

The vulnerable state of the Ghana coast: The case of Faana-Bortianor

Martin Oteng-Ababio

Department of Geography and Resource Development
University of Ghana
moababio@yahoo.com or moababio@ug.edu.gh

Kwadwo Owusu

Department of Geography and Resource Development
University of Ghana
kowusu@ug.edu.gh

Kwasi Appeaning Addo

Department of Oceanography and Fisheries
University of Ghana
appeaning@yahoo.com

ABSTRACT

Coastal communities worldwide are becoming increasingly vulnerable to a wide range of potential hazards including shoreline erosion and coastal resource degradation. The problem is exacerbated due to rapid urbanization and the concomitant anthropogenic beach changes which influence coastal processes. The lack of basic services and disaster warning as well as response mechanisms makes the situation daunting. Using mainly qualitative methods, which include two Focus Group Discussions and 17 in-depth interviews, the authors explore the perception of respondents in regard to coastal erosion and how to mitigate the observed condition. The research incorporates both physical and social science knowledge. Our key finding is that although the Faana coastline is eroding at a significantly high rate, residents are resolved to maintain their occupancy for as long as they have the opportunity to practise their trade. The authors argue that proactive measures can be taken to reduce vulnerability and provide the enabling conditions for communities to absorb and bounce back from disruptions in basic services and economic activities.

KEYWORDS

Coastal erosion, sea level rise, coastal management, Faana, Ghana

Introduction

The coastline of Ghana like many in the rest of the world has changed over the years in response to changes in the natural environment. Such changes have occurred over a wide range of temporal and spatial scales that reflect influences such as movement of the earth crust, and variations in sea level and climate. The physical shoreline change is also influenced by coastal engineering structures and other human activities. Although the coastal environment can retain some degree of natural character, increased human modification reduces the “naturalness”

(Dahm, 2000). Coastal erosion, which is a natural geomorphic process, becomes a hazard when it poses or is perceived to pose a threat to life and property (Ricketts, 1986).

Studies by Nail *et al.* (1993) identified twenty-four coastal erosion hot-spots in Ghana that need urgent attention. In the worse affected parts of Ghana near Keta, coastal erosion has persisted for over a century (NADMO, 2007). The historic rate of erosion was about four metres per annum (Ly, 1980) before the construction of the Keta Sea defence structures. The high rate of erosion is due to the shoreline's orientation and the damming of the Volta River. It is also reported that the erosion currently being experienced at the Prampram beach is the "end effect" of the breakwaters of the Tema Harbour (NADMO, 2007). Notwithstanding the above, the coastal environment continues to attract settlers not only for the aesthetic and recreational value, but also for the occupational opportunities and cultural values it provides.

According to Boateng (2006), most attempts at solving coastal erosion problems in Ghana have been based on ad hoc measures which have not been effective, hence the need to tackle the challenge in a holistic manner. The dilemma faced by governments is the lack of sufficient funding to protect the coastal communities or to completely relocate them. According to Appeaning Addo (2009), controlling coastal erosion using engineering interventions such as the construction of groynes as in Keta, only transfers the problem to the adjoining coastlines. In the case of the Keta Sea defence project, the problem of erosion has resurfaced between Horvi and Brekusu (NADMO, 2007; Oteng-Ababio, 2010b). Negative environmental outcomes also result from mitigation measures that adversely affect natural character such as revetment. Such 'hard' engineering approaches may succeed in controlling shoreline retreat and thus protect the coastal beachfront. However, the practices influence changes in geomorphic features along the adjoining shoreline.

'Soft' mitigation options, like dune re-vegetation or beach nourishment are deemed positive environmental outcomes because they do not reduce the public amenity value of the coast. In addition to buffering the sea front properties, the 'soft' engineering method enables continuous use of the beach for recreational purposes. Sand for such projects could be dredged from harbours or pumped from offshore sandbars (Schlacher *et al.*, 2007). However, the technique has several disadvantages and may not be effective after all. Dredging disrupts marine organisms and the sand of the right texture may be hard to come by. The replenished beaches are also short-lived. According to Flanagan (1993), more than \$5 million was spent replenishing the beach at Ocean City, New Jersey, in 1982. The beach disappeared within three months, after a series of northeasters (storms of speed exceeding 100km/h and accompanied by precipitation and lightning) hit the area. Similarly, a massive dredging project that cost more than \$17 million replenished eight kilometres of beaches along the San Diego coast in 2000. Within months, after the largest waves of the year pounded the coast, more than half of the sand was gone (Flanagan, 1993). Thus the choice of mitigation strategy obviously has important social, cultural, aesthetic and economic impacts.

