



Coastal Areas as Learning Resources to Enhance Regional Potential Understanding: A Study in Pesisir Selatan District

Muhammad Arif^{1*}, Enok Maryani¹, Mamat Ruhimat¹, Dede Sugandi¹

¹Geography Education Study Program, Universitas Pendidikan Indonesia, Indonesia

*Correspondence to: muhammadarif@upi.edu

Abstract: The coastal zone consists of a diverse range of resources. This area's ecosystems are also quite complex and dynamic. Information about the coastal zone is necessary to provide knowledge to readers, which will be helpful for conservation efforts, sustainable planning and development, further research, and fostering coastal environmental literacy. This study aims to collect information about the resources present in the coastal zone and then integrate it into relevant learning materials such as geography. This research is a narrative review literature study. Secondary data was obtained from the Fisheries and Marine Affairs Office of West Sumatra Province, along with relevant scientific articles. Several related articles and government documents were collected, analyzed, and summarized in the body of this article. The information concerning appropriate geography learning materials was then analyzed to produce relevant content diagrams. The results of the literature review show that coastal zone resources include mangrove areas, coral reefs, seagrass beds, biodiversity, and marine tourism. Some geography learning materials for secondary school levels in Indonesia include marine and coastal materials, hydrodynamics, coastal and marine pollution, natural resources, biodiversity, ecosystems, flora and fauna, environmental and population geography, and tourism geography. The findings of this research can serve as a reference for researchers and practitioners to develop and integrate the potential of coastal areas into relevant learning.

Keywords: coastal areas, regional potential, learning resources

Recommended citation: Arif, M., Maryani, E., Ruhimat, M., & Sugandi, D. (2024). Coastal Areas as Learning Resources to Enhance Regional Potential Understanding: A Study in Pesisir Selatan District. *Journal of Innovation in Educational and Cultural Research*, 5(3), 492-500.

INTRODUCTION

Pesisir Selatan Regency is in the southern part of West Sumatra Province, Indonesia. This regency stretches along the coast facing the Indian Ocean, making most of the area a coastal region. The regency boasts an extensive coastal area with a coastline stretching approximately 218 km (Maryeni & Saputri, 2022). This coastal region comprises various ecosystems, including mangroves, coral reefs, and seagrass beds (Hasim, 2021; Whitfield, 2017). The diverse landscapes of the coastal areas in Pesisir Selatan Regency represent a potential that can be explored and developed into valuable learning resources. Therefore, this area is interesting to be studied in the context of geography education or environmentally-oriented learning. The coastal resources in this region are fascinating subjects for geography education. Geography education delves into spatial aspects of the Earth's surface and human activities influencing and interacting with the natural environment (Kurniawan et al., 2020). The natural environment surrounding learners becomes interesting and familiar, creating relevance in the studied material (Hasyim, 2019; Wibowo, 2019). Coastal resources need to be analyzed to be utilized as learning resources. Learning resources encompass everything that can be utilized in learning activities and come in various forms (Nalatilfitroh & Banowati, 2021). Several considerations must be considered when creating learning resources, including learning objectives, target audience, structure, relevant content, clarity and simplicity, accessibility, and evaluation and feedback (Ramawati, 2016).

Previous studies have identified coastal area resources, such as the research by Elegbede et al. (2023) that describes the biotic and abiotic components of coastal areas, Seitz et al. (2014), and Amir (1987) who provide information related to coastal biological resources, and Boström et al. (2011) who identify ecosystems and natural biological resources as coastal resources. Nikijuluw (2017) identifies issues and conservation policies for coastal resources in Indonesia. However, the specific coastal resources in Pesisir Selatan Regency (West Sumatra, Indonesia) remain unexplored in previous studies. One effort to address this issue is to generate informative content about the coastal resources in Pesisir Selatan Regency. This information is valuable for teachers as study materials and learning resources in geography and environmentally oriented education. The research objectives are 1) to identify coastal resources in Pesisir Selatan Regency and 2) to describe the content of coastal resources for several identified resources. This research aims to fill the gap in existing knowledge by providing comprehensive information on coastal resources. The novelty of this research lies in the more comprehensive information gathered from various references and the specific mapping of the southern coastal

mangrove areas conducted by the author. The findings will enrich geography education in Pesisir Selatan Regency and promote a more holistic understanding of the diverse coastal ecosystems. The information provided is also helpful for other research, such as developing instruments for assessing knowledge about coastal zone resources.

