

## **Integrating Sea-Level Rise Adaptation into Planning policies in the Coastal Zone**



Victims of Hurricane Katrina in New Orleans,  
USA (Why files)



Coastal erosion in Ada, Ghana



Flooding in Tewkesbury, UK  
(Daily Mail)

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## **Overview**



1. Background information
2. Methodology
3. Sea Level Rise Adaptation Policies
4. Planning Policy in the Coastal Zone
5. Model for Integrating Climate Induced Sea-Level Rise Adaptation into Planning Policy in the Coastal Zone
6. Impacts of Adaptation Policies on Coastal Settlements
7. Conclusion

## Background Information



Inter-governmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) indicated that it is at least 90% certain that:

- Human emissions of greenhouse gases rather than natural variations are warming the planet's surface.
- Global temperature is likely to rise between 1.1°C and 6.4°C by 2099.
- Sea level likely to rise between 0.18m – 0.59m by 2099.



[www.ecofriendly.org](http://www.ecofriendly.org)



[www.japanfocus.org](http://www.japanfocus.org)

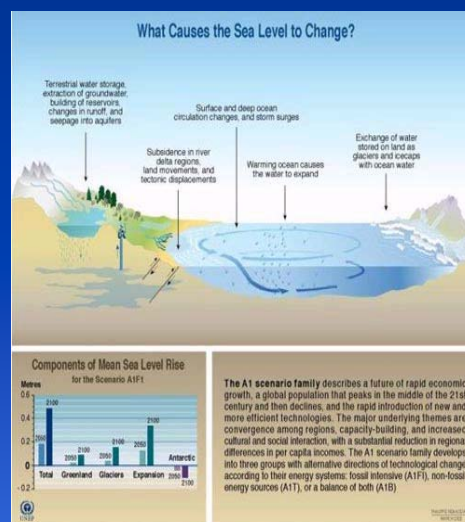


## Background Information



### Factors Responsible for Sea Level Change

- Eustatic movement of the sea level,
- Steric changes,
- Sedimentation and
- Tectonic movements (Bird, 2000)
- N/B This paper focuses on climate induced SLR because it has higher possibility for adaptation planning than the tectonic induced SLR.



## Background Information



Possible impacts of sea-level rise on the coastal zone are:

- ⦿ Increased inundation (flooding) of coastal lands
- ⦿ More frequent storm-surge flooding e.g Hurricane and Cyclones
- ⦿ Accelerated coastal erosion
- ⦿ Salt intrusion into fresh and groundwater sources thus reducing the supply of fresh water in coastal towns;
- ⦿ Altered hydrodynamic in estuaries and tidal river systems which may destroy estuarine ecosystems
- ⦿ Change in sedimentation patterns.

IPCC, (2007) sixty percent of the world's 39 metropolises with a population of over 5 million are located within 100km of the coast, including 12 of the world's 16 cities with populations greater than 10 million

Nicholls, et al (2007) acknowledged that most of the above possible impacts are already occurring.

## Background Information



Level of SLR impacts on countries

- ⦿ the nature of the coastline and the level of exposure (delta, marsh, estuary lowlands/uplands, soft geology/hard geology etc);
- ⦿ the nature and value of developments on vulnerable coastal lands;
- ⦿ the capacity and affordability to build defence and protection schemes;
- ⦿ the natural adaptive capacity of the coast;
- ⦿ adaptation planning and mitigation and
- ⦿ availability of cost effective sources of alternative supply of goods and services to the hinterland, landlocked countries in times of climate hazards.

# Background Information

Given all these what does the world have to do?



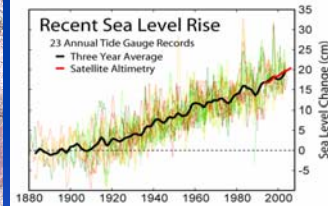
The science is not right don't worry about climate change, 2099? More time.



We don't have to wait, we might be taken by surprise. Lets plan for climate change adaptation now.