In this paper, the authors explore relocation as a viable alternative to either using "hard" or "soft" engineering measures to control coastal erosion along the Faana coast in Ghana, despite

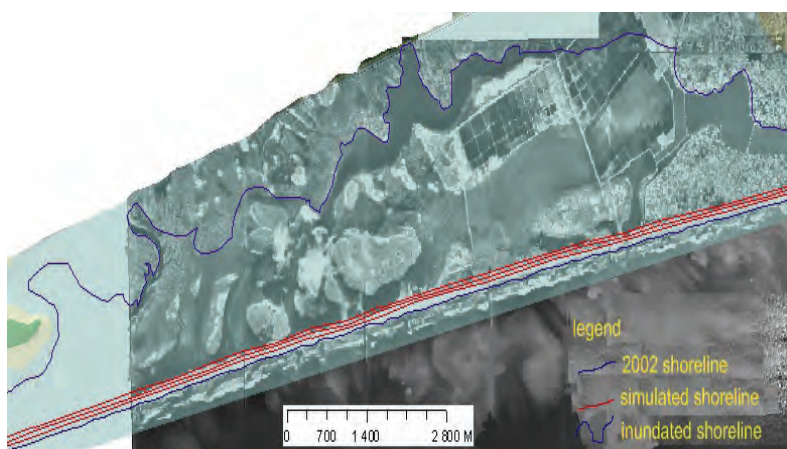
the fact that this approach has not been effectively adopted in Ghana. The study explores the Faana coastal community's perceptions of the coastal erosion and how the situation can be managed to help maintain the "natural character" of the environment.

Background – The evolution of the Faana shoreline

The coastline of Ghana is approximately 550km long. The zone is generally described as low lying and below the 30m contour above sea level, thus making it prone to erosion. Its vulnerability to erosion is further heightened by its zonal orientation and the fact that it is an open coast that enables swell waves to break obliquely to the shoreline, generating long shore currents that carry sediment alongshore (Armah, 1991). The coastal communities in Ghana are mostly permanent indigenous settlements, many of which are centuries old. The settlers live and permanently earn their livelihood at these settlements. In recent years, private property developers, both foreign and local, have also acquired land along the coast for residential and commercial purposes. This, in a way, compounds the challenges of coastal erosion as mobility of the indigenes becomes restricted.

Coastal erosion affects the social and economic life of the local population, threatens the cultural heritage and hinders coastal tourism development. In the western part of the Accra coast, 17 coastal inhabitants have lost their buildings to coastal erosion over a 26-year period (Campbell, 2006). Additionally, coastal retreat has also eroded natural fish landing sites and degraded the coastal environment. The historic rate of erosion along Ghana's Accra coast is 1.13 ± 0.17 m/yr (Appeaning Addo *et al.*, 2008). However, the specific rate of erosion at Faana is about 1.30 ± 0.17 m/yr (Appeaning Addo, 2009), which is relatively higher. A model simulation by Appeaning Addo *et al.* (2008) under scenarios of climate change indicates that coastal erosion at Faana may be severe in the future and that the sandbar that separates the sea from the Sakumo wetlands will be breached between 2052 and 2082. Figure 1 shows a 20-year stage shoreline position in the western part of Accra (Faana).

Figure 1. 20-year stage shoreline position in the western part of Accra (Faana)



Source: Appeaning Addo et al., 2008

Various reasons have been assigned to explain the relatively high rate of erosion in Faana. Firstly, according to Appeaning Addo *et al.* (2008), the coastal erosion in Faana is a result of the dam constructed over the Densu River and the Kokrobite irrigation scheme. Additionally, the unique orientation of the shoreline (approximately east-west direction) enables incident waves to break obliquely and generate long shore currents that facilitate littoral drift, while sea level rise influences tidal current effectiveness. Other anthropogenic activities like sand mining have also reduced the sediment supply to the littoral zone that has resulted in an imbalance in the sediment budget. Meanwhile the breaching of the barrier ridge will result in flooding of the wetlands although the presence of relatively high hinterlands may prevent inundation further inland.