METHODS

This research adopts a descriptive study design, a method used to accurately depict existing phenomena (Atmowardoyo, 2018). The primary objective of descriptive research is to portray the phenomena under investigation systematically. The study was conducted in Pesisir Selatan Regency, West Sumatra Province, and focused on coastal resources. Secondary data from the Department of Fisheries and Marine Affairs of West Sumatra Province, the Central Statistics Agency, and the Regional Disaster Management Agency are utilized. The instrument used to analyze regional potential in Pesisir Selatan District is a map of resource potential identified through literature searches. The data analysis technique in this research was carried out descriptively. The steps used in this research are shown in Figure 1.

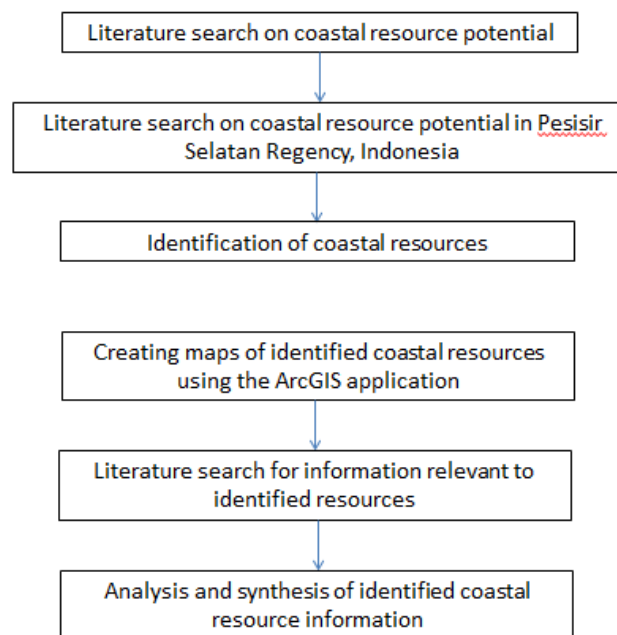


Figure 1. Stages of Research Implementation

As a literature review study, this research uses the narrative review technique, a type of literature review that provides a synthesized summary of a given topic. This technique is more descriptive and not bound by systematic procedures. It was chosen because it allows the researcher to obtain information in a broader context or when systematic methods may not be practical for generating more comprehensive information. The data used in this research consists of secondary data, including government documents and relevant references. Government documents comprise those from the Department of Fisheries and Marine Affairs and the Department of Education. Relevant references were obtained through Google Scholar searches using various keywords related to the scope of coastal area resources. This research begins with determining the scope of the study. Relevant literature is then sought and analyzed. After analyzing the content of the obtained references, the researcher summarizes and synthesizes them according to the scope of "coastal area resources." More detailed data, such as mangrove forests in South Coastal areas, are mapped using the ArcGIS application. The synthesized results are re-analyzed by linking the identified resources with relevant geographical learning studies.

RESULT AND DISCUSSION

Coastal resources encompass several natural ecosystems found in coastal areas. Natural ecosystems in coastal regions include coral reefs, mangrove forests, seagrass beds, sandy beaches, pes-caprea formations, barringtonia formations, estuaries, lagoons, and deltas (Dahuri et al., 2021; Uneputty et al., 2023). The potential coastal resources in Indonesia include coral reefs, mangrove forests, seagrass beds, fisheries, and seaweed (Baransano & Mangimbulude, 2018). Coastal resources are categorized into two types: renewable resources

(living resources) and non-renewable resources (non-living resources). Renewable coastal resources fall under living resources and include marine life such as fish, shellfish, shrimp, crabs, lobsters, mollusks, reptiles, aquatic animals, and high aquatic plants. Coastal areas are home to more than 160 species. Non-living resources encompass water, gravel, and sand (up to a depth of 40 meters), minerals (including garnet, zircon, rutile, tourmaline, illenite, and sillimanite), and other materials such as crude oil and gas (Elegbede et al., 2023).

