Southeast Asia

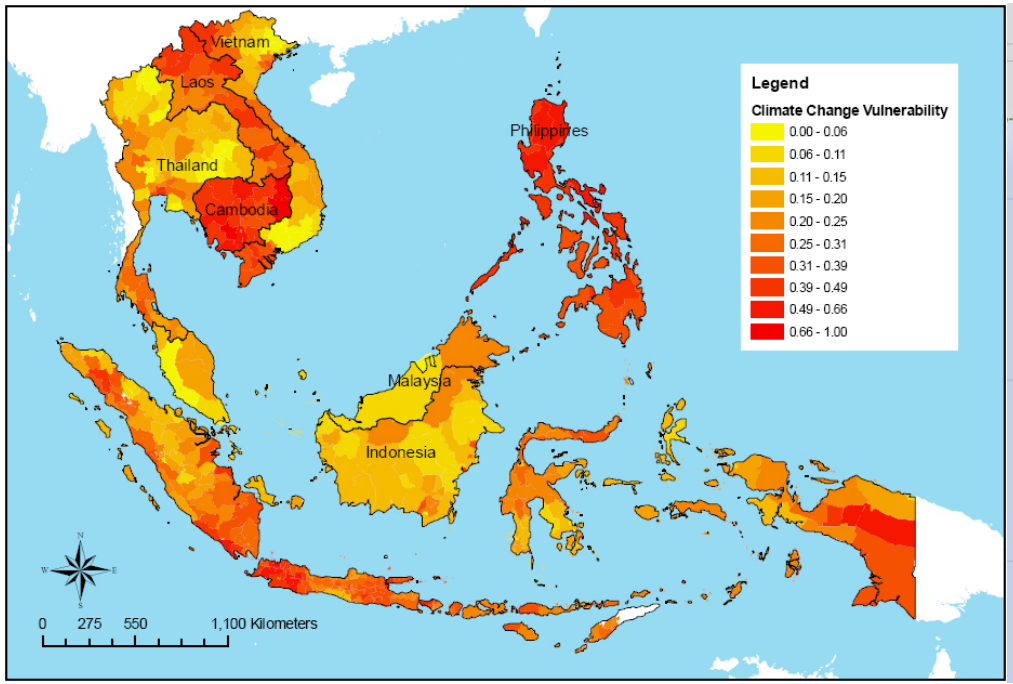
Southeast Asia

Vulnerability (1)

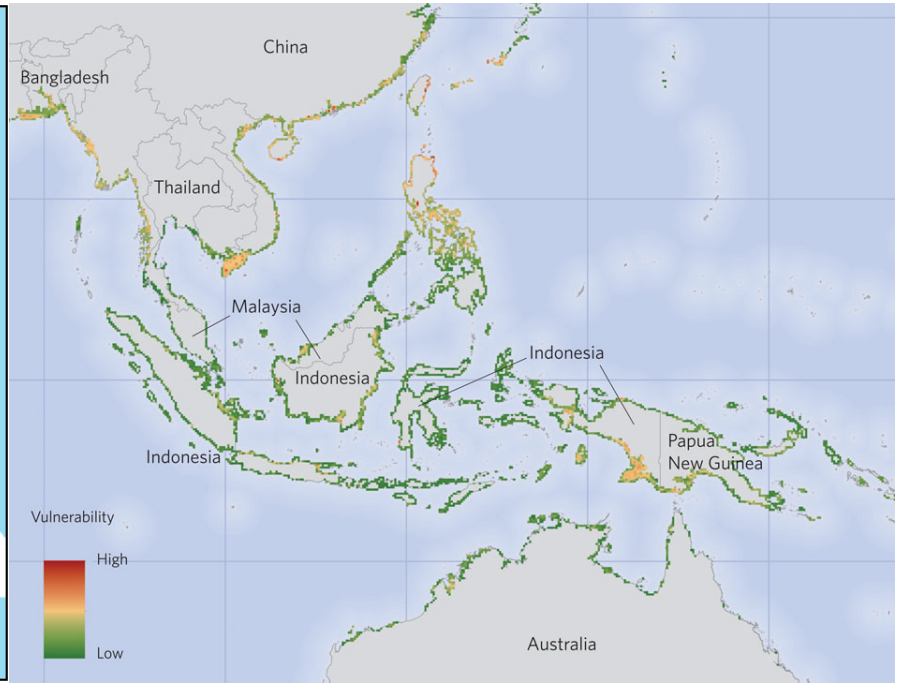
- One of most vulnerable regions (others being South Asia and small island states). Due to its long coastlines, high concentration of population and economic activity in coastal areas, and heavy reliance on agriculture, natural resources, and forestry.
- Already affected by climate change : increasing frequency and intensity of extreme weather events such as heat waves, droughts, floods and tropical cyclones in recent decades. Exacerbating water shortages, constraining agricultural production and threatening food security, causing forest fires and coastal degradation, and increasing health risks.

Vulnerability (2)

- Some highlights : impacts and adaptation options in four areas - coastal ecosystems, freshwater resources, food security, human settlements.



(EEPSEA 2009)

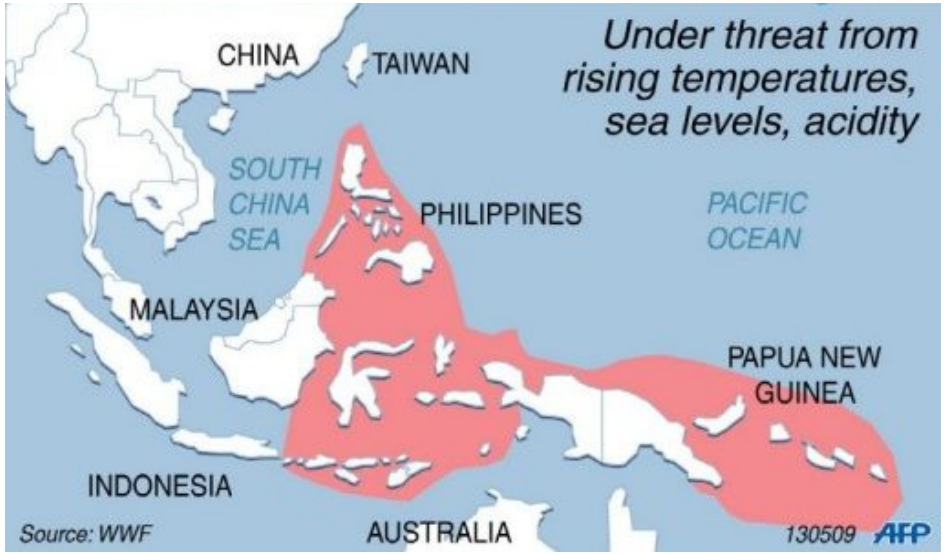


(Jones et al 2012)