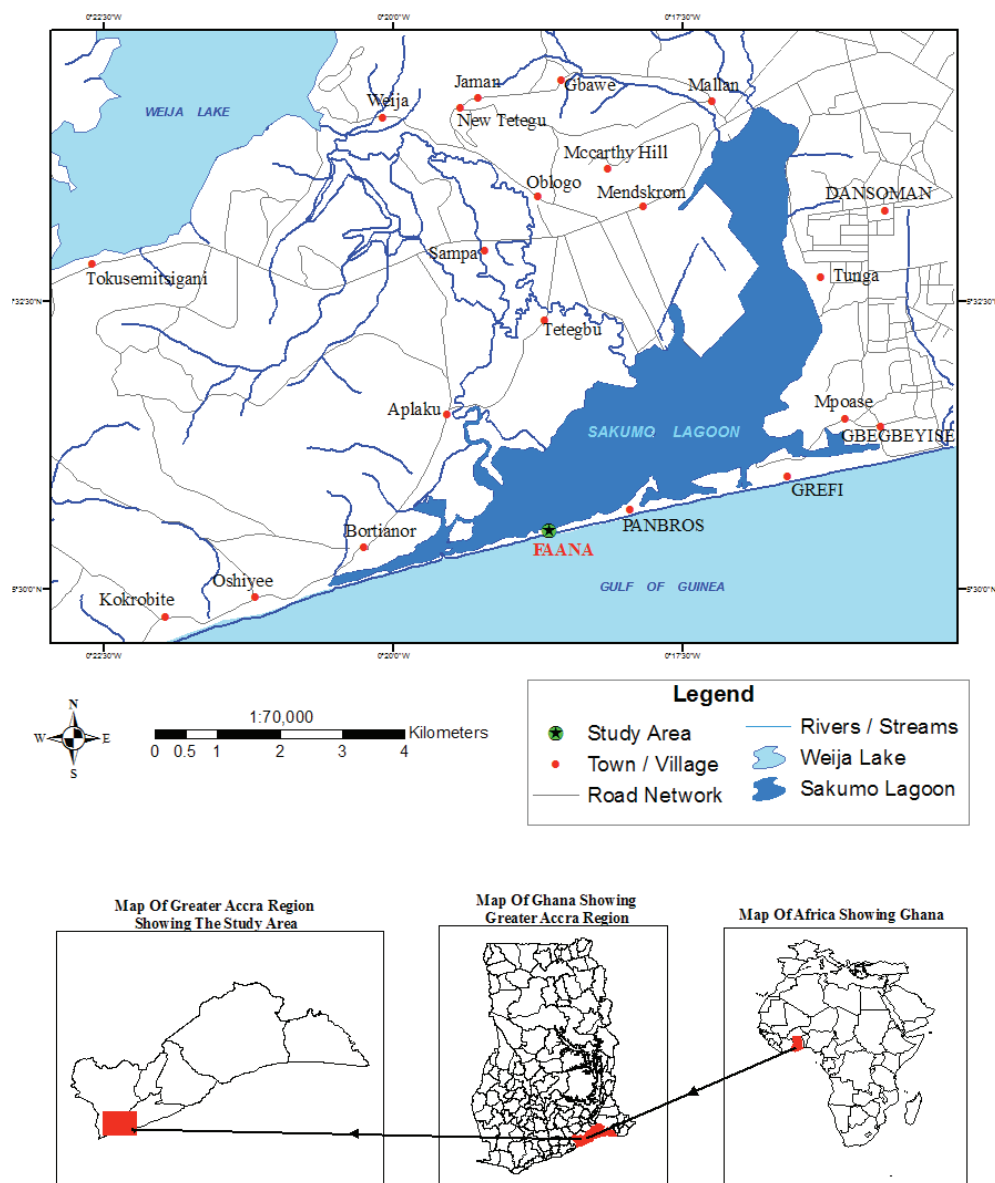
At Faana, the local community has improvised the use of 'solid waste' and other organic material as a barrier along the shoreline, although the effectiveness of such mechanism appears very insignificant. Meanwhile, apart from the fact that the coastline is condemned to extinction, the low elevation of the Faana coastal environment makes the use of engineering techniques in controlling the current erosion doubtful and inappropriate. Indeed, the construction of coastal structures will affect the natural fish landing sites and collapse the local fishing industry. The residents' perception or belief that they experience strong destructive waves only when the sea is disturbed, i.e. if someone dies in the sea, has also affected their understanding of the phenomena and thus negatively influenced their preference for hard engineering defence structures.