Coastal areas constitute environments that include land, sea, and freshwater, with nearly 40% of the world's population residing in these regions. Ecosystems found in coastal areas encompass estuarine, beach, wetland, shoreline, mangrove forests, seagrass, salt marsh, coral reefs, and other crucial habitats (Milon & Alvarez, 2019). The coastal landscape includes both vegetation habitats (coral reefs, shells, etc.) and animal habitats (coral reefs, shells, etc.) (Ridge et al., 2020). Based on a literature review concerning coastal resources, these areas include living and non-living resources and various ecosystems such as mangrove ecosystems, coral reefs, estuaries, seagrass beds, sandy beaches, lagoons, and deltas. These globally distributed coastal resources are further identified within Pesisir Selatan, Indonesia. Coastal resources identified in the Pesisir Selatan region may, in part, remain unidentified. The variations in these ecosystems can be attributed to differences in climate, topography, geology, and other factors. Based on the literature review, Pesisir Selatan Regency's coastal resources include mangrove ecosystems, coral reefs, seagrass beds, and living resources. Compared to those generally identified, the disparity in coastal resources in the Pesisir Selatan Regency lies in the fact that non-living resources have not been identified in the regency. So far, no minerals, oil and gas, or other non-living resources have been explored. Sand mining is conducted in river areas, not in coastal areas. A report published by the (Department of Marine and Fisheries of West Sumatra Province, 2017) states that marine tourism is included in coastal resources in Pesisir Selatan Regency. Therefore, coastal resources in Pesisir Selatan Regency encompass mangroves, coral reefs, seagrass beds, living resources, and marine tourism.

Mangroves are woody plants that thrive at the interface between land and sea in tropical and subtropical latitudes. They flourish in varying salinity, gentle wave action, high temperatures, muddy soil, and anaerobic conditions. They are typically found around river estuaries and deltas in the tidal regions of tropical and subtropical countries (Kathiresan & Bingham, 2001). Mangroves play a crucial role in maintaining the health and productivity of coastal ecosystems. They provide various services and functions, including serving as habitats for local fauna and flora, a source of food and other goods, carbon absorption (blue carbon storage), and protection against natural disasters such as storm surges and coastal erosion. Mangroves also contribute to water quality maintenance, support coral reef and seagrass ecosystems, and offer livelihood opportunities for coastal communities through fisheries cultivation, animal feed production, wood, and ecotourism (Akram et al., 2023).

Mangroves play a crucial role in ecological, socio-economic, and socio-cultural aspects, demonstrating their significant importance. Ecologically, mangrove forests serve as carbon sequestration sites, remediate pollutants, maintain coastal stability against erosion, saltwater intrusion, and storm surges, preserve natural habitats, provide nesting and breeding grounds, and contribute to land formation (Karniati et al., 2021; Maryani, 2022). From a socio-economic perspective, mangrove forests contribute to various products and activities, including construction timber, charcoal, plywood, paper pulp, telephone poles, pilings, fish traps, docks, railway ties, wood for furniture and handicrafts, thatch for roofing, tannins, medicinal substances, sugar, alcohol, acetic acid, animal protein, honey, carbohydrates, and dyes. Additionally, they fulfill socio-cultural functions as conservation areas, educational sites, ecotourism destinations, and cultural identities (Maryani, 2022). Data from the (Department of Marine and Fisheries of West Sumatra Province, 2017) indicates that the total area of mangrove ecosystems in Pesisir Selatan Regency, West Sumatra, is 2,549.55 hectares. *Rhizophora apiculata* dominates the mangrove species in the region, with the highest density found in Teluk Betung (9566.67 ind/ha) and the lowest in Pulau Marak (2500.00 ind/ha). The distribution values are presented using relative density (KR) and importance value (NP), influenced by the predominantly muddy sandy substrate and ecologically suitable for this species.