Hurricane Katrina (www.gemzies.com)

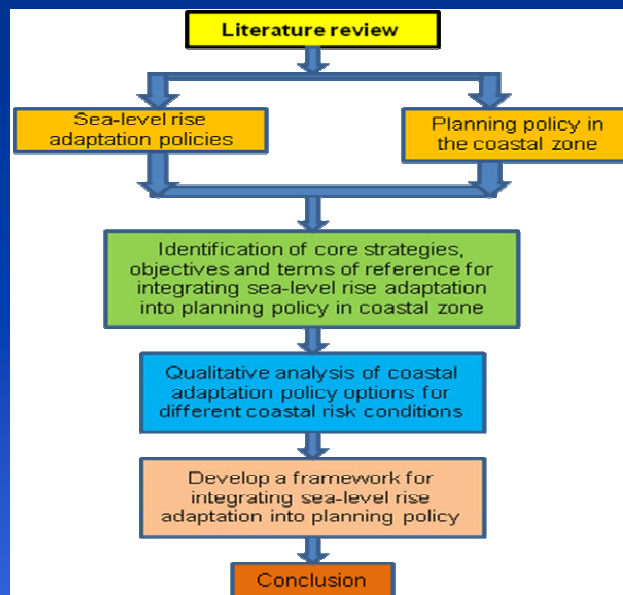


IPPC, (2001)



Flooding in Norton UK (BBC, 2007)

## METHODOLOGY



## SEA LEVEL RISE ADAPTATION POLICIES

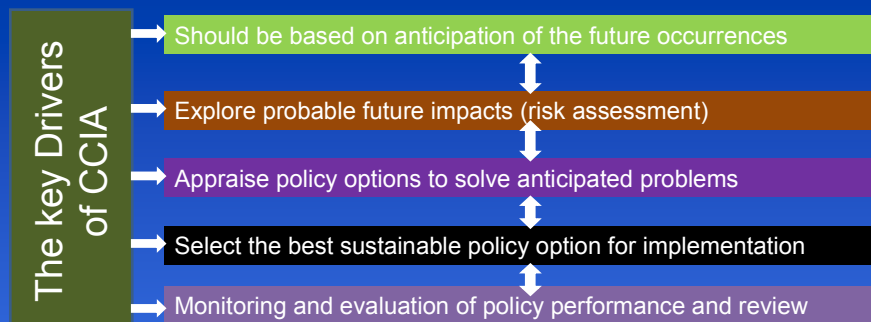
SLR ADAPTATION STRATEGIES	Policy	SOURCES
Sea-Level Rise Adaptation Objectives	<ul style="list-style-type: none"> <li>Prevent the loss</li> <li>Tolerate the loss</li> <li>Spread or share the loss</li> <li>Change the affected activity</li> <li>Change the location of the activity</li> </ul>	McCulloch, et al (2002)
Sea-Level Rise Adaptation planning process	<ul style="list-style-type: none"> <li>Information collection and awareness creation</li> <li>Planning and design</li> <li>Implementation</li> <li>Monitoring and</li> <li>Evaluation.</li> </ul>	Klein <i>et al.</i> (2000)
Sea-Level Rise Adaptation policy options	<ul style="list-style-type: none"> <li>Protection</li> <li>Accommodation</li> <li>Retreat</li> </ul> (or) <ul style="list-style-type: none"> <li>Hold the line</li> <li>Advance the line</li> <li>Managed Realignment</li> <li>No active intervention</li> </ul>	Biljsma <i>et al.</i> (1996) adopted by IPCC (2001) DEFRA (2006)
Basis for selection sea-level rise (SLR) adaptation policy option for implementation	<ul style="list-style-type: none"> <li>Risk/ hazard assessment</li> <li>Cost benefit analysis</li> <li>Local sea-level rise projections</li> <li>Appraisal of the SLR adaptation policy options base on adaptation objectives, natural vulnerability of the coast and human development.</li> </ul>	Walsh et al (2004)

## PLANNING POLICIES IN THE COASTAL ZONE

- Integrated Coastal Zone Management (ICZM)
- Environmental Impact Assessment (EIA)
- Sustainable Development