In the circumstances, it appears relocation is the preferred alternative solution to this coastal settlement that is on the brink of collapsing. Relocation, if well coordinated, can be executed with limited funds compared with the capital intensive engineering methods, and can also preserve the livelihood of the people. In as much as it may be painful, development planners are beginning to view relocation or 'strategic retreat' from the shoreline as a necessary option.

The study area

Faana was selected as the study area on the basis of three main criteria. Firstly, the community has in recent times been experiencing a beach erosion problem which threatens local properties (Cambell, 2006). Secondly, a body of scientific knowledge about the behaviour of the beach system has been built up over time. Finally, a history of community action and past decisions is available through key informants but there is a lack of knowledge about the social dynamics of the problem. Faana is a small fishing community located at latitude 5.3180° N and longitude 0.10010° W along the Gulf of Guinea. The community, which is closer to Bortianor, is bounded on the north by the Sakumo lagoon and on the south by the Gulf of Guinea. Figure 2 shows the location of Faana. The community is located on the barrier ridge separating the Sakumo Lagoon from the sea. The geology consists of poorly consolidated rocks (Muff & Efa, 2006).

Figure 2. The study area



Source: Appeaning Addo *et al.*, 2009

The community (see Fig. 3) is accessible by paddled canoes, which take between 20-30 minutes from Bortianor and the coast is characterized by a gently sloping shoreline. The significant wave height for 50 percent of the time is about 1.4 m, the period is between 10 to 15 seconds and spring high tide is about 1.26 m (Appeaning Addo *et al.*, 2008). Historically, sea level rise in Ghana, which is in conformity with global trends, is estimated at about 2 mm/yr (Ibé & Quélennac, 1989; Armah *et al.*, 2005; Appeaning Addo *et al.*, 2008).

Figure 3. *An overview of Faana Community*



Source: Field survey, May 2010.

The population of Faana, estimated to be between 800-1200, consists mostly of migrant fishermen from the Volta Region of Ghana. The majority of the population (over two-thirds) are made up of women and children. The main economic activity in the community is fishing and it is the main source of livelihood for the entire community. While the men are engaged in “corporate fishing”, the women work as fishmongers and provide other retail supporting services (selling of drinks, cigarettes, food, etc). Most of the children provide fishing assistance to their parents, including the mending of torn nets.

From the interview with the settlers, it emerged that few of the children in the village attend formal schools. This could probably be as a result of a lack of educational facilities within the settlement and the fact that prospective pupils would have to commute daily between Faana and Bortianor (the immediate settlement with an educational facility) by boat. During the survey period, a school-going pupil was sighted loitering in his school uniform during school hours. In terms of local governance, the community has an elected leader who is also the local representative at the District Assembly. He also doubles as the representative of the land owners. With regard to infrastructure, Faana is deprived of almost all forms of basic socio-economic infrastructure such as electricity, potable drinking water, waste disposal site, clinic and market.

The only facility sighted is a two-seater Kumasi Ventilated Indirect Pit Latrine (KVIP - a local variant on the internationally-used VIP toilet) built by an NGO but since abandoned because residents detested the idea of carrying water to the facility whenever one intends to use it. Instead, the residents prefer the use of the seashore as place of convenience whilst solid waste is disposed along the beach. Almost all the community members live in structures built with thatch while the few affluent ones use timber. Residents access facilities like drinking water,

Figure 4. *Women and children carting drinking water from Bortianor to Faana*



Source: Field survey, May 2010.

Figure 5. *A local “Pharmacy Shop” at Faana*



Source: Field survey, May 2010.

schools, clinics and markets daily at Bortianor and beyond via canoes. Fig. 4 shows a boat owner transporting women and children to Faana (for a fee) after they had collected drinking water from Botianor. The team also sighted a local pharmacy outlet (see Fig. 5) where residents can access first aid medication like paracetamol and a few antibiotics.