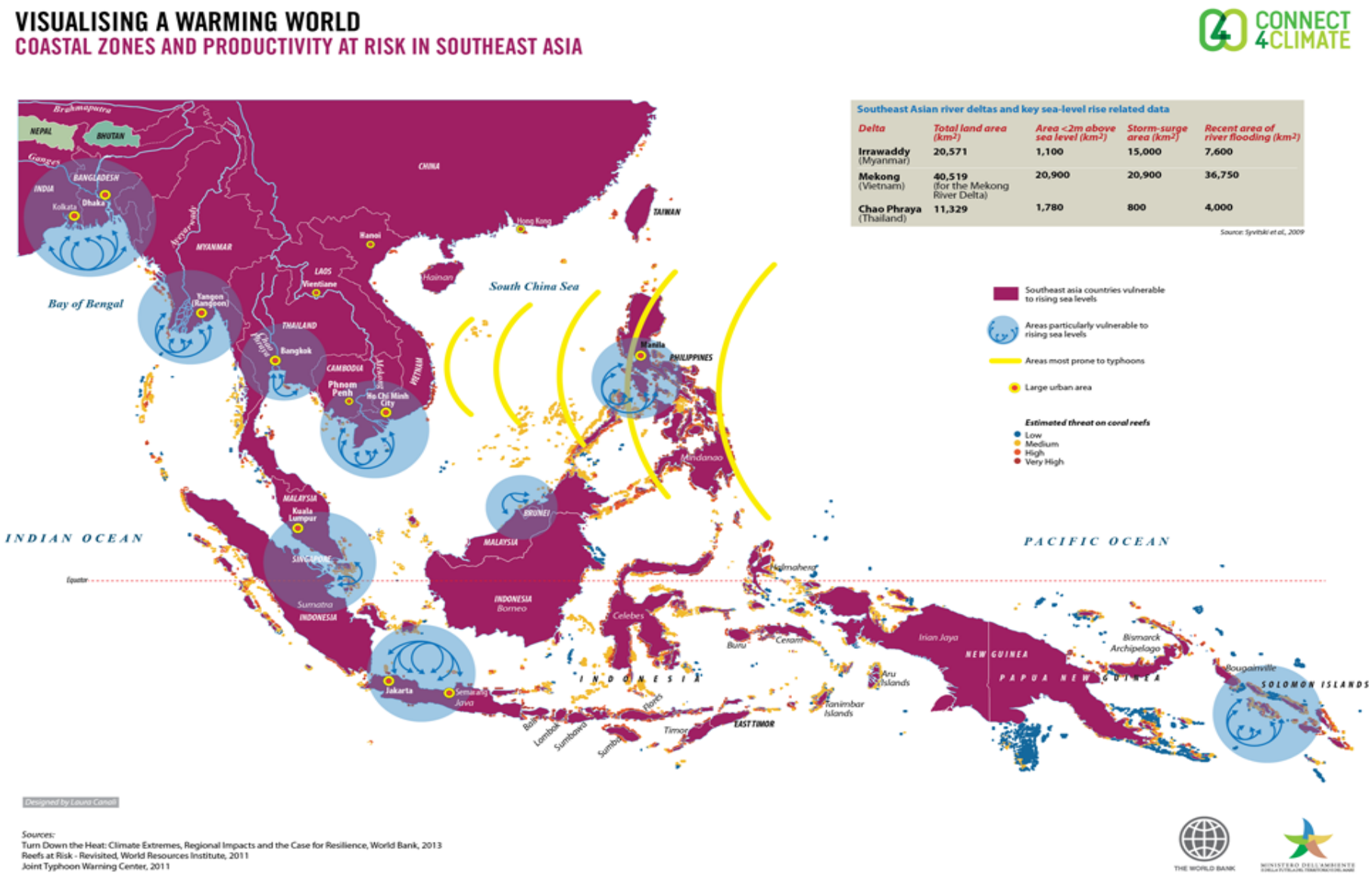
Coastal systems

- Low-lying coasts support mangrove forests, most of world peat swamp forests.
- 40% of world's coral reefs in Asia, mostly in SE Asia.
- Most diverse reef communities in coral triangle.
- Also widespread seagrass beds.

(NASA/USGS)



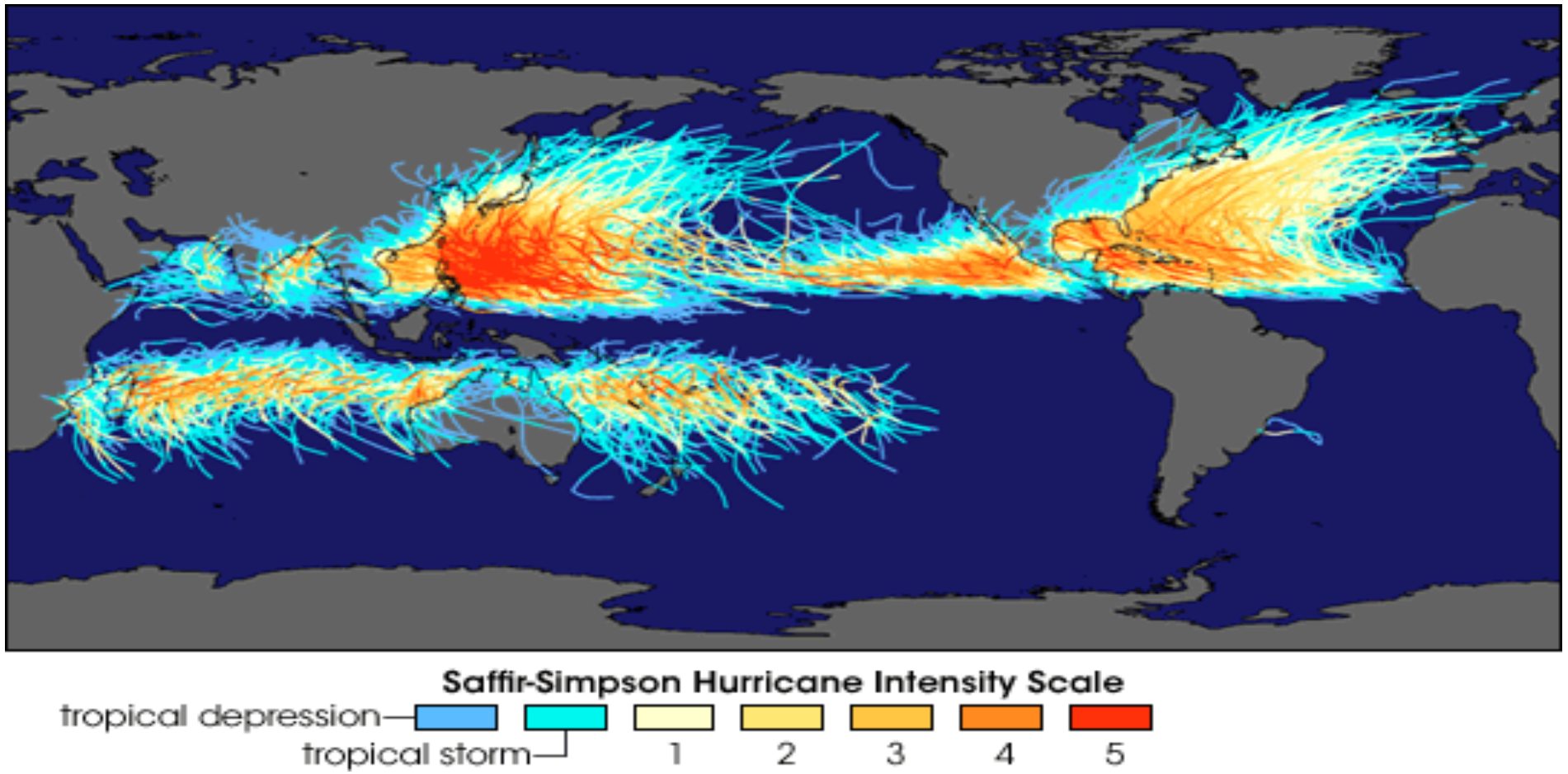
Coastal systems



Projected impacts

- Increasing SST and ocean acidification : declines in coral-dominated reefs and other calcified marine organisms.
- SLR : increase coastal flooding, coastal erosion and saltwater intrusion; mangroves, salt marshes and seagrass beds decline unless they receive sufficient fresh sediments to keep pace of SLR or retreat inland.
- Cyclone intensification with SLR : increase coastal flooding. In 2013, 176 million people in the region were affected by natural disasters such as flooding and cyclones, with 3.5 million displaced due to climate-related catastrophes.

