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Utilization of sediment pin to describe the beach accretion by riverine mangroves

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Abstract

Sediment pin was used to measure the accumulation of sediment materials in the mangrove ecosystem of Sukol River, Bongabong, Oriental Mindoro, Philippines. The roots of the mangroves trapped the sediments that enter the riverine system. Their source could be from the upland or due to high tide current. Through the use of PVC pole as pins along the study site, the accretion of sediments was captured for data gathering and analysis. The results showed that the technique is useful to discuss the dynamic of sediment capture within the studied ecosystem. This provided an analysis of the beach condition near the riverine mangrove ecosystem. A healthy mangrove structure can provide a sediment budget for the shoreline mitigating coastal erosion.

Keywords: riverine mangroves, sediment budget, sediment pin, Sukol River

Introduction

Retreating shoreline pose threat to the properties and lives of the people in the coastal area. The low-lying areas are permanently submerged to the water, expanding towards the back shore. The settlements along the coastal zone were vacated due to this event that happens gradually (Le Cozannet et al., 2014) [1]. In order to understand the behavior of the shoreline relative to its morphological condition, the source of sediment budget that builds the beach should be identified. This is important in order to mitigate the retreating that occurs in the coastal shore in the global scale. Determining the origin of the sediment deposited in the beach will help in protecting the source, and sustaining the mechanism.

One of the mechanisms that provides the sediment budget in the beach or shoreline is the riverine mangroves. This ecosystem is effective in trapping the sediments that originates from the weathering done by the river, as the water flows rocks turned to sediments, it was transported to the estuarine where the riverine mangroves are thriving. Through the roots or pneumatophores, the sediment was trapped during the low tide, and when high tide happens, these sediment budgets are washed down to the beach for deposit, and build up (Wolanski, 1995) [2]. Describing the efficiency of mangrove ecosystem in a simple spectrum will definitely help in justifying their importance in providing the build up of sediment in the beach that reinforce the accretion in the shoreline. In this case, the study used the sediment pin method to describe the effectiveness of mangroves in capturing sediment budget for the marine zone.

Sediment pins were utilized in this study to record the sediment capture of the mangroves in the study area. This served as a basis for monitoring changes in the substrate condition of the beach. The captured sediment within the mangroves were transported to the shoreline through the high tide and low tide. When there was a high tide, the sediments were captured in the mangrove area and then released back to the shore during the transition of low tide. These sediment deposits usually come from the upland brought by the water flowing in the river channel. The sediments were trapped in the mangroves of a particular riverine system then transported to the shoreline during tide shift. This process prevents retreating shoreline and coastal erosion because the mangroves stabilize sediment budget for the beach. The stability of the beach is a sign of healthy mangroves in the riverine (Chmura et al., 2003). For this finding, the importance of mangroves in protecting the beach against the abovementioned event will be understood, and conservation for these riverine mangroves will be considered.

Materials and Method

The study was conducted in the Barangay Poblacion (sitio

K.I.) and Barangay Aplaya near the Sukol River, Province of Oriental Mindoro, Municipality of Bongabong, Philippines.