Data and methods

The study made use of both primary and secondary data sources. As a starting point, there was a review of the available literature on coastal erosion. Secondary data were collected, analyzed and reviewed. These included relevant academic articles, books, newspapers, magazines and reports of previous studies. This process was limited by the reluctance on the part of some public servants to make available certain official documents, because of the State Secrets Act 101 of 1962 and the Government Servants Conduct Rules of 1979 which bind bureaucrats to an oath of secrecy. Notwithstanding these forms of administrative rigidity and restrictions, the available reports were accessed and thoroughly reviewed.

This case study research is intended to shed light on key factors shaping environmental outcomes based on participants' experiences in making decisions to manage the situation. Interviewees were selected to represent the array of stakeholders and interests involved in or familiar with negotiating the outcome, and included representatives from the Local Authority, National Disaster Management Organisation (NADMO), the Environmental Protection Agency (EPA), Town and Country Planning, the Traditional Authority, and the local Assembly member. Additionally, the Head of the fishermen's association and the leader of the fishmongers retailing group were also interviewed. Finally, two youths, one a 'truant' school boy and the other, a school drop-out (both aged below 18) were contacted. In all, seventeen (17) key stakeholders were interviewed.

In assessing the residents' perceptions about the coastal erosion and their coping strategies, the study adopted focus groups in the collection of the primary data. This method was deemed appropriate because, according to Ulin *et al.* (2005), group interviewing is most appropriate when the research aims to explore attitudes or reactions of a group or community in response to some commonly experienced aspect of their environment. Such a technique allows the participants to candidly offer insights on the perspectives of the community, revealing clues to the social contexts that shape their opinions (Scammell & Dearry, 1997; Scammell *et al.*, 2009).

In the service of addressing the objectives set, two separate focus group discussions were conducted; the first group consisted mainly of the resident migrant fisherfolk mainly from the Volta region of Ghana. They have almost similar socio-economic demographics (aged between 35 and 65, with at best an elementary level of education and married with a household size of not less than 5). They have lived (as caretakers) and worked on the land for and on behalf of the landowners for decades. During the second group discussion, the absentee traditional landowners and the fetish priest who superintends the activities on the land were invited to participate. This strategy was adopted because it was more likely to generate more free and open discussion. Both groups exhibited higher historical knowledge about the area.

Apart from the traditional landowners and the fetish priest, the other participants in the two discussions were randomly but purposively selected (non-probability) from among the residents with the assistance of the Assemblyman of the area. To facilitate a dynamic interaction between the participants, the first group consisted of nine people while the second group attracted

eleven participants. For eligibility purposes, persons under age 18 or living less than five years in the area were deemed ineligible because such persons were considered to be restricted with regard to authentic local oral history. The list of participants was made up overwhelmingly of migrants and was male dominated. This was because the residents were mostly (90%) migrants while the fishing activity is mainly male dominated. Additionally, most of the females were reluctant to participate in the discussion with their husbands.

The choice of the venue for the focus group was mainly informed by the safety, familiarity, accessibility, comfort and convenience of participants and in both instances steps were taken to ensure the privacy of participants. Both focus groups were conducted using a questionnaire guide which sought to explore participants' knowledge, perceptions and coping strategies in facing the fast eroding beach. For tactical reasons, the initial questions were broad, general and open-ended. Once it became apparent that participants were comfortable speaking candidly, questions became narrower and more focused, after they had been briefed about the likelihood of the beach being completely washed away. This was purposefully done to help stimulate the discussion. All proceedings which were in the local Ga language were recorded, later transcribed, translated into English and analyzed. This paper provides a succinct overview of the case study and then presents a synthesis of the key factors influencing the final environmental outcome. Although every effort has been made to avoid identifying interviewees, the circumstances and nature of the information provided may result in their identity being apparent to some. All those interviewed found this acceptable.

Results and discussion

Over the years, coastal erosion has been a major problem to settlements along the coast. In the case of Ghana, these problems are more or less seasonal, and intensify during periods of high tides usually between July and August. This period is not only characterised by displacement of settlements but also affects the major economic activity (fishing) of the people through the flooding of the natural fishing landing sites.

