Coastal Adaptation Working Group

ADAPTATION IN COASTAL SYSTEMS: RECONCILING UNCERTAINTY WITH COMPLEX SOCIO-ECOLOGICAL SYSTEMS

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NRC 2009: Decisions & Climate Change

- "*We're Not Ready*":
  - Governmental agencies, private institutions and individuals are *"conceptually and practically unprepared"* to either address the challenges or to capitalize on the opportunities presented by uncertain events.
- "*Stationarity is Dead*" (Milly et al., *Science* 2008):
  - Application of past climate information (and their associated probabilities of extreme events) are no longer valid for the design and implementation of infrastructure or societal policies such as zoning and transport.
- Climate change will create a *"novel and dynamic decision environment"*
  - A situation which demands a fundamentally different decision regime than the current, historically-focused methods.

National Research Council. 2009. Informing decisions in a changing climate. Washington DC: National Academies Press.

Current Methods of Dealing with Uncertainty

- *Beat it into submission*: Command & Control
- *Assume it away:* out of sight, out of mind.
- Seek "*spurious certitude"* (Gunderson,1999)
  - *"…to break a problem down into trivial questions spawning answers and policy actions that are unambiguously "correct", but, in the end, are either irrelevant or pathologic"*

Definitions & Concepts

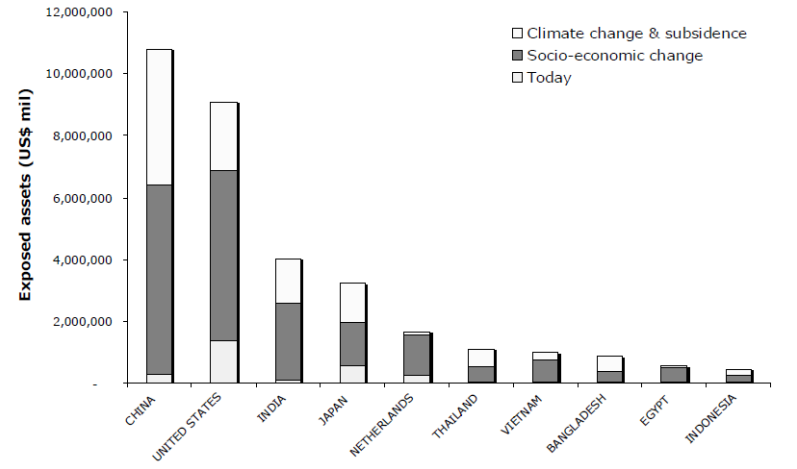
- Vulnerability as a function of *exposure & sensitivity*
- *Adaptive capacity* (Smit and Wandel, 2006)
  - social network stability , infrastructure robustness , ecological resilience
  - determinants being both local and regional
- *Maladaptation* actions that may give short term benefits to one group at the expense of larger society or other groups over the longer term

Climate Risk Drivers for Coastal Areas

Climate Change Impacts			Interacting Factors	
			Climate	Non-Climate
Sea Level Rise	Inundation	Elevated Extreme Water Levels	Wave/storm climate, erosion, sediment supply	Sediment supply, flood management, erosion, land reclamation, land use
		Backwater effect from rivers	Run-off	Catchment management and land use
	Morphological Change	Wetland loss (and change)	CO2 fertilisation of biomass production, sediment supply and migration space	Sediment supply, migration space, land reclamation (i.e. direct destruction)
		Erosion (of beaches and soft cliffs)	Sediment supply, wave/storm climate	Sediment supply
	Hydrological change	Saltwater intrusion (surface and groundwater)	Run-off/rainfall	Catchment/aquifer management (over-use), land-use
		Rising water tables/impeded drainage	Run-off/rainfall	Land-use, aquifer use, catchment management
Changes in storminess	Inundation	(as above)		
	Wind	Damage to buildings and infrastructure	n/a	Land-use and building standards
	Rainfall	Local flooding	Run-off	Land-use, catchment management and building standards

Table 1: Climate change-related drivers of risk in coastal regions (adapted from Parry et al. 2009)

Significant social assets are exposed



Parry, M., Arnell, N., Berry, P., Dodman, D., Fankhauser, S., Hope, C., Kovats, S., Nicholls, R., Satterthwaite, D., Tiffin, R. and Wheeler, T. 2009: Assessing the Costs of Adaptation to Climate Change: A Review of the UNFCCC and Other Recent Estimates. International Institute for Environment and Development and the Grantham Institute for Climate Change, Imperial College, London.

