Trend, Fact and Figures of climate change impacts to urban systems and functions

Kick-off Workshop on Mainstreaming Climate Change Adaption Planning in Human Settlements Sector

13 – 14 July 2017, Amari Watergate Hotel, Bangkok

Bach Tan Sinh (Ph.D)
National Institute for Science and Technology Policy and Strategy Studies

Climate Change/Extreme Weather Vulnerability and Risk Assessment

- We do not plan for climate change – we plan for *climate resilience* so that environmental, social and economic conditions are not at risk when climate changes

Challenges in planning for climate resilience

- Technical knowledge of climate change is necessary, but not sufficient to guide actions
- Climate experts cannot provide solutions: every department must take actions in their area of responsibility
- Solutions are NOT easily transferred from one location to another – each context is different
- Both climate knowledge and local knowledge are essential to practical actions

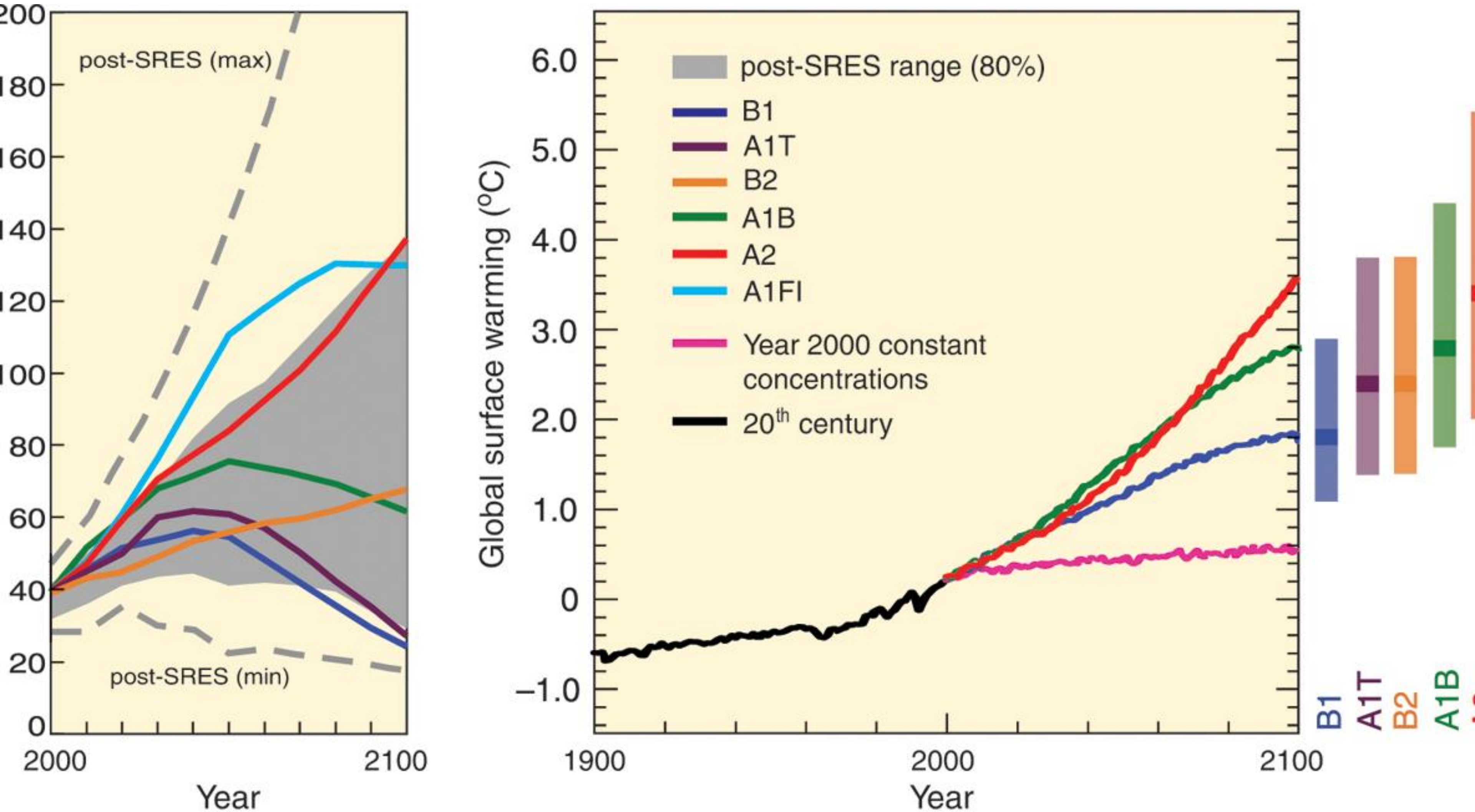
What do we mean by *resilience?*

'the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity of self-organization, and the capacity to adapt to stress and change.'