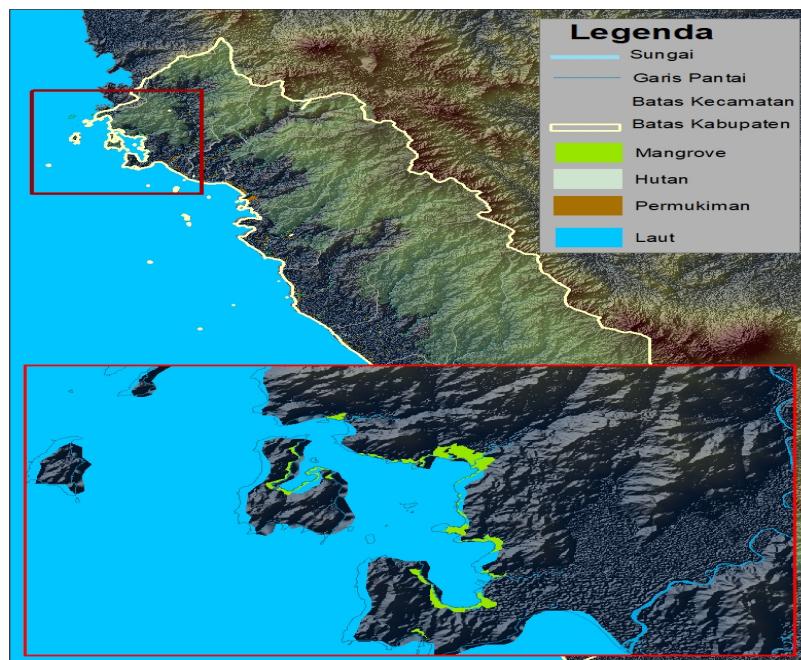


Figure 1. Mangrove Potential Map of Pesisir Selatan Regency

Figure 1 displays the potential map of mangroves in Pesisir Selatan Regency. The green areas on the map indicate the presence of mangrove forests. Based on this map, it can be concluded that mangrove forests are found in the northern part of Pesisir Selatan Regency. This potential significantly supports the geography learning process in formal education by applying a contextual approach. The contextual approach has advantages in promoting in-depth learning to develop students' understanding of their environment. This approach incorporates learned concepts into students' life experiences (Suryawati & Osman, 2018). It helps teachers connect lesson material with students' direct experiences Davtyan (2014). It stimulates students to think critically, discover, and relate what they learn to the reality around them (Bustami et al., 2018).

Coral reefs are complex, distinctive, and unique ecosystems characterized by high biodiversity of resident species (Uar et al., 2016). The coral reef ecosystem holds significant ecological, social, economic, and cultural value for communities (Rumahorbo et al., 2019). As coastal environmental protectors, coral reefs play a crucial role in mitigating erosion caused by large waves and act as a vital resource for fisheries (Ramadhan et al., 2017). Coral reefs serve as shelter for aquatic organisms, provide raw materials for lime, and are a source of calcium carbonate (Prasad et al., 2023). Coral reefs are typically found in shallow tropical waters with clear, warm, and clean water (Nikijuluw, 2017). Reefs in different basins (Caribbean, Pacific Ocean, and Indian Ocean) possess their own unique characteristics depending on their location (Freeman et al., 2013). Salinity, sufficient light availability, and water current speed influence the coral reef ecosystem (Freeman et al., 2013). The suitable salinity for coral reef habitats ranges from 27-20 ppm, and these habitats thrive in shallow areas at depths of 0-50 meters to receive sunlight. Coral reefs also require calm water currents and small waves for optimal development. Coral reefs are experiencing degradation worldwide, with temperature changes posing the most significant threat. Global warming has led to widespread coral bleaching. Additionally, human activities contribute to the increasing degradation of these ecosystems (Hoek & Bayoumi, 2017). Pollution and damaging fishing practices can result in coral reef destruction. Climate change, a natural factor, causes coral reefs to die due to thermal stress (Susiloningtyas et al., 2018).