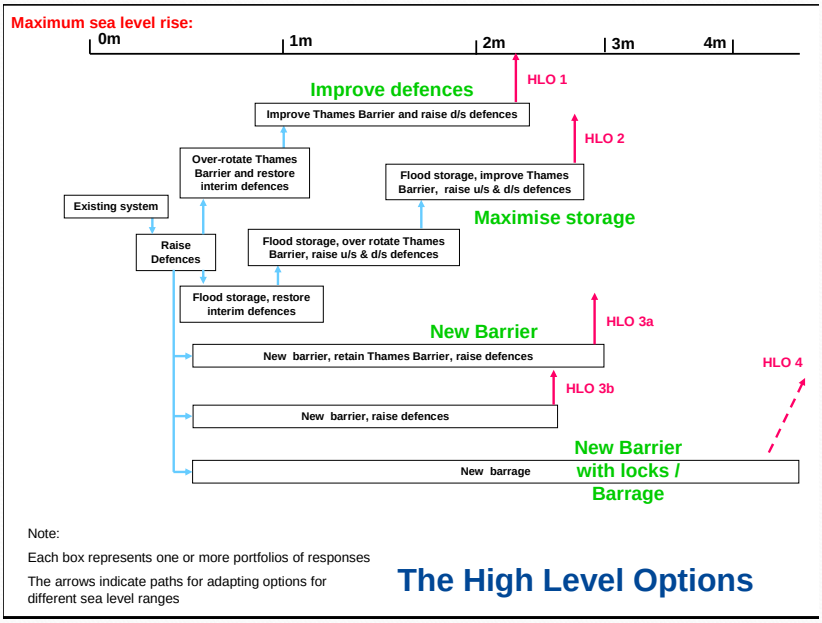
Adaptation: Options, Costs & Tools

- Planned adaptation events
  - Managing exposure
  - Accommodation
  - Protection
- Adaptation as a Decision Making Process
- Tools: Moving beyond *Mainstreaming*
  - Adaptive management
  - Evolutionary approaches
  - Identifying *critical transitions* (tipping points…) (Scheffer, 2009)

Thames 2100 Case Study

- Adequacy and options surrounding the Thames Barrier
- A large flood barrier that protects London from North Sea storm surges.
  - Built in response to the 1953 surge disaster
  - Designed to provide at least 1-in-1000 year standard of protection out to 2030.
  - Opened in 1984;
- Given this long lead-time experienced for planning and building (31 years), the Thames 2100 project was instigated in 2000.

Thames 2100 Case Study: Pathway Options to allow adaptation



New Thoughts:
Climate Change as a "*Black Swan*" Problem
(Taleb, 2007)

- The event is surprising (at least, to the observer).
- The event has major impacts.
- After the fact, the event is rationalized by hindsight, as if it had been expected.

BP Oil Spill Response and the Changing Climate Future: a flock of Black Swans?

- Who is in charge?
- What can/should be done before or after an event?
- The role of government/business?
- Adaptation? Restoration? Retribution?

Discussion for Working Group

- The "Best Possible Science" myth?
  - Embrace uncertainty and look evasive…
  - Ignore uncertainty and look incompetent when things change…
- Integration with socio-cultural issues is preliminary at best…
- *Policy Paradoxes* (Cortner & Moote, 1999)
  - expert and open decision making
  - Flexibility vs consistency
- Most coastal challenges are replete with uncertainties…
- The path forward
  - create favorable conditions for decision support and risk analysis tools
  - aid planners and participants in developing technically accurate and functionally efficient adaptation policies.