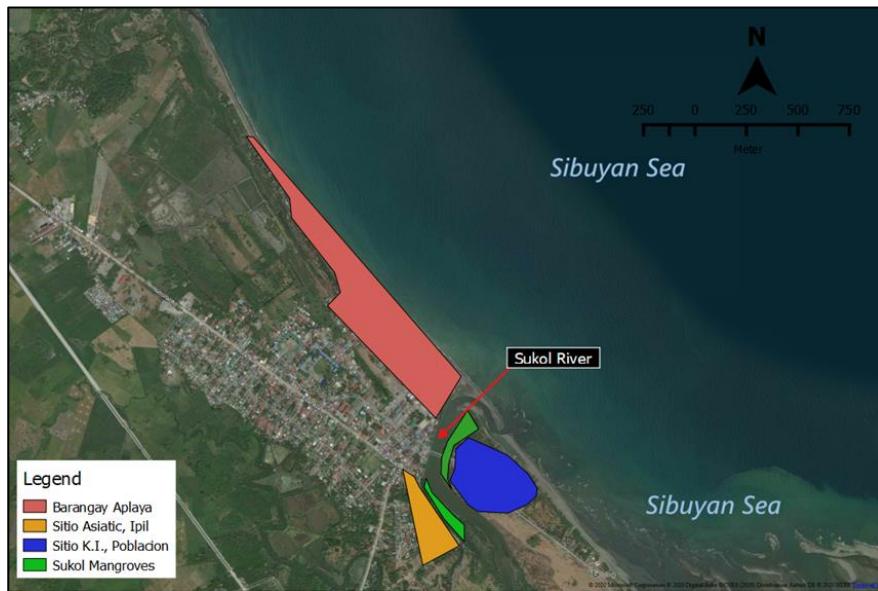


Fig 1: The map of the research locale, Sukol River, Oriental Mindoro, Philippines (Quitain, 2021)

The study utilized the sediment pin method adapted from the USGS 2012. There were three sediment pins deployed on the different areas of the Sukol river mangroves. The sediments were improvised PVC pipes with attached tape measure for sediment capture recording purposes. These pins were visited every quarter for monitoring, the initial recording of data was done on December 2019 to February 2020.

On the other hand, the study also utilized the Google Earth Pro to show the historical background through its timeline feature regarding the accretion of the beach along Barangay Aplaya which the mouth of the Sukol estuarine is connected. This was utilized to support the assessment the mangroves aid the coastal zone in maintaining the sediment budget it requires to prevent submersion.

through the utilization of sediment pins, based on Figure 2, Results of Sediment Capture of Sukol River Mangroves, showed that the first station accumulated an average height of 3.12 cm sediment, station 2 gain 2.75 cm and station 3 sediment pins trapped 3 cm. The results of sediment capture justified the effectiveness of the mangroves in the study site to prevent retreating shoreline. On the other hand, a historical image of map from Google Earth Pro showing the timeline of sediment build-up along the riverine system of Sukol compliments the possible impact of the mangroves in mitigating the retreating shoreline. The results regarding sediment capture through estimates using pins have a significant relationship along the beach of Barangay Aplaya and sitio K.I., Poblacion.

Results and Discussion

In more than a month (December 2019- February 2020)

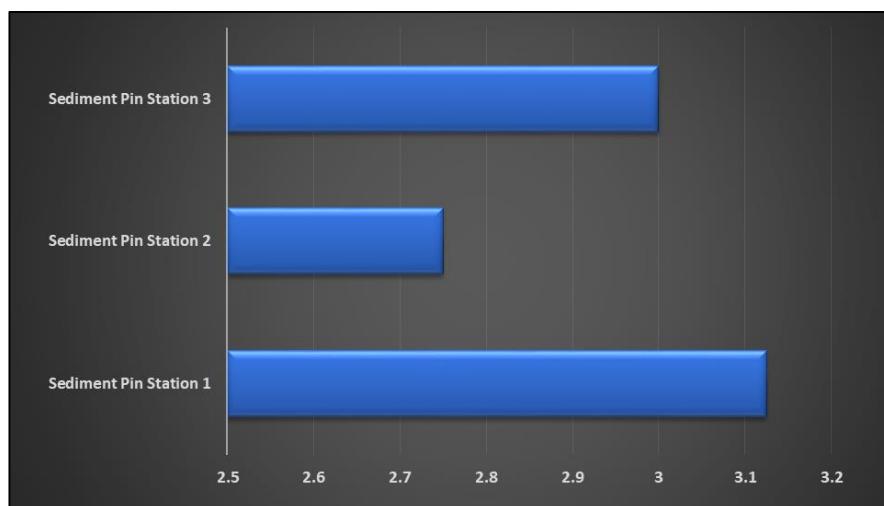


Fig 2: Results of Sediment Capture of Sukol River Mangroves

In terms of sediment deposition, Figure 3, the baseline map of sediment deposit occurrence along the beach of Barangay Aplaya and sitio K.I. Poblacion shoreline dated November

30, 2010, delineated by a red quadrant, reveals no sediment accumulation in the estuarine along the beach of Barangay Aplaya and sitio K.I., Poblacion.