- IPCC

- Resilience means *change* and response in the face of new threats
- Requires learning from experience: don't make the same mistake again
- Adaptation: predict problems and avoid them. But this won't work if problems highly uncertain

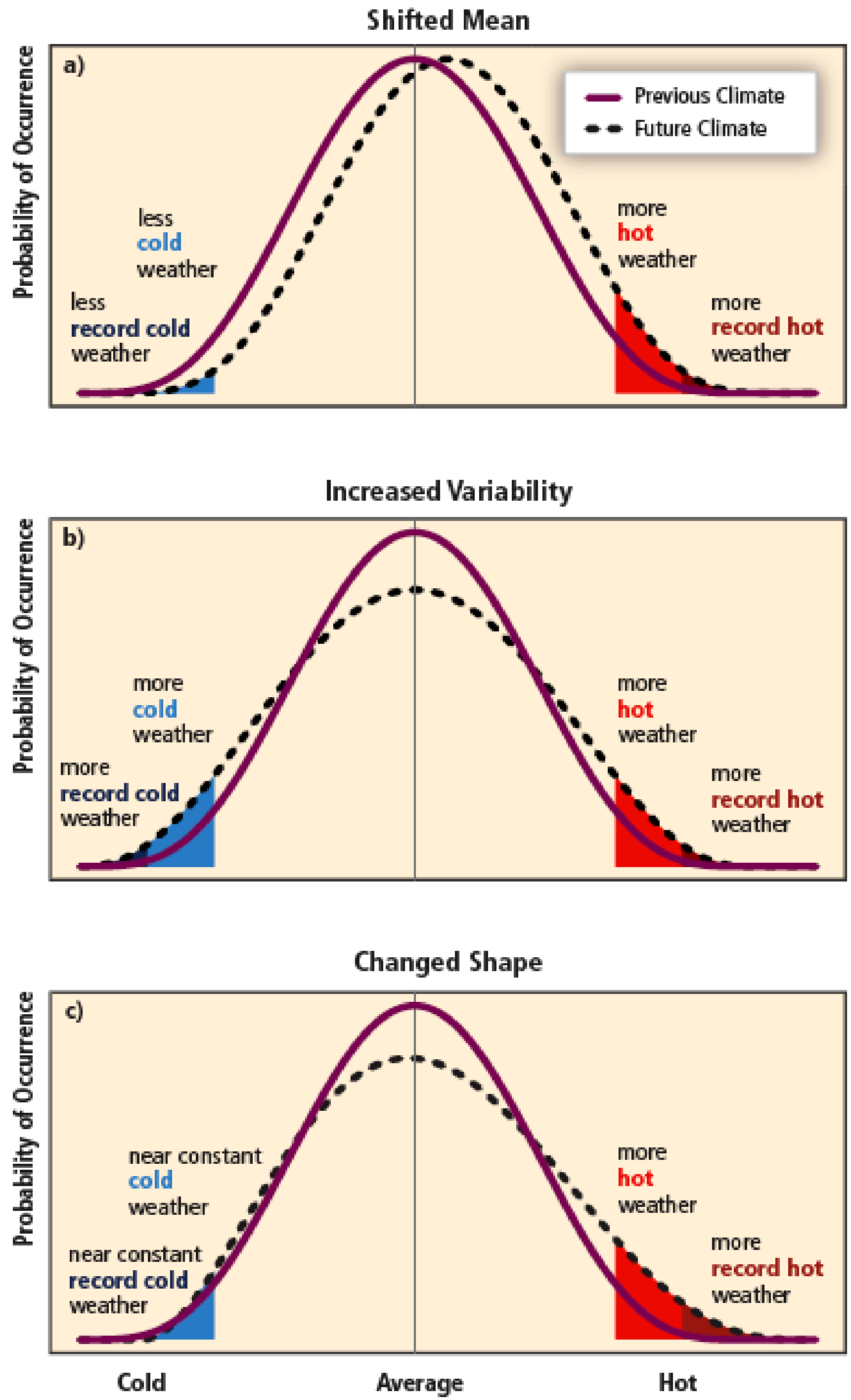
Why is planning for climate resilience difficult?



Why Resilience is Important: Extreme Events

- Climate models estimate mean conditions
- But extremes are highly uncertain, especially for precipitation
- Problem: we must plan for extremes

Charts: IPCC 2012, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation



Uncertainty of climate data

- Future climate data is generated by models that have many sources of uncertainty
- Science is changing as new knowledge available
- Models will generate statistical results which are useful as a *general* guideline, based on specific assumptions, but we cannot predict accurately
- Models are least reliable when it comes to extreme events, because these are rare and so there is not good historical data to calibrate the models
- Conclusion: climate projections about extreme events will always be highly uncertain. More detailed climate data cannot lead to better planning.