Risk perception of coastal erosion in Faana

In order to assess the knowledge and level of awareness of residents of Faana about the problem of coastal erosion and how they are coping with the menace, a series of focus group discussions were conducted. During the discussions participants were asked if they were aware of erosion in their coast land. Further questions were asked about when such an event becomes quite noticeable and what their future plans are regarding the phenomenon. The results of the analysis show that all the participants are aware of the "devastating" effects of the erosion.

They unanimously indicated that the problems associated with coastal erosion became apparent about fifty years ago and since then it has been a cyclical annual affair which intensifies during July and August. They added that the process has resulted in the continuous reduction in the stretch of land. One participant was even of the opinion that "at the end of each year, the sea takes away about a foot of the land". Most significantly, they intimated, *"It is the sea that has consumed all our block houses, to the extent that today we have to use thatch in building. At times,*

the waves are too severe that the whole area gets flooded. Sometimes, we have to temporarily relocate till the waves recede before returning. There are times you get up in mornings only to find out that your room is flooded”.

With regard to the possible causes of the erosion, participants attributed it to natural factors which in their estimation affect every coastal settlement. They however noted that the situation becomes severe when the “sea is disturbed”. According to them the “sea is disturbed” when somebody dies in the sea or defies the traditional norms governing its use. It was for example, revealed that it is a taboo to fish in the sea on Tuesdays and this is to be respected by all without any compromise. According to them, the residents thus incur the wrath of the sea once this norm is disrespected, a traditional belief which until recently has been used to harmonise effectively a man’s relationship with his ecosystem. Concerning the consequence of the periodic erosion in the area, the ‘Chief’ of the community intimated that *“The periodic loss of structures and belongings has contributed to the increasing number of forced migrants in the community. During periods of such severe tides, many of our youth return home (in the Volta region) but some always fail to return when things have normalised. Some also find solace in living and doing menial jobs in Accra, thereby compromising their future. We lose at least 50 young men annually through such distress situations and this has serious consequences on the future of our profession”.*

A few dissenting views were however noticed during the second group discussions, on the reason why the youth are leaving the settlement. According to this dissenting school of thought, mainly the landowners, the youth are migrating because of the lack of social infrastructure in the town. They were of the opinion that *“This town is deprived of all basic infrastructure. There are no schools, place of convenience, clinic, social amenities etc. The boys and girls will have to ferry drinking water from a nearby settlement daily while the very few school-going children do the same. Both men and women openly and jointly use the sea shore as place of convenience. These conditions cannot put the youthful exuberant tendencies in them in check hence their experimental trips to the cities”.*

Asked whether there has been any government intervention or a proposition ever since the problem became apparent, all the participants in both discussions unanimously responded in the negative. The participants observed; *“At the national level, nothing has been done to mitigate the problem. Nobody has ever stepped here, not even the District Chief Executive. The only person who visited here was the Member of Parliament during the periods close to the general elections and I sincerely believe that she will be here again when the next election is due”.*

Coping strategies of the community

In the absence of clear-cut government plans and policies to address these problems, the communities have adopted some coping strategies which are informed by their knowledge and awareness about the dynamics of ocean tides. First, their residential structures are mainly built with thatch which is seen as very cost effective. The participants noted that they had to stop using sand-crate blocks because of the strong tidal waves, which also facilitate corrosion of the blocks. This is also due to the loss of structures associated with occasional relocation when

there are high tidal waves. Secondly, to avoid occasional unexpected flooding at night, residents have to mount their beds higher above the ground. It is also a common practice in the neighbourhood to see most structures being anchored with ropes.

Another common coping strategy among residents is the use of solid waste and tree branches to serve as sediment entrapment. It was observed during the field study that, at the backyard of every structure, is a pile of rubbish, a mechanism to reduce the landward limits of the high tides. Similarly, they have deliberately raised the level of the sea shore to prevent the ocean tides from overflowing the banks of the shore. The community also has a mechanism by which an outlet is opened to enable the water to rejoin the sea to avoid flooding, when they realise that the level of the lagoon has reached an alarming proportion.

The community also has a strong social network that has helped them withstand the atrocities of the sea till the present. The community is united by tribe and profession (fishing). As already stated, most of the settlers are from the Volta Region which shares similar socio-cultural characteristics and practices. The language, dietary pattern and cultural values are virtually identical. In terms of their profession, these migrants (settlers) are all fishermen while their spouses are also engaged in fishing-related activities. Indeed, the men engage in group fishing (corporate fishing) while the group leaders keep the proceeds until an agreed period when all the proceeds accumulated over the period are shared among members. This has made each member of the community become his brother's keeper, thus it is not uncommon to see the whole community wholeheartedly rushing to the aid of a distressed colleague.