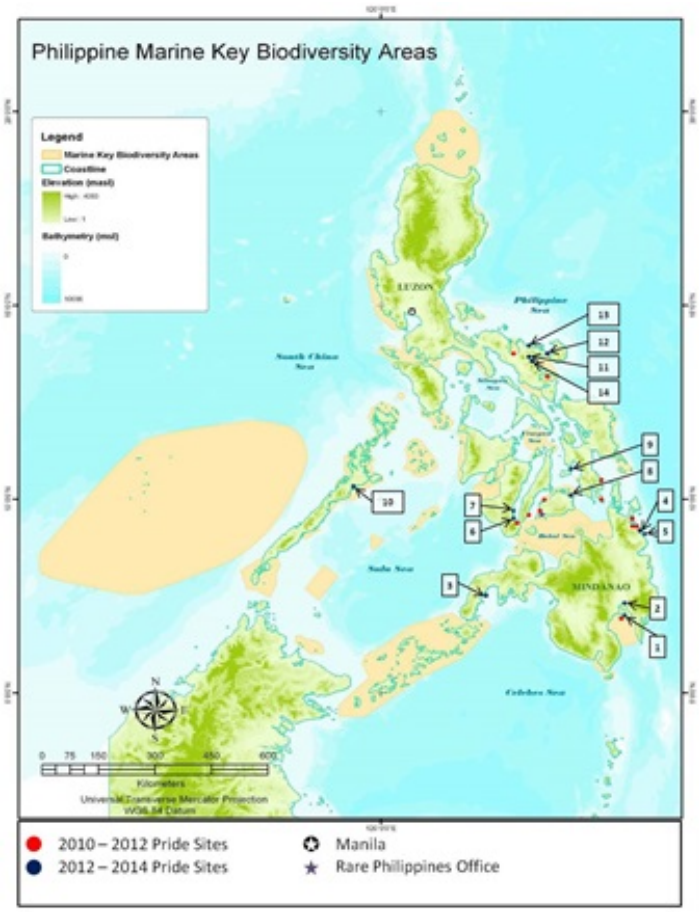
Cyclones



(Rohde)

Adaptation options

- Creation of MPAs targetting areas where SST are projected to change least : increase resilience.
- Landward buffer zones : for inland migration of mangroves and seagrasses.



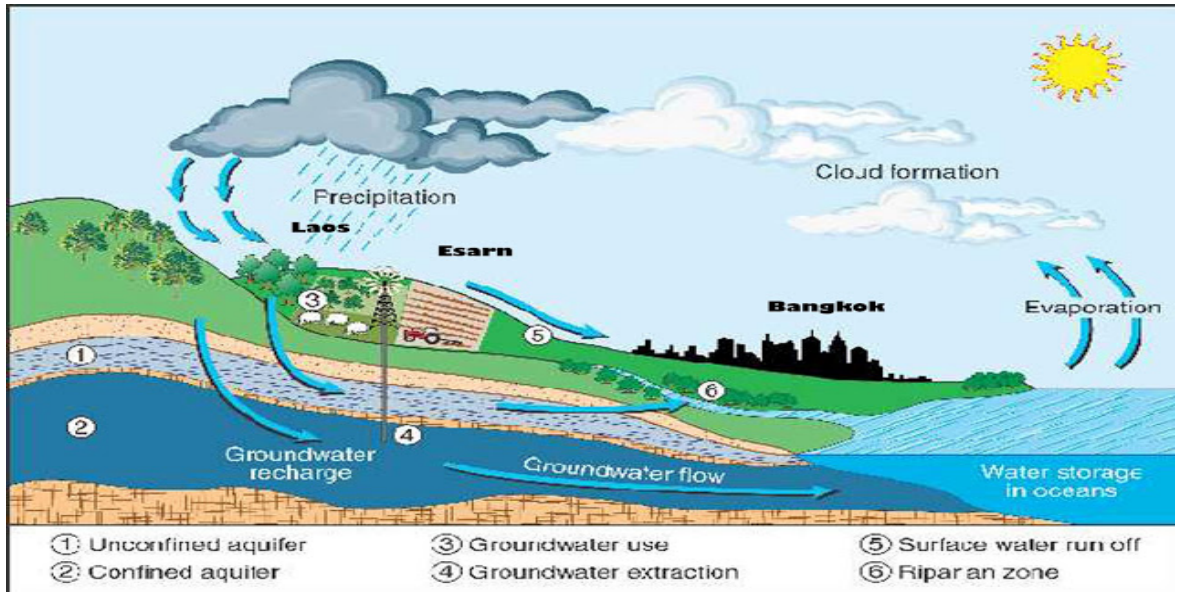
(USAID)

Freshwater resources

- Importance : because of massive population and heavy economic dependence on agriculture, but water availability is highly uneven and requires assessment
- Non-climate drivers : soaring populations, increasing per-capita domestic use, due to urbanization and thriving economic growth, and increasing use of irrigation.
- Observed impacts : apart from climate impact on availability, heavily influenced by human activities.

Projected impacts

- Future water availability differ substantially among river basins and seasons.
- Water demand is increasing because of increases in population, irrigated agriculture and industry.
- Future projections suggest a decrease in river runoff in January in the Chao Phraya River basin in Thailand

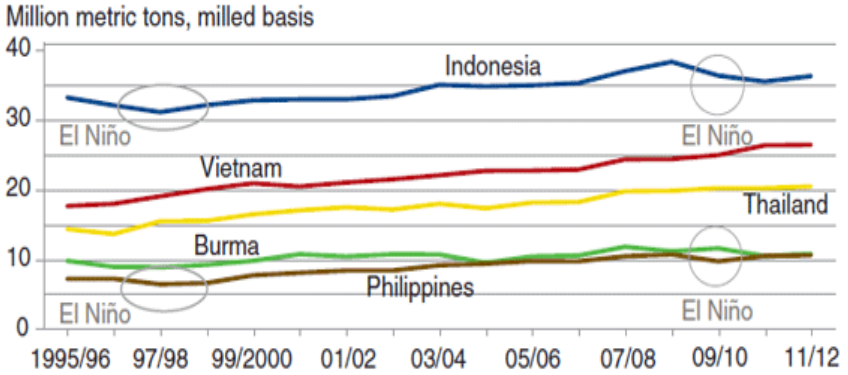


Adaptation options

- Develop adaptive/integrated water resource management of the trade-offs balancing water availability against increasing demand.
- Diversify water supply sources including reuse and recycling, and use of household-level water resources, e.g. roof water harvesting.
- Reservoirs partly mitigate seasonal differences and increase water availability for irrigation.
- In coastal areas, desalination of seawater or brackish water to supplement.
- Integrated water management within river basins to benefit countries.

