Research Article

Sediment Map: Mapping the Distribution of Sediment Quality at Hutan Lipur Bukit Ayer, Perlis

Nurainun Hanani Juhari Kangsar[1], Afif Jazimin Mahadzir[2], Sharir Aizat Kamaruddin[3,*], Aimie Rifhan Hashim[4], Rohayu Ramli[5], and Eliy Nazira Mat Nazir[6]

[1] Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; hananijuhari.0606@gmail.com

[2] Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; afifjazimini27@yahoo.com

[3] Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; shariraizat@uitm.edu.my

[4] Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; 2021403326@student.uitm.edu.my

[5] Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; rohayuramli@uitm.edu.my

[6] Faculty of Business and Management, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia; eliy083@uitm.edu.my

* Correspondence: shariraizat@uitm.edu.my; 017-561 1159.

Abstract: *Being able to store nutrients and serve as the habitat for a variety of marine creatures, sediment is an essential component of the community that makes up the marine environment. Knowing the benefits of different forms of sediment, whether they come from freshwater or saltwater, would enable numerous companies that are directly tied to the marine environment to find their way more easily. The spatial variation of sediment quality should be mapped as baseline information due to their significance. Our new technology aims to create maps of sediment. Our product is called Sediment Map. Since there is currently less sediment map being developed, particularly in Malaysia's northern region, our product benefits even more. In terms of community advantages, Sediment Map will support a wide range of clients, including municipal, governmental, and non-governmental organisations. Overall, the Sediment Map is consistent with the Sustainable Development Goals established by the United Nations SDG 14: "Life below water," SDG 2: "Zero hunger," SDG 3: "Good health and well-being," and SDG 13: "Climate action".*

Keywords: Geodatabase; Marine; Map; Sediment; Sustainable.

1. INTRODUCTION

Sediment is an integral part of the community making up the marine environment, capable of storing nutrients and being the habitat for several marine organisms. To be informed of the boon available in different types of sediment—be it from saltwater or freshwater, would help in clearer paths of various industries closely related to the marine environment. The content in both saltwater and freshwater marine sediment has given them unique characteristics specific to each of their locations. Rainforests in Malaysia consist of clay and peat where the Tasik Chini's inland forest had 71% of clay

in its sediment percentage, 44% of clay in the seasonal flood forest of Tasik Chini, and 42% of soil in the riverine forest with silty clay (Khairil et. al., 2014). The perfect loam consists of sand, soil, and clay particle mixture.

Saltwater sediment, on the other hand, is made of sandy loam soil and a mixed variation of sandy and silt loam, both sampled from Penang and Kedah (Mohammad Zubi et. al, 2021). The particle sizes differences of sediment in freshwater and saltwater area gave them characteristics solely unique to their locations, such as water moisture content and pH levels, leading to the total organic carbon that can be stored in the sediment. Other factors also may contribute to the differences in qualities that can be found in the sediment. Seasons have affected the organic carbon content in river estuaries in Pahang, with the carbon content being 1.16% in pre-monsoon and 0.88% in post-monsoon season (Kamaruzzaman et. al., 2009). Human activities such as tourism and pollution from illegal waste dumping may also alter the normal Total organic Content (TOC) readings, as observed in Pulau Langkawi where the water was analysed, yielding 1.08% to 3.40%, research conducted by Kamaruzzaman in 2010. It also has been cross-checked with data of TOC collected from Port Dickson and Arabian Gulf and was proven that the TOC in Pulau Langkawi is higher (Kamaruzzaman et. al., 2010).

With different types of sediment composition, sediment grain size also affects the grip strength of the sediment, soil with a coarser grain such as silt clay usually found in saltwater sediment has a higher grip strength than peat commonly found in freshwater sediment. The pH levels of different sediment in different marine locations result from the location where it was sampled. Pasoh Forest Reserve has a mean pH of 3.44 which is typical of the soil of rainforest in Peninsular Malaysia, compared to the pH of marine soil 8.2 (Chan et al., 2013). External factors such as organic matter and grain size allowing for the decomposition of said organic matter play a heavy role in the readings of this characteristic. The moisture content of soil can be linked to various reasons, some of them being the weather and the topographical area. A field observation done at Bukit Tarek Experimental Watershed has shown that the surface soil responded to rain events eagerly, with declines that can be detected when the rain stops (Noguchi et al., 1997). With more vigorous activities done at the soil surface than deeper into the ground, water is easily discarded from the topsoil than deeper. The smaller grain size of saltwater sediment made it more porous, allowing water to pass through faster and lower its water retention potential than that of freshwater sediment.

A geodatabase of sediment data collected from the surface area of Hutan Lipur Bukit Ayer ecosystems is used to create the surface map. To begin, our innovation project would focus on Hutan Lipur Bukit Ayer regions. The geodatabase now contains information such as pH, moisture etc. The developed maps were precisely digitized using remote sensing imagery. The map that is created can be digital or printed, depending on the demand of the clients.

The objective of this innovative product is to produce sediment maps over the Hutan Lipur Bukit Ayer regions. The development of the database is based on the collection of samples of sediment from the Hutan Lipur Bukit Ayer region. The samples were analysed immediately after being collected in containers and were processed at the marine technology and marine biology laboratories.

2. METHOD & MATERIAL

The maps developed were based on the integration of attribute data (sediment data), spatial data (geolocation of sampling areas), and a geodatabase and software (ArcGIS software). ESRI created and maintains the ArcGIS family of client, server, and online geographic information systems.

3. FINDINGS

3.1 Novelty and Uniqueness

Sediment maps have developed very little thus far, especially in Malaysia's Northern region. The creation of these maps will improve knowledge about Hutan Lipur Bukit Ayer's ecological zones. This product stands out because environmental data were pricey and less widely covered by scientists or environmentalists. (Hashim et al., 2022; Kamarudin et al., 2022; Mohd Rizal et at., 2022)

3.2 Benefit to Mankind

The created sediment spatial maps will be useful to many people. The map could be used by government agencies like the Department of Environment to evaluate the condition of the Hutan Lipur Bukit Ayer regions. Any changes to the standard data can be studied and the negative impacts can be treated with proper methods, ensuring the quality of life for the organism living in the area. It has been observed in a study on seagrass and fine sediment pollution in New Zealand that despite having ample sunlight throughout the experiment, seagrass species that were chosen for observation react negatively to the presence of fine sediment in the area, as hypothesized by the researchers (Zabarte-Maeztu et al., 2020). Even a slight change in the grain size of sediment can affect the entire ecosystem living in an area, cementing the importance of sediment for the livelihood of marine organisms. Sediment also contains nutrients and minerals important to the health of the downstream ecosystem, while providing substrate for the creation of beaches and sand pits (Sediment as an Ecological Function - King County, 2021). On the other hand, non-government organisations might utilise the information to gauge the degree of biodiversity and raise awareness of the value of good sediment quality. The data can be utilised as the starting point for study by academic institutions and universities.

3.3 Commercialisation Potential

Potential clients can be expected from locals, government bodies and non-government bodies (Tourism players, marine culture operators etc.).

4. CONCLUSION

Overall, the Sediment Map is consistent with the Sustainable Development Goals established by the United Nations SDG 14: "Life below water," SDG 2: "Zero hunger," SDG 3: "Good health and well-being," and SDG 13: "Climate action".

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