Climate: the future will not be like the past

- Climate change is accelerating
- Extreme events are increasing in frequency
- Variability is increasing (e.g. Supper Storm Sandy in NY in 2008)
- Need to make decisions that provide good outcomes under uncertainty
- Reduce vulnerabilities and build resilience
- These can be described as *robust decisions*

Prepare for Low probability / high consequence events

Must be able to say “No” to development in some areas

Super flood in Bangkok 2014

Super Storm Sandy in 2008

Key messages

- Climate change is accelerating everywhere
- Extreme events are increasing, but so is uncertainty
- Decisions based on historical conditions will create huge costs to private sector and to local government – threat to investment
- Build resilience through *robust decisions*: be prepared for low probability / high consequence

Urban Sustainability Features

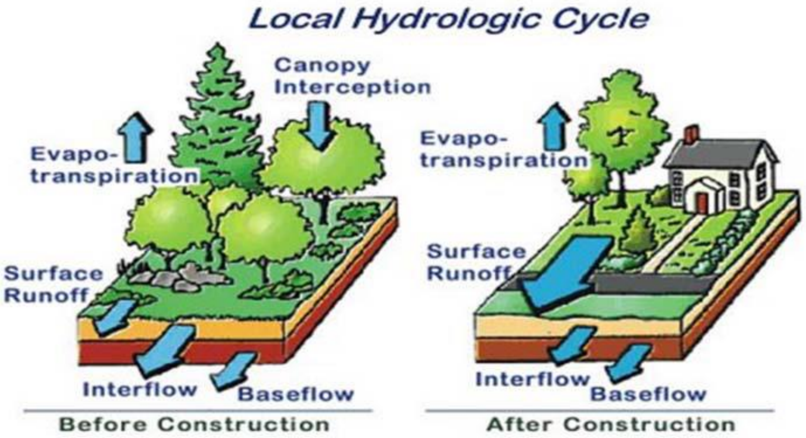
- **Reducing use of potable water**
- **Designing rainwater/ storm water to provide landscape amenity**
- **Using native/ adapted plants**

- **Reducing urban heat island effects**
- **Using recycled and regional materials**
- **Design for human health and well-being;**
- **Promoting sustainability awareness and education**

Trends in Urban Watersheds

- Increased storm water peak flow
- Increased storm water volume
- Higher contaminant content
- Reduced groundwater recharge

- Flooding
- Stream degradation
- Pollution of lakes



Storm water and Climate Change

- Changes in the amount, timing, and intensity of rain events in combination with land development can affect the amount of storm water runoff that needs to be controlled;
- The combination of climate and land use change may make existing storm water related flooding worse.

Impact on Existing Storm water Infrastructure (1)

- Climate change studies show that a large number of existing culvert will become undersized;
- One New England study showed that the number of undersized culverts from 29 to 100%;
- The study showed that the cost of Low Investment Development (LID) would be much smaller than replacing the pipes.

Impact on Existing Storm water Infrastructure (2)

- LID are designed for small storms;
- Larger areas would have to be converted to affect large storms;
- A realistic 2-3% of watershed used for LID showed that an increase of 9% in the 25 year flood could be mitigated

Low Impact Development (LID)

Low impact development (LID) is increasingly being adopted as an alternative to traditional water management system

Urban Green Solutions (1)

Rain garden-bioretention areas

Porous pavements

Urban Green Solutions (2)

Green roofs

Rainwater harvesting

Life-Cycle analysis of LID practices

- Very little studies done to assess Energy used and green house gases (GHG) emitted by LID construction;
- One study found reduction but less than expected. The study integrated LID in a street design that required more than typical material and equipment

Required Action at Municipal Level

- Increased runoff from urbanization and climate change can threaten both natural and built infrastructure;
- Planning decisions at municipal level should address design to account for these projections;
- Not preparing for climate change will increase risk of loss of life and property

Conclusions

- By definition LID will mitigate impact of climate change;
- Larger areas might need to be converted to LID to account for future storm and flooding frequencies;
- More studies need to be done to compare

life-cycle analysis of LID practices compared to conventional storm water systems

Drivers of the Urban Heat Island (1)

1. Loss of natural vegetation

2. Replacement of vegetation with impervious materials

Drivers of the Urban Heat Island (2)

3. Waste heat from vehicles, industry, A/C

4. Trapping of heat by building "canyons"

Health Threat

- Principal climate-related treat to human health;
- 1995 Chicago: 2 ½ days, 739 excess deaths
- 2003 Europe: 35,000-50,000 excess deaths over 3 weeks

Cook County morgue workers walk between a row of refrigerated trucks outside the morgue in July 1995, when a deadly heat wave struck Chicago. Photo: Mike Fisher/AP. NPR report 9/10/12, www.scpr.org.

References

- Climate Resilience and Adaptation Symposium. University of Texas at Arlington. 06 Feb 2015
- Tyler, S. 2015. Planning for Climate Change: Why we need a new Approach. Presentation at the workshop on Metrological and Climate Change Information in socio-economic development plan. Quy Nhon, Vietnam. 08 April.2015.

Thank you for your attention!

Email: sinhbt@gmail.com