Is relocation or reconstruction an option?

Participants were asked to suggest a preferred solution which in their view could help solve or mitigate the problem. The results show that residents are not in favour of any possibility of the government or a Non-Governmental Organisation (NGO) constructing a sea defence wall. According to them, the construction of a sea defence wall is incompatible with the fishing profession and will deny them their fishing expeditions, which are their major source of livelihood. They also displayed their displeasure at any relocation option.

The few who demonstrated some willingness to relocate, however, mentioned some conditions: *"we will choose relocation as an alternative, only if any planned defence infrastructures will enable us to come back to fish, perform our annual rituals and of course, with some monetary compensation"*. By implication, relocation will not only be difficult but in terms of current community knowledge and appreciation a very remote possibility. In their considered opinion, "continuous traditional sacrifices to our gods will stand between us and the continuous erosion of our sea shore".

From the foregoing it is clear that the existence of the community is dependent on the accessibility to fishing, which is the major source of livelihood. Additionally, local knowledge and awareness about the dynamics of the ocean tides inform their coping strategies. Responses from the residents indicate that, as long as the above conditions exist, they will continue to manage their stay at the present location. The authors acknowledge that the low representation of women and children less than 18 years as well as the exclusion of the newly arrived residents

could in some geographical settings potentially bias the data and possibly the conclusions. However, within this traditional setting where the views of the elderly and men in particular reign supreme, and within the limit of the current data collected, the conclusions reached are legitimate.

Summary and conclusion

Coastal erosion, exemplified in this study, is a natural process; however, it may become a problem when exacerbated by human activities or natural hazards. It is widespread in the coastal zone of Accra and indeed coastal Ghana owing to a combination of various natural forces, population growth and unmanaged economic activities. This has necessitated major efforts to manage the situation and to restore the ability of the coast to accommodate short and long-term changes induced by human activities, extreme events and sea-level rise.

Disputes over how to address such coastal erosion are frequently emotional and contentious because of the values and interests associated with the coastal environment and the distribution of costs and benefits generated by different management strategies. We argued that environmental outcomes as a result of a coastal erosion event which impact negatively on private or community assets are influenced by who is involved in negotiating solutions and how contending interests are reconciled, how resource management agencies behave and the nature of the physical coastal environment.

We were further of the opinion that generally, a co-operative relationship between local authorities, technical experts and communities through facilitated discussion, learning, information exchange and resolution of conflicting values and interests leads to a positive environmental outcome. It is also argued that the absence of such a consensus gives birth to independent action by individuals or community groups. For an environmentally harmonious relationship, it is important to ensure that all interests are represented in the decision-making process and that power differences are addressed to avoid capture of the process by a group with narrow interests that conflict with community interests. This may mean incorporating interests beyond the immediately impacted community.

To ensure a sustainable outcome, the local authority which most invariably is the lead agency in such negotiations, ought to have a clear understanding of the scientific and historical (traditional) information relevant to an event and this provides a good basis for beginning negotiations with stakeholders over potential options. Although there is an obvious discrepancy between residents' lay knowledge and 'scientific' findings, the authorities can improve and reorient this traditional knowledge towards providing a nucleus for a more sustainable management practice. Indeed, any management framework should harness both traditional and scientific knowledge to ensure a sustainable process (Oteng-Ababio, 2010a). One of the dangers in addressing coastal erosion as occurring at Faana is the tendency to focus on short-term stakeholder interests at the local community level rather than longer term regional and national interests. In most cases, a response to individual community concerns, if not managed carefully, could lead to a highly modified coastal environment. It is imperative for the authorities to provide national guidance on how to manage coastal erosion.