In Pesisir Selatan Regency, the coral reefs cover an extensive area of 1,065.37 hectares. The condition of the coral reefs in this region is considered good. The highest percentage of coverage is found in Baringin Island, with 83.00 percent coverage, while the lowest is in the eastern part of Aua Gadang Island, with 5.00 percent coverage. This variation is due to the underwater substrate conditions influenced by sandy and fragmented coral substrates and competition for space in the struggle for food dominated by larger corals (Department of Marine and Fisheries of West Sumatra Province, 2017). The seagrass ecosystem is a biological organizational unit involving interactions between biotic and abiotic components (Phillips & Milchakova, 2003). Seagrasses are flowering marine plants that form extensive underwater meadows, predominantly found and adapted to shallow marine environments (Ambo-Rappe et al., 2019; Zurba, 2018). Seagrasses thrive in shallow coastal waters, situated between mangrove formations and coral reefs, growing in sandy habitats with a temperature range of 28-30 °C, a maximum depth of 30 meters, and salinity ranging from 24-35 ppm (Zurba, 2018).

The seagrass ecosystem serves multiple functions to support life systems and plays a crucial role in coastal and marine dynamics, especially in coastal fisheries (Tangke, 2010). Seagrasses play a vital role as breeding grounds and shelter for marine organisms, provide food for human consumption, contribute to pharmaceutical resources, defend against coastal erosion, purify seawater, stabilize sediment, and trap deposits. They are also primary producers of food webs (Duffy, 2006; Zurba, 2018). According to Rahmawati et al. (2019), the seagrass ecosystem is one of the most promising carbon sinks. Seagrasses absorb carbon dioxide and convert it into potential energy stored in organic carbon. The organic carbon from seagrasses and other organic materials is trapped in seagrass sediments. Due to this capacity, seagrasses are recognized as a natural carbon dioxide remover (NCDR). Compared to tropical rainforests, seagrass meadows have a more significant potential for capturing and storing large amounts of carbon, known as blue carbon.

Seagrass, a flowering plant (angiosperm) and an integral part of the marine or coastal ecosystem, possesses rhizomes, leaves, and true roots that live submerged in the sea. It colonizes areas through the dispersal of seeds (propagules) produced sexually. In Pesisir Selatan, seagrasses are currently found only in Batu Kalang, whereas they were once present at several points, such as Pulau Cubadak and Pulau Setan. According to data from the Department of Marine and Fisheries of West Sumatra Province (2017), the seagrass meadow's extent in the marine waters of Pesisir Selatan Regency is approximately 2 hectares (Department of Marine and Fisheries of West Sumatra Province, 2017). Living resources are classified as renewable and include fish, clams, shrimp, crabs, lobsters, mollusks, aquatic animals, and aquatic plants (Elegbede et al., 2023). Various types of phytoplankton, zooplankton, aquatic plants, insects, fish, birds, and marine mammals are part of the living resources in coastal areas (Irfan & Alatawi, 2019). The living resources in the coastal region of Pesisir Selatan Regency include various types of marine fish such as snapper, yellowtail, mackerel, pompano, grouper, anchovies, mullet, tuna, bonito, mackerel, sardines, king mackerel, dorado, grouper, pufferfish, parrotfish, rays, sharks, and others. Marine biota species include shrimp, lobsters, crabs, squid, cuttlefish, octopus, and sea cucumbers (Department of Marine and Fisheries of West Sumatra Province, 2017).

Several things that can endanger the continued availability of these biological resources are 1) Excessive exploitation, which will cause loss of genetic diversity, causing a decrease in the population of certain species, which will have an impact on other species in the food chain; 2) habitat modification such as dam construction, deforestation, and stream flow diversion; 3) water pollution by metals or toxic compounds, this causes aquatic living creatures to be susceptible to infections produced by aquatic pathogens. Disposal of waste causes deoxygenation and increases the level of death in organisms; 4) Thermal pollution, changes in water temperature, and dissolved oxygen concentration in the water will cause the death of small aquatic animals and sensitivity in animals (Irfan & Alatawi, 2019). Water pollution affects the immune system of aquatic living creatures. Water pollution produces a biological response that ultimately causes oxidative damage to food and decreased environmental quality (Bassem, 2020).