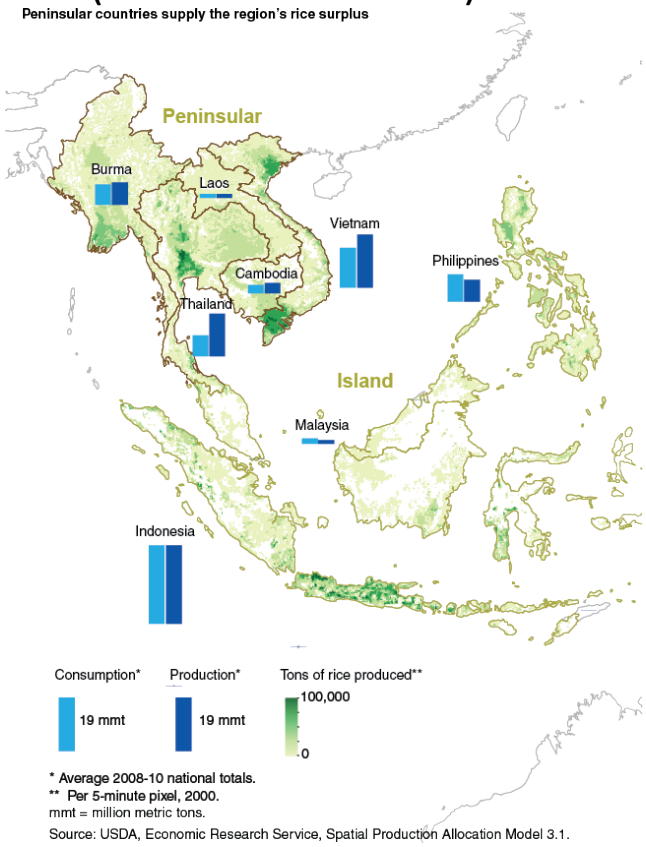
Food security (1)

- Current temperatures : already approaching critical levels during susceptible stages of the rice plant in Myanmar/Thailand/Laos/Cambodia (March-June), Vietnam (April/August), Philippines (April/June), Indonesia (August).
- SLR : key issue for many coastal areas as rich agricultural lands may be submerged. Threatens coastal and deltaic rice production areas particularly in Mekong River Delta. E.g. about 7% of Vietnam's agriculture land may be submerged, decrease in Myanmar's rice yield due salt water intrusion.



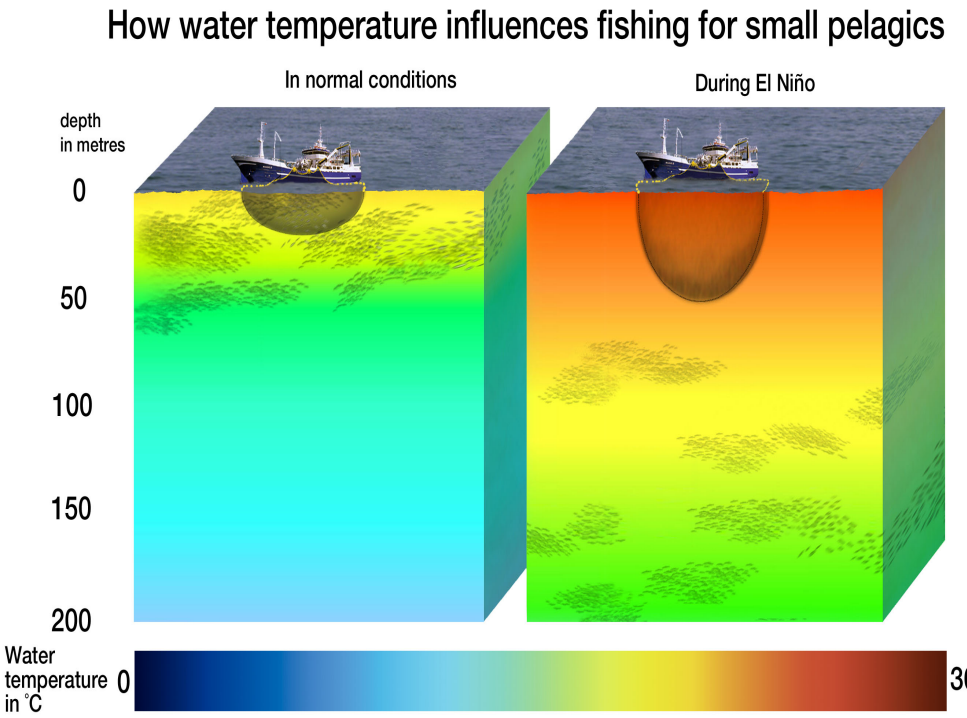
(USDA)

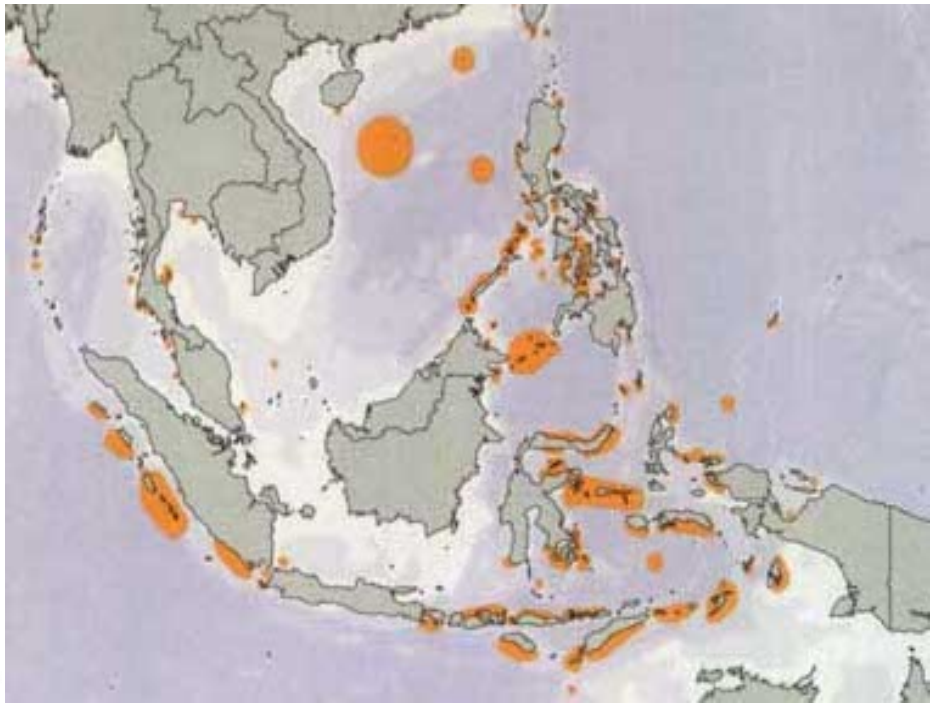
(Baldwin et al 2012)



Food security (2)

- SLR : expected to impact both capture fisheries and aquaculture production in river deltas. Decline in marine productivity in part because of vulnerability of coral reefs to both warming and ocean acidification.
- Destructive fisheries.