Fig 3: The Baseline Map of Sediment Deposit Occurrence along the Beach of Barangay Aplaya and sitio K.I. Poblacion Shoreline dated November 30, 2010

In terms of sedimentary build up, Figure 4, Map image of Barangay Aplaya and sitio K.I., Poblacion beach dated December 11, 2014, shows that sedimentary materials started

to accumulate in the shoreline of Barangay Aplaya and sitio K.I., Poblacion. This is prior to the observation during year 2010 where the same area had no sediment deposits.

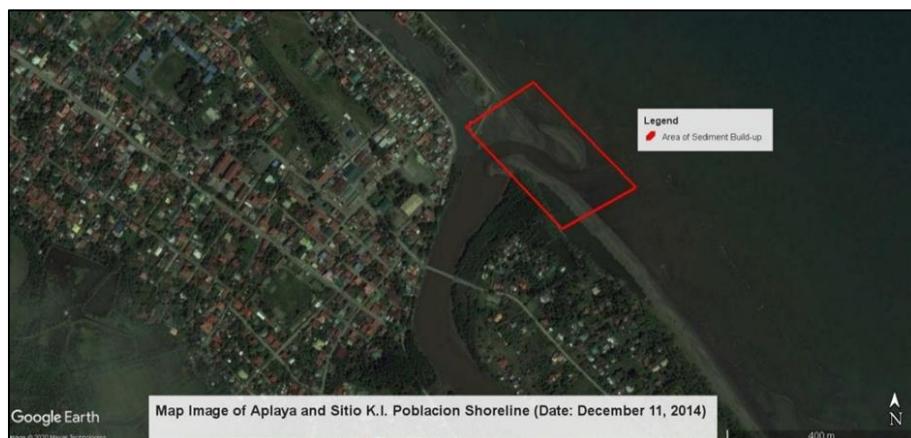


Fig 4: Map image of Barangay Aplaya and sitio K.I., Poblacion Beach dated December 11, 2014

The massive accumulation of sediment is shown in Figure 5, Map image of Barangay Aplaya and sitio K.I., Poblacion

beach dated December 22, 2018.



Fig 5: Map image of Barangay Aplaya and sitio K.I., Poblacion Beach dated December 22, 2018

The stable condition of the beach along Aplaya and sitio K.I., Poblacion is shown in Figure 6, Map image of Barangay Aplaya and sitio K.I., Poblacion beach dated February 4, 2020, due to the regulated distribution of sediment materials trapped in the mangroves of Sukol River. They made the substrate materials firm as tides shift and flood passes through the channel.

This event complements the shoreline through the prevention of coastal erosion. The sediment pins make available of a parameter that can present the effectiveness of the mangrove's roots and branches in reinforcing accretion along the beach ecosystem. The approach is practically used for beach monitoring in order to record timeline data regarding the condition of the substrate in the shoreline.



Figure 6. Map image of Barangay Aplaya and sitio K.I., Poblacion beach dated February 4, 2020

Thus, the study inter-connects the relationship of the sediment materials provided by the mangroves in the coastal zone and the accumulated sediments within this ecosystem through the measuring pins. On the other hand, the remote sense image utilized as map is significant in presenting the accretion history of the study site beach area with relation to the mangrove presence near the shoreline. They provide actual visualization of the changes done by the mangroves of Sukol River in building sand bars as protection for the shoreline of Barangay Aplaya and sitio K.I., Poblacion.

Conclusion

The sediment pins are efficient to utilize in describing the sediment deposits made by the riverine mangroves. They provide a simple data that can be used to correlate with other methods that discussed the same research concept in beach accretion. Furthermore, the pins are effective to gather data for monitoring purposes with regards to beach condition.

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