References

- APPEANING ADDO, K. 2009. Detection, measurement and prediction of shoreline change in Accra, Ghana: Shoreline recession analysis and modelling under the scenario of climate change in a data starved environment. Saarbrücken: Lambert Academic Publishing. 240 p.
- APPEANING ADDO, K., WALKDEN, M. & MILLS, J.P. 2008. Detection, measurement and prediction of shoreline recession in Accra, Ghana. *ISPRS Journal of Photogrammetry & Remote Sensing*, 63(5):543-558, Sept.
- ARMAH, A.K. 1991. Coastal erosion in Ghana: causes, patterns, research needs and possible solutions. (In ASCE (American Society of Civil Engineers). Coastal Zone '91: Papers read at the Seventh Symposium on Coastal and Ocean Management held in New York. New York, NY: ASCE. p. 2463-2473.)
- ARMAH, A.K., WIAFE, G. & KPILLE, D.G. 2005. Sea-level rise and coastal biodiversity in West Africa: A case study from Ghana. (In Low, P.S., ed. Climate Change and Africa. Cambridge: Cambridge University Press. p. 204-217.)
- BOATENG, I. 2006. Shoreline management planning: can it benefit Ghana? A case study of UK SMPs and their potential relevance in Ghana. Available at: https://www.fig.net/pub/accra/papers/ts16/ts16_04_boateng.pdf Date of access: 20 No. 2009.
- CAMPBELL, M.O. 2006. The sustainability of coconut palm *Cocos Nucifera* Linnaeus 1753 in Coastal Ghana. *Journal of Coastal Research*, 22(5):1118-1124, Sept.
- DAHM, J. 2000. Natural character: concept development in New Zealand planning law and policy. Hamilton: Environment Waikato.
- FLANAGAN, R. 1993. Beaches on the brink. *Earth*, 2(6):24-33, Nov.
- IBÉ, A.C. & QUÉLENNAC, R.E. 1989. Methodology for assessment and control of coastal erosion in West Africa and Central Africa. UNEP Regional Sea Reports and Studies No. 107. New York, NY: United Nations Environment Programme.
- LY, C.K. 1980. The role of the Akosombo Dam on the Volta River in causing erosion in central and eastern Ghana (West Africa). *Marine Geology*, 37(3-4):323-332, Sept.
- MUFF, R. & EFA, E. 2006. Explanatory Notes for the Geological Map for Urban Planning. 1:50000 Greater Accra Metropolitan Area. 36.
- NADMO (National Disaster Management Organisation). 2007. Hazard Mapping in Ghana. Unpublished report by NADMO/Government of Ghana.
- NAIL, G.G., ADDO, M.J.A. & WELLENS-MENSAH, J. 1993. Coastal erosion points in Ghana and their protection. Report of the national workshop on climate change and in its impact on water, oceans, fisheries and coastal zones. Accra: Ghana national committee for the international hydrological programme, 189-202.
- OTENG-ABABIO, M. 2010a. No ownership, no commitment – the bane of environmental regulations in Ghana. *Ghana Social Science Journal*, 7(1):36-51.
- OTENG-ABABIO, M. 2010b. Private sector involvement in solid waste management in the Greater Accra Metropolitan Area in Ghana. *Waste Management & Research*, 28(4):322-329, April.
- RICKETTS, P.J. 1986. National policy and management responses to the hazard of coastal erosion in Britain and the United States. *Applied Geography*, 6(3):197-221, July.

SCAMMELL, M.L. & DEARRY, A. 1997. N.I.o.E.H Sciences. Advancing the community-driven research agenda; Environmental Justice & Community-Based Prevention/Intervention Grantee Meeting; Research Triangle Park, NC. 27 p.

SCAMMELL, K.M., SENIER, L., DARRAH-OKIKE, J., BROWN, P. & SANTOS, S. 2009. Tangible evidence, trust and power: public perceptions of community environmental health studies. *Social Science & Medicine*, 68(1):143-153, 6 Nov.

SCHLACHER, T.A., DUGAN, J.V., SCHOEMAN, D.S., LASTRA, M., JONES, A., SCAPINI, F., MCLACHLAN, A. & DEFEO, O. 2007. Sandy beaches at the brink. *Biodiversity Research*, 13(5):556-560, Sept.

ULIN, P.R., ROBINSON, E.T. & TOLLEY, E.E. 2005. Qualitative data analysis. (In Ulin, P.R., Robinson, E.T. & Tolley, E.E., eds. *Qualitative methods in public health: A field guide for applied research*. San Francisco, CA: Jossey-Bass. p. 139-174.)