(WRI 1998)

Adaptation options

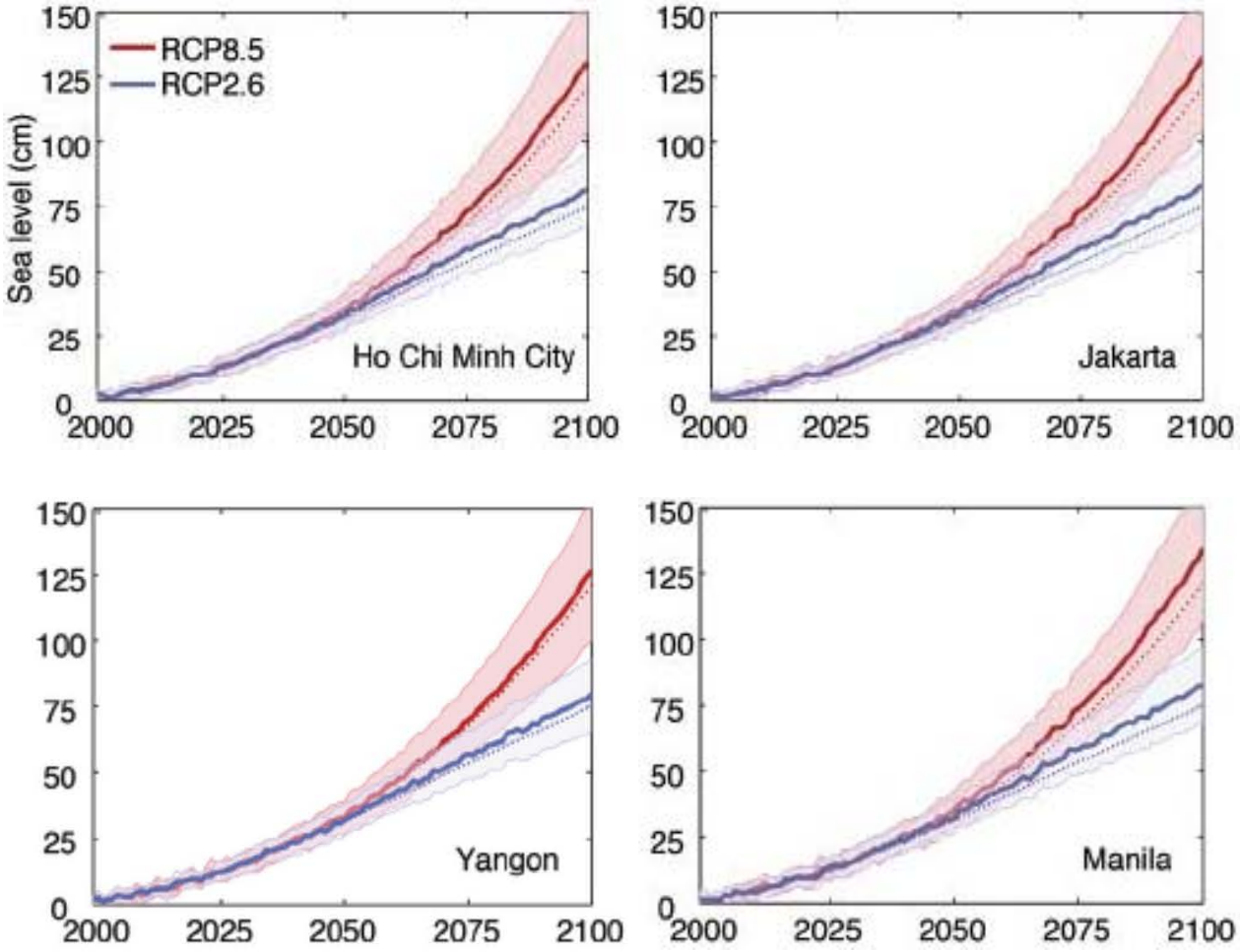
- Crop breeding : for high temperature condition : promising option. E.g. 9 salt-tolerant rice varieties in 2013 in Philippines.
- Aquaculture : better management practices for shrimp, pangasius catfish, brackish-water and near-shore aquaculture, marine cage culture (Thailand, Philippines, Indonesia, Vietnam).

(BFAR)

(IRRI)

Human settlements (1)

- Population centres in deltaic areas : exposed to high degree of cumulative climate-related risk (all environmental and socioeconomic factors).



(ADB 2013)

Human settlements (2)

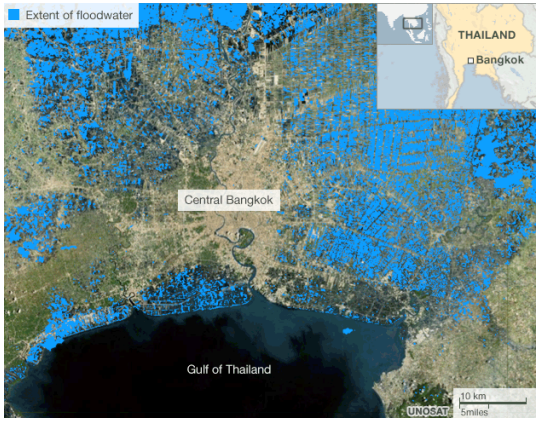
- By 2070 : SE Asian cities with most risk to coastal flooding include Ho Chi Minh City, Bangkok, Rangoon, Jakarta and Manila (Globally, Asia has 15 of top 20 cities for projected population exposure and 13 of top 20 for asset exposure).

Key South East Asian Agglomerations	Population (2005, in millions)	Projected Exposed Population (2070, in millions)	Local Sea Level Rise Projections in a 4°C World in 2070 (above 1986–2005)
Jakarta	13.2	2.2	66cm
Yangon	4.1	4.9	63cm
Manila	10.6	0.5	66cm
Bangkok	6.5	5.1	65cm
Ho Chi Minh City	5.0	9.2	65cm

Source: Population data from Hanson et al. (2011); SLR RCP8.5 (in this report).

