Coastal Planning and Mitigation Options to reduce Hazard Vulnerabilities, Hard and Soft options of Erosion Control and to Mitigate Storm Damage

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Outline

- Introduction: Ghana's shoreline
- Coastal erosion and assessments
- Causes of coastal erosion
- Impacts of coastal erosion
- Coastal erosion management options
- Conclusions/ Way forward

Ghana Coastal Zone

The geographical scope of Ghana's coastal zone formally includes a land area extending to the 30 meter contour, and a coastal offshore shelf area to the 100 fathom depth. As a proxy for watershed boundaries that might influence the coastal areas, a 'management zone' includes all areas at less than the 75 meter contour. These resultant physical boundaries help define a coastal zone that comprises 21coastal districts in Ghana's Western, Central, Greater Accra and Volta Regions. All of these coastal districts have at least some portion of their territories that is within the 30 meter contour, even though some do not have a coastline.



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Coastal erosion in Ghana

- Coastal erosion poses serious threat to life and properties along Ghana's coast. This is because major industries, urban settlements, livelihood sources, tourism and heritage sites, conservation sites, major transportation systems, etc. are located within the coastal zone.
- Coastal erosion is natural, but mere threat to human infrastructure produces response from property owners and

Coastal erosion assessments

- Results of the assessment indicate that coastal erosion is very substantial and wide spread along the coast, but the rate of recession varies across the entire coastline.
- Appeaning Addo et al. (2008)
 - Accra: -1.13 m/year
- Boateng (2012)
 - Keta to Old Ningo: -3.9 m/year
 - Tema port to Korle Lagoon: -2.7 m/year
 - Elmina to Takoradi Port: -1.6 m/year
 - Cape Three Point to Ankobra Estuary: 0.05 m/year
- Jonah *et al.* (2015)
 - Elmina, Cape Coast and Moree: -1.22 m/year

Projected future coastline positions show exposure of communities and assets to coastal flooding



Impacts of coastal erosion to coastal Ghana

- 1.Human settlements and infrastructure
- 2.Recreation and tourism
- 3. Water Resources
- 4. Fisheries and aquaculture
- 5.Agriculture and forestry
- 6.Human health
- 7.Nearshore and beach ecology (possible phase shifts)

Managing coastal erosion

- The complexity of the coastal erosion problem requires an equally complex solution
- Management strategies, both past and present, remain "ad hoc" and site specific.
- Planning for the future means understanding the causes and eliminating the human factors

Causes of Erosion

- Natural processes
- Human activities



Adapted from Cai et al. (2009)

Human-related Coastal Erosion factors

- River watershed changes
- Dam construction, eg. Akosombo dam
- Erosion mitigation measures
- Poor placement of coastal infrastructure
- Sand mining



Sand mining along Ghana's coast

- The most significant human-related erosion causal factor in Ghana.
- Sand is the first line of defense against tidal wave, storm and tidal surges
- Widely practiced along most sections of Ghana's coast



High Intensity of Beach sand mining activities



	Category		Nature	Sub-category
1.	Beach mining	sand	Commercial, in small to large scale	Tipper truck-based
				Non-tipper truck-based
				Manually transported
1.	Beach mining	gravel	Commercial, in small to large scale	
1.	Coastal quarry	stone	Commercial, in small to large scale	

Annual estimate of 285,376 cubic meters of sand exploited from six beaches by commercial sand miners from 6 sites in the Elmina, Cape Coast and Moree area (Jonah *et al.*, 2015)

Ineffectiveness of erosion mitigation measures if human activities are uncontrolled





Threat to fishery

• Threats to fish landing sites will remain if beach sand mining remains uncontrolled, eg. Biriwa





Expenditure on coastal defense structures



- ✓ It is quite futile for governments to spend huge sums of monies to protect the interest of coastal communities while allowing sand mining activities to still persist in other communities.
- ✓ Who then pays for coastal sea defense in communities that we have allowed beach sand mining to persist?



 Beach sand mining is practiced even along the reclaimed beaches of Ada Foah

Managing Coastal Erosion

 Coastal erosion is a complex problem that requires equally complex solutions, oftentimes requiring not only technological/engineering expertise but policy/regulatory interventions as well. 'Draft' Ghana National Environment Policy Coastal Erosion Management Activities

- Direct investment in control structures, e.g. Keta Sea Defence Project
- Gabions and boulder revetments to arrest erosion
- Mangrove replanting and planting of other vegetative cover, e.g. at Winneba
- Regulatory incentives fines for illegal mining
- Policy reforms in land use planning and coastal zone management

Coastal Erosion Management

Mitigation measures should aim at:

>minimizing beach erosion

>enforcing existing environmental laws

enacting and enforcing relevant bye laws that would protect and forestall further degradation of the environment and ecosystems.

Developing a Coastal Zone Management Plan for Ghana's coast

Coastal Erosion Management Options

- Four generic approaches often used:
 - Do nothing; (non-intervention or perhaps small-scale intervention to protect public health and safety)
 - Hold the existing defence line
 - Advance the existing defence line (reclamation)
 - Retreat the existing defence line

Mitigation options

Ideally, management would entail natural retreat, removing manmade structures to accommodate the dynamism of the shore; however, this is generally not possible. In such cases, coastal authorities intervene more actively using either:

- 'Soft' engineering solutions (nourishment) or
- 'Hard' armouring of the shoreline".

Hard engineering measures

• Vertical sea walls



Ineffectiveness of several hard engineering measures

Current Government sponsored sea defence wall at Elmina



Hard engineering measures

• Gabions



Anomabo Beach Resort

Hard engineering measures

 Groins (fences or walls generally perpendicular to the coastline, designed to intercept sand and gravel movement along the beach; constructed from timber, sheet piling, concrete or boulders.



Groins at Ada

 Rock armouring (the most common 'hard' defence; designed walls and revetments constructed of boulders of a uniform size)



Rock armouring at Elmina

Soft mitigation options

- Beach nourishment
 - Ada coastal defence works a hybrid of soft and hard engineering



Soft Mitigation Options

- Construction set back
 - Especially for undeveloped sections

Soft Mitigation Options

- Managed retreat
 - Eg. Ekumfi Immuna (The Immuna Project), Otrokpe, etc.



Soft Mitigation Options

 Managing beach sand mining activities in coastal communities.
➢ Make communities more resilient

Dune vegetation planting



Way forward – UCC's Centre for Coastal Management (CCM)

CCM is establishing an Environmental and GIS Data Hub:

- GIS and Remote Sensing Unit for Coastal Area Planning and Management
- FishCoM, Ghana Database on Fisheries and Coastal Management in Ghana

Conclusion

- Hard engineering solutions are useful but very expensive. They also impact coastal livelihoods. Local knowledge in support of soft measures are encouraged
- Sensitization of coastal communities including early warning systems and setbacks are encouraged
- Human activities e.g. sand winning should be discouraged to a large extent
- Government and non-government actors must commit to enforce low cost coastal adaptation and mitigative measures for coastal protection

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