The next thing that is worth considering is

**Climate Change Impact Assessment (CCIA)**



## INTEGRATING CLIMATE CHANGE AND SEA-LEVEL RISE ADAPTATION INTO PLANNING POLICY IN THE COASTAL ZONE

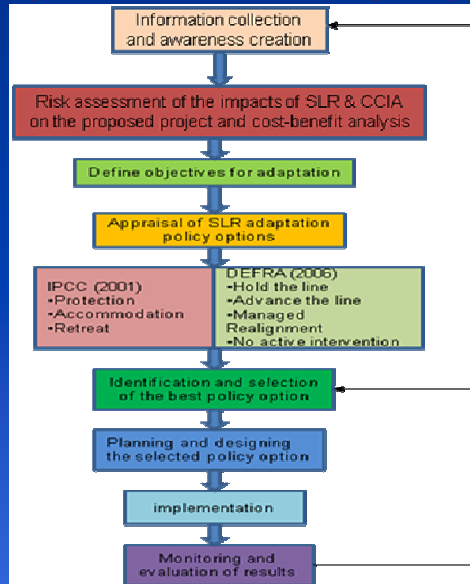
### Framework for Integrating SLR Adaptation into planning policy

Planning authorities need to answer two questions.

1. Does a project /development need EIA or not?

2. Does a project/development need CCIA or not?

If it does then the framework for integrating CC and SL adaptation into planning policy can be applied



## INTEGRATING CLIMATE CHANGE AND SEA-LEVEL RISE ADAPTATION INTO PLANNING POLICY IN THE COASTAL ZONE



Appraisal of the Policy option is crucial for successful adaptation planning



Source: after Crichton (2001)



## INTEGRATING CLIMATE CHANGE AND SEA-LEVEL RISE ADAPTATION INTO PLANNING POLICY IN THE COASTAL ZONE

### Appraisal of coastal adaptation policy options: human development

Impact /effects	Protection	Accommodation	Retreat
<b>Developed coastlines</b>	Must be protected if the cost of protection is less than the value of land and properties that would be lost as result of the impact.	Should be embraced if the soft defences recommended by accommodation can offer the necessary protection for life and properties	Should be considered only where the cost of protection far exceeds the value of vulnerable land and properties.
<b>Undeveloped coastline</b>	Allowing the natural processes to operate along an undeveloped coastline may be more economical than protection. Protection may be needed where allowing natural processes leads to severe contamination.	Accommodation may be ideal where the land is used for agricultural production and ecotourism.	This may be considered the best option for undeveloped coastlines, except where land is really scarce (small Islands) or the undeveloped land along the coast is earmarked for agricultural production.
<b>Where local economy and culture depend on coastal and marine resources</b>	Protection should be the best option if it will not lead to the destruction of the particular coastal resource supporting the economy (eg. beach)	This should be the best option as it will use soft approaches to maintain the natural resilience in order to keep the particular coastal or marine resource.	Retreat should not be an option, except where the local economy depends on ecotourism.
<b>Where local economy/culture does not depend on coastal and marine resources.</b>	This should not be considered, except where vulnerable land and properties are of higher value than the cost of protection (eg. small islands)	It should be possible to accommodate the impacts since residual impacts may not affect the local economy (none or less impact on local economy)	Should be possible to retreat, because the local economy may not be affected.

### Appraisal of coastal adaptation policy options: Natural coastal conditions

Impact /effects	Protection	Accommodation	Retreat
<b>Hard coastal geology</b>	This may not be beneficial since the natural conditions can withstand the impacts of sea level rise. Perhaps minor schemes like 'cliff toe' stabilisation may be necessary.	Natural conditions provide the necessary resilience for accommodation and there will not be the need to retreat. There may be the need for beach nourishment and rehabilitation of barriers against flooding.	There is no need for retreat since the hard geology can often withstand erosion and thus offer natural protection.
<b>Soft Coastal geology</b>	There is the need for protection since the natural resilience may not be enough to withstand the impacts of sea level rise. Where there is much rainfall and clay geology, cliff slumping may make protection difficult and expensive.	It may be very difficult to accommodate erosion and slumping of soft cliffs	The natural resilience is not strong enough to withstand the impact so retreat will lead to greater loss of land, properties and coastal infrastructure. Here retreat may not be the best option.
<b>Low coastline</b>	Protection against inundation and erosion will be required. Without protection against flooding, there will be increased intrusion of saltwater into aquifers, loss of beaches and wetlands.	It may be very difficult to accommodate inundation, erosion and reduction of freshwater supply.	This will allow wetlands and beaches to migrate inland and survive in the long-term but this implies loss of arable farmlands, low food production and high cost of resettlement and payment of compensations.
<b>High (cliff) coastline</b>	May require little protection in the form of cliff stabilisation and erosion but not protection against flooding.	High cliffs provide a natural protection against flooding, thus making accommodation possible.	Retreat may not be economical since the natural condition makes accommodation easy.