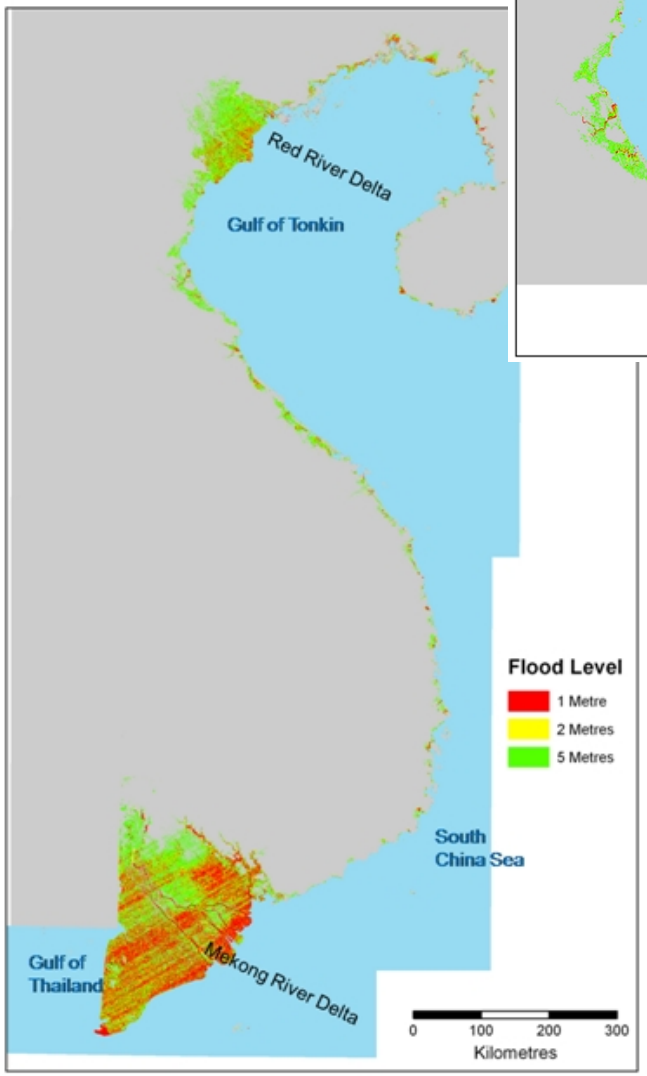
Year	2025	2050	2075	2100
Sea-level rise projection (cm)	14	32	58	88
Total flood inundation area (km²)	1429	1611	1917	2311
Percentage of total Bangkok area	43%	48%	57%	69%

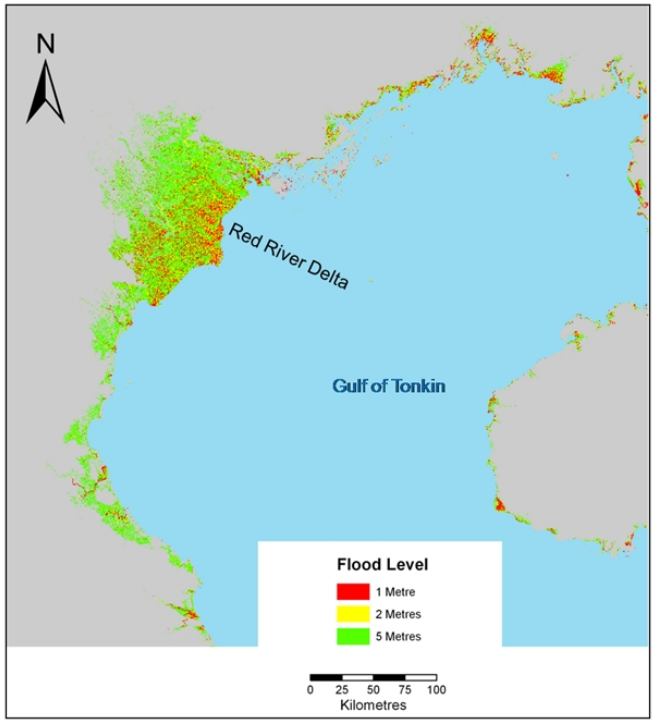
Source: Adapted from Dutta (2011).

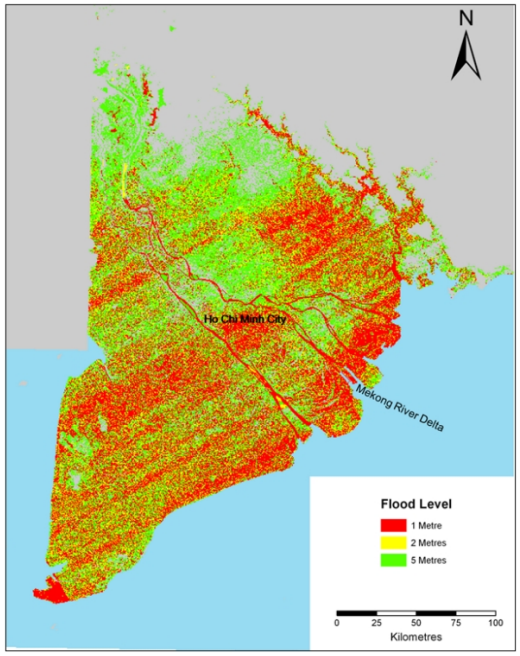


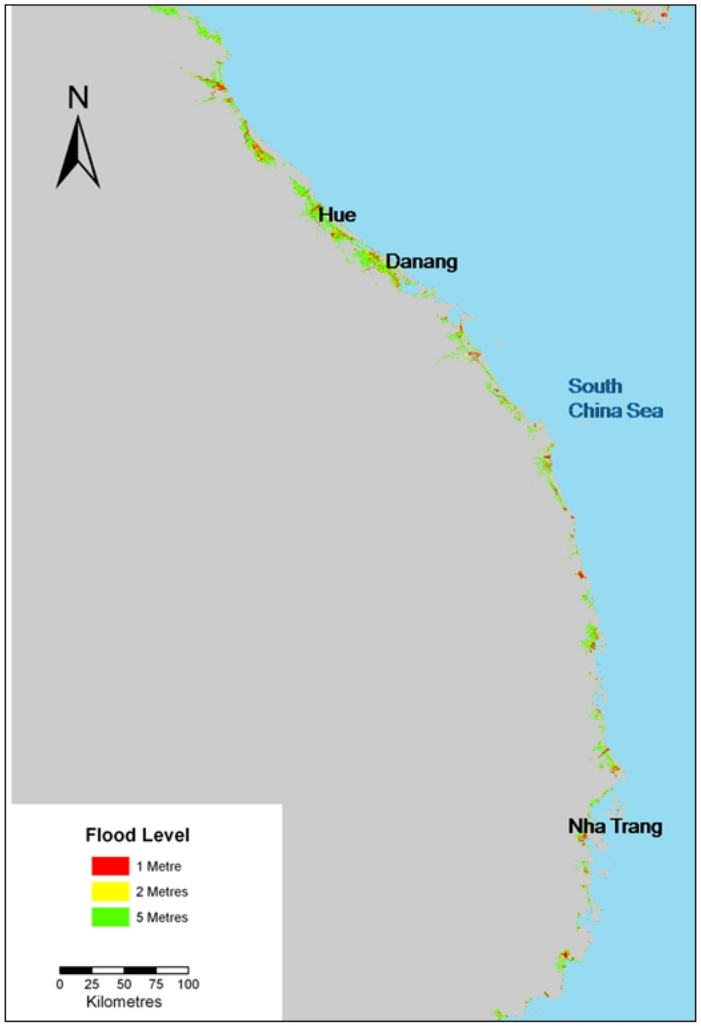
Vietnam - SLR

(Boateng 2009)



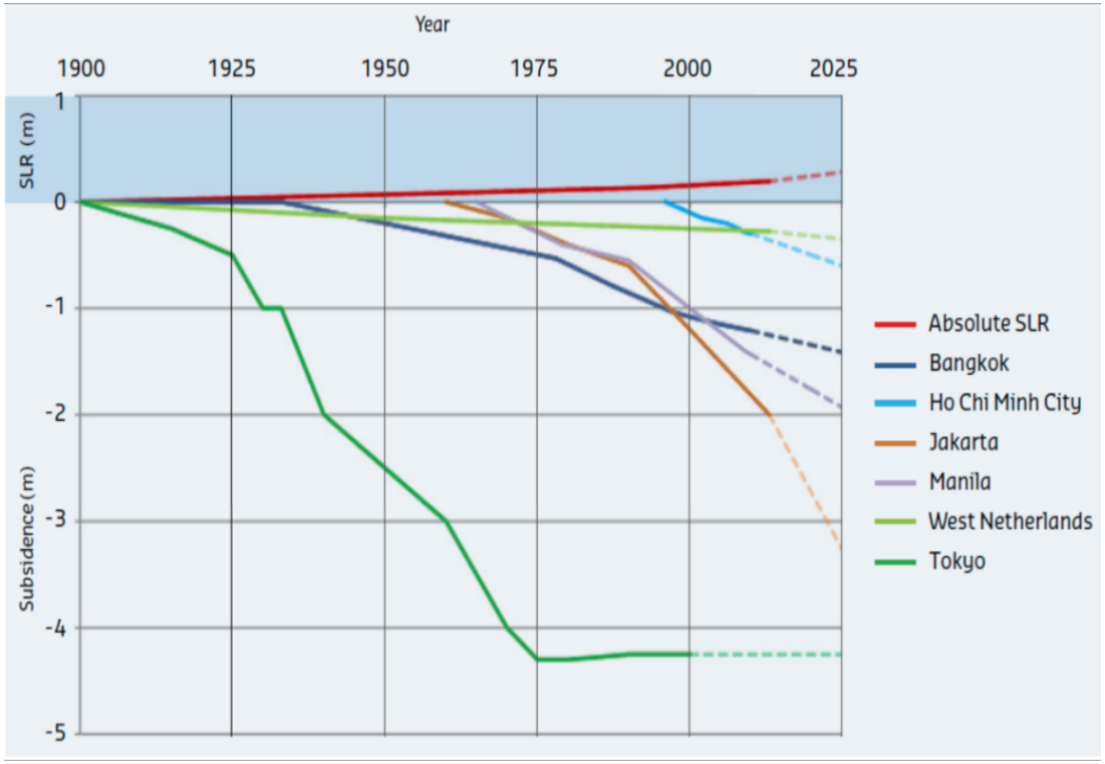




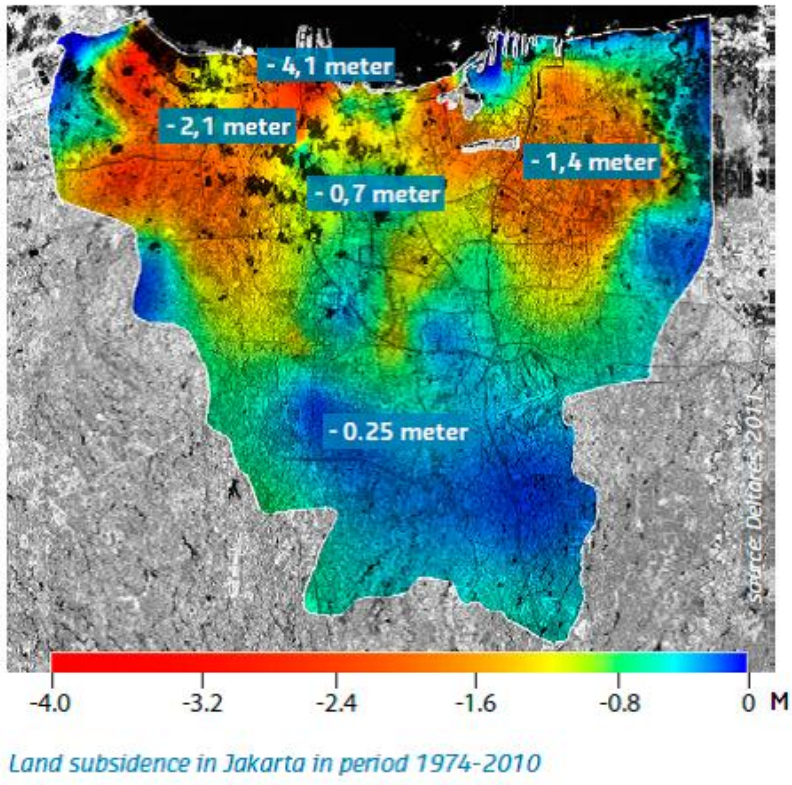


Human settlements (3)

- Groundwater withdrawal and surface drainage for urban development: resulting in land subsidence in Bangkok, Jakarta, Manila, Ho Chi Minh, Semarang, etc, increasing hazard exposure to coastal inundation and SLR.



(Deltares)

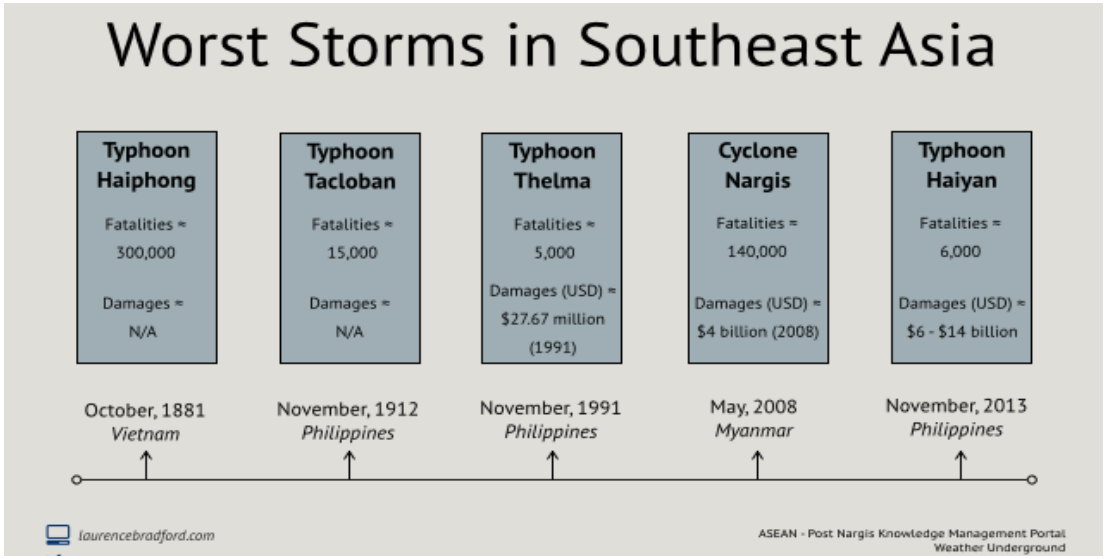


Land subsidence in Jakarta in period 1974-2010

(CCOP)

Human settlements (4)

- Tropical cyclones (typhoons) : (frequency and intensity of cyclones not fully known); storm surge sensitive to tropical cyclones; precipitation be more extensive where tropical cyclones make landfall.
  Monsoons : increases in precipitation extremes.



Adaptation options (1)

- Focus on solely adapting through physical infrastructure in urban areas requires complementary adapting planning, management, governance and institutional arrangements to deal with uncertainty and unprecedented challenges.
- Integrating DRR and CCA in urban development, urban planning.