Hypothetical Appraisal of DEFRA's Strategic Coastal Defence Option			
Option	Appropriate for	Adopt Where	Notes
Hold the line	Existing development	Industrial or urban development present.	May also be appropriate for satellites or ribbon development, depending on value protected and cost of protection
	Infrastructure	Present and cannot be moved.	Coastal infrastructure is often sited to take advantage of the combined land and sea resource. Any impacts, particularly on the adjacent coast must be accounted for.
	Future planning allocation	Infrastructure or development planned which can justify the need for and cost of production.	Current planning guidance presumes against development in areas subject to coastal flooding or erosion.
	Conservation sites	Need for protection and positive benefit to the site, or a site exists as a consequence of the present "shoreline"	This needs careful consideration of how the site would evolve if it were reconnected or exposed to an open and active shoreline.
Advance the line.	Future planning allocation.	Development must use coastal frontage or requires direct access to sea.	Likely to have significant impact on remainder of management unit and adjacent units
	Advancing shoreline.	Coast is advancing and value of reclaimed land is greater than any protection costs and there is no attendant negative impact on adjacent coast.	Great care is needed to ensure that this is a long-term trend and that enclosing a sediment sink is not to the net detriment of the system.
Managed Realignment	Narrow coastal margin	Coast is defended and is retreating or steepening and there is room to allow set back of defences or remove landward constraint.	As coastal margins gets narrower (steepening beaches, loss of salt marsh etc) exposure increases and leads to more massive and expensive defences, and that justify the need to consider realigning of the shoreline.
No active intervention	Conservation sites	Protection is detrimental to conservation interests and could be improved by allowing natural processes to operate.	May need to be managed as a single, stepped or progressive change depending on the conservation interests
	Retreating shoreline	Foreshore is eroding and value of land lost is less than the cost of protection	For this to be a worthwhile option there should also be a nature conservation benefit or at least no loss.
	Mobile natural features	A feature moves with time, often in a cyclic pattern.	Providing room to move is particularly appropriate in the vicinity of spits, tidal inlets, estuary margins etc.

## IMPACTS OF ADAPTATION POLICIES ON COASTAL SETTLEMENTS



- Provide security for life and properties in the coast zone and sustain economic development
- Highly beneficial to developed countries eg. US, UK and the Netherlands due to high capacity for adaptation.
- Developing countries (in Africa Asia and America) are more vulnerable but have low adaptive capacity which must be improved.
- Adaptation plans should be developed and implemented sooner than later.

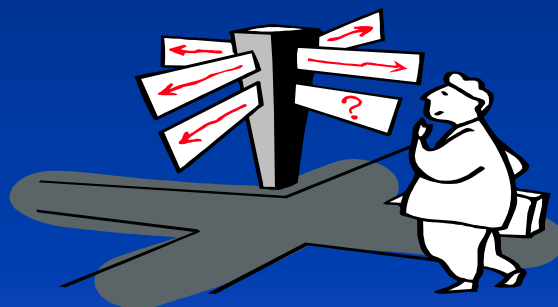


## Conclusion



- ◉ Climate induced SLR and its potential impacts on the coast is real and it is here with us today and tomorrow.
- ◉ Therefore, there is an urgent need for coastal communities to explore and develop sea level rise adaptation plan that could potentially offset some of the worst climate change problems.
- ◉ Effort should be made to support venerable coastal communities to build adaptive capacity especially, those in developing countries.
- ◉ Climate change and SLR adaptation planning cannot be dealt with in isolation due it complexities.
- ◉ SLR adaptation should be integrated into planning policy in the coastal zone.
- ◉ The framework for integration outlined in this presentation could be adapted in all coastal setting/environment though with some modification to make it compatible with the local institutional framework.
- ◉ Practitioners are welcome for further discussion and consultation on how to adapt the model.

Any Question?



Thank You