Adaptation options (2)

Urban development	• Integrate flood risk management into spatial planning to protect groundwater recharge zones and floodplains • Adopt building codes and infrastructure standards to consider changes such as new flood return periods • Prepare disaster preparedness plans that consider disruptions to services • Develop measures that address the needs of vulnerable populations
Transport	• Redesign or relocate road facilities • Add or redesign protective measures for road corridors and coasts • Increase drainage for road facilities against projected increases in precipitation and erosion • Ensure road access to hospitals and evacuation centers and distribution of relief where road infrastructure may be damaged during extreme events

(ADB 2012)

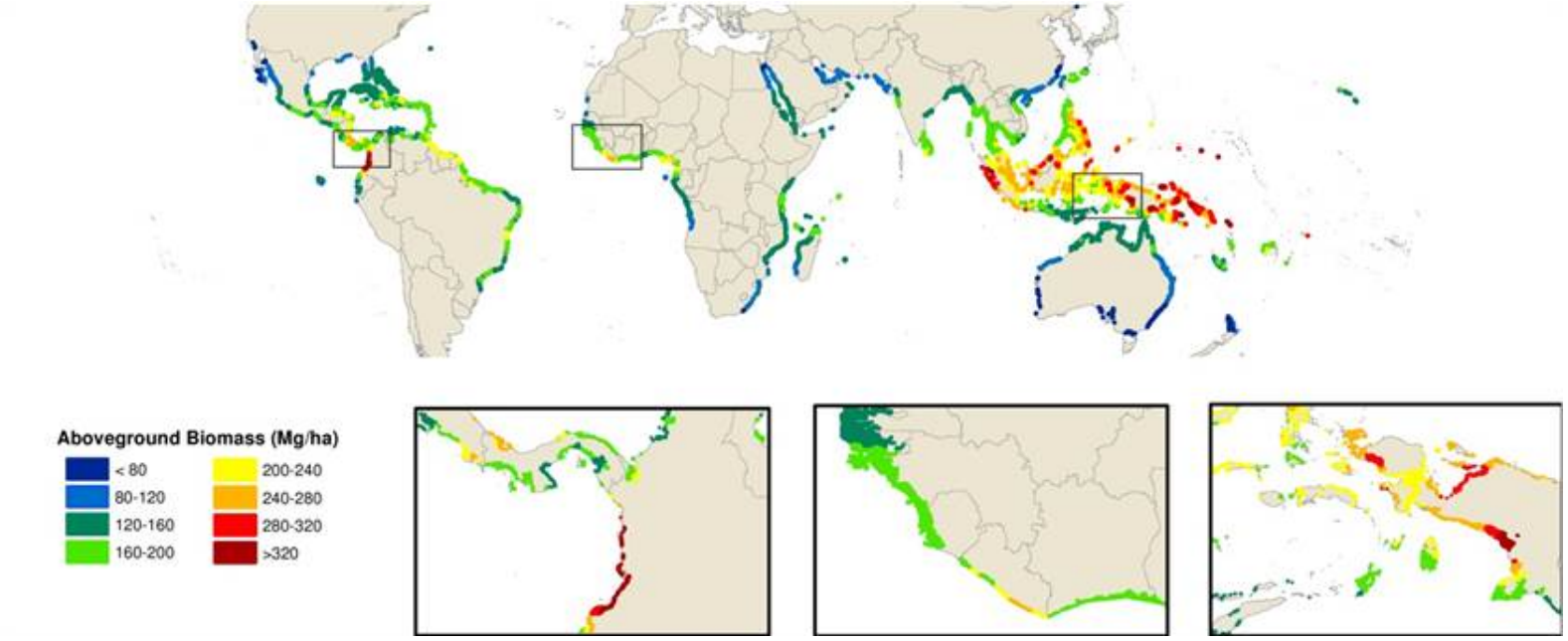
Adaptation options (3)

- Alleviate urban heat-island effect by greening areas
- Develop additional or redesigned urban drainage to alleviate the effects of increased precipitation
- Improve energy efficiency in buildings to reduce energy demand, especially where energy supply may be falling
- Reduce the need to travel

(ABD 2012)

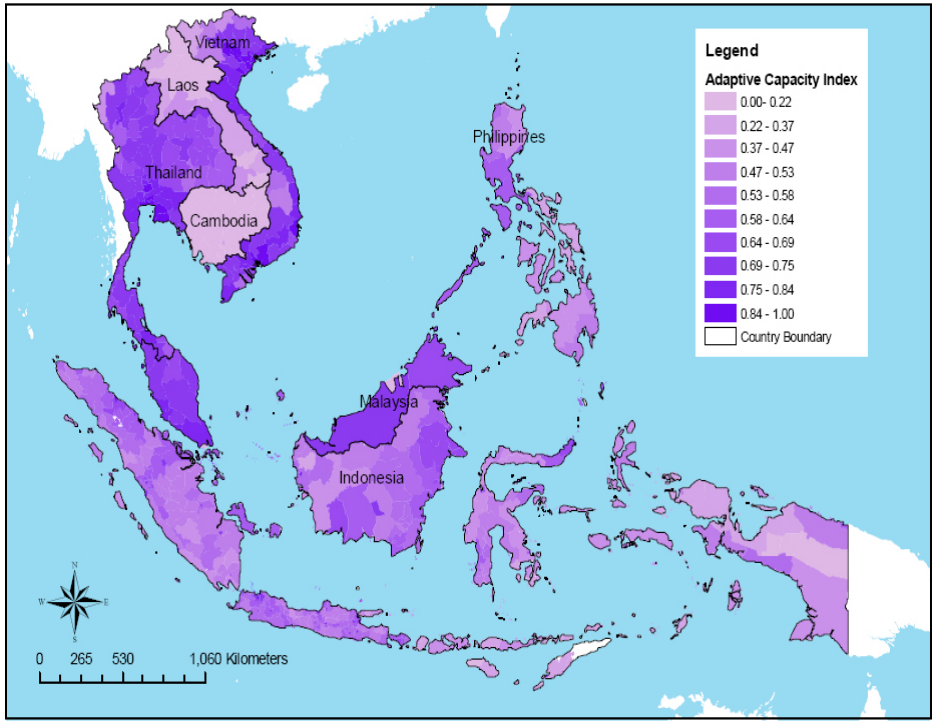
Adaptation & mitigation interactions

- Agroforestry practices : carbon storage, decrease soil erosion, increase resilience against floods, landslides and drought, biodiversity benefits, reduce financial impact of crop failure, etc.
- Very high carbon sequestration potential of organic-rich soils in mangroves and peat swamp forests.
- Sustainable cities with fewer fossil-fuel driven vehicles (mitigation) and more trees and greenery.



Conclusion

- Southeast Asia is third poorest performing region after Sub-Saharan Africa and Southern Asia in terms of the Human Development Indicators.
- Impacts on human security primarily manifest through impacts on water resources, agriculture, coastal areas, resource-dependent livelihoods, and urban settlements and infrastructure, with implications for human health and well-being.
- Adaptation options : variable; scope for adaptation and mitigation.



(EEPSEA 2009)

Thank you