The natural beauty in coastal areas is a significant attraction for tourists. Several publications identify the economic impact of marine and coastal tourism using the term "Blue Economy" (Kabil et al., 2021; Sotiriadis & Shen, 2020; Tegar & Gurning, 2018). Maritime tourism entirely depends on the sea, including activities like diving, surfing, water skiing, maritime parks, and marine mammal watching (Tegar & Gurning, 2018). Meanwhile, the Blue Economy involves effectively managing water resources for the present and future generations, encompassing economic, environmental, and social dimensions (Kabil et al., 2021). Maritime Tourism needs to balance economic and environmental concerns to remain promising in the future. This is crucial because one of the selling points of Maritime Tourism is the beauty of the beaches, underwater ecosystems, and water quality. Cases of Maritime Tourism in Southeast Asia, as noted by Stryzhak et al. (2020), have resulted in economic benefits, environmental changes, and climate impact. Efforts are needed to synergize these two aspects. In line with this statement, Ghosh (2011) emphasizes that Maritime Tourism can lead to severe conflicts in both economic and environmental aspects. While it can boost the economy, it may also cause unwanted invasions into the natural environment. By focusing on sustainability, well-preserved nature tourism can contribute to economic progress and promote natural resources (Daskin et al., 2020).

The potential tourism in Pesisir Selatan Regency includes beaches, diving, and snorkeling. Beach tourism is found in the Carocok Tarusan Area, Batu Kalang, Carocok Painan, Bukit Langkisau, Pasir Putih Kambang, Pantai Sago, Pantai Salido, Pulau Cingkuak, Muaro Bayang, Pantai Sumedang, Pantai Sambungo (Silaut), Pulau Kereta, Pulau Aua Gadang, Pulau Aua Ketek, Pulau Penyu, Pantai Teluk Kasai, Pantai Sungai Nipah, Pamutusan, and Pantai Sungai Pinang. Diving tourism is available in the Small Islands Area of Mandeh, including Pulau Aua Gadang, Pulau Aua Ketek, Pulau Penyu, Pulau Pagang, Pulau Marak, Pulau Cubadak, and Pulau Keraba Gadang. Snorkeling tourism is also present in the Small Islands Area of Mandeh, covering Pulau Aua Gadang, Pulau Aua Ketek, Pulau Penyu, Pulau Pagang, Pulau Marak, Pulau Cubadak, and Pulau Keraba Gadang. The Mandeh Integrated Marine Tourism Area consists of a cluster of small islands, such as Pulau Nyamuk, Pulau Marak, Pulau Cubadak, Pulau Sironjong Kecil, Pulau Sironjong Gadang, Pulau Setan Kecil, Pulau Setan Gadang, Pulau Taraju, Pulau Pagang, Pulau Ular, and Pulau Nibung. Some of these islands have been developed as resort areas or

inhabited by the local community. Islands under traditional community management include Pulau Marak, Pulau Cubadak, Pulau Sironjong Kecil, Pulau Sironjong Gadang, Pulau Setan Kecil, Pulau Setan Gadang, Pulau Taraju, Pulau Pagang, and Pulau Ular ([Department of Marine and Fisheries of West Sumatra Province, 2017](#)). Potential resources in the coastal area of Pesisir Selatan Regency can be utilized as learning resources through contextual and problem-based approaches. Exploring ecosystems around students' environments will make the study more engaging. Ecosystems such as mangroves, coral reefs, seagrass beds, and living resources are vulnerable to damage. Problem-based learning approaches like problem-based and project-based learning with an environmental focus are suitable for learners. For real-world problem-oriented learning, the geography curriculum of Pesisir Selatan Regency can utilize these coastal resources as learning materials. The selection of coastal resources as learning materials must consider the learning content and objectives. Figure 2 provides an alternative mapping of potential coastal resources to be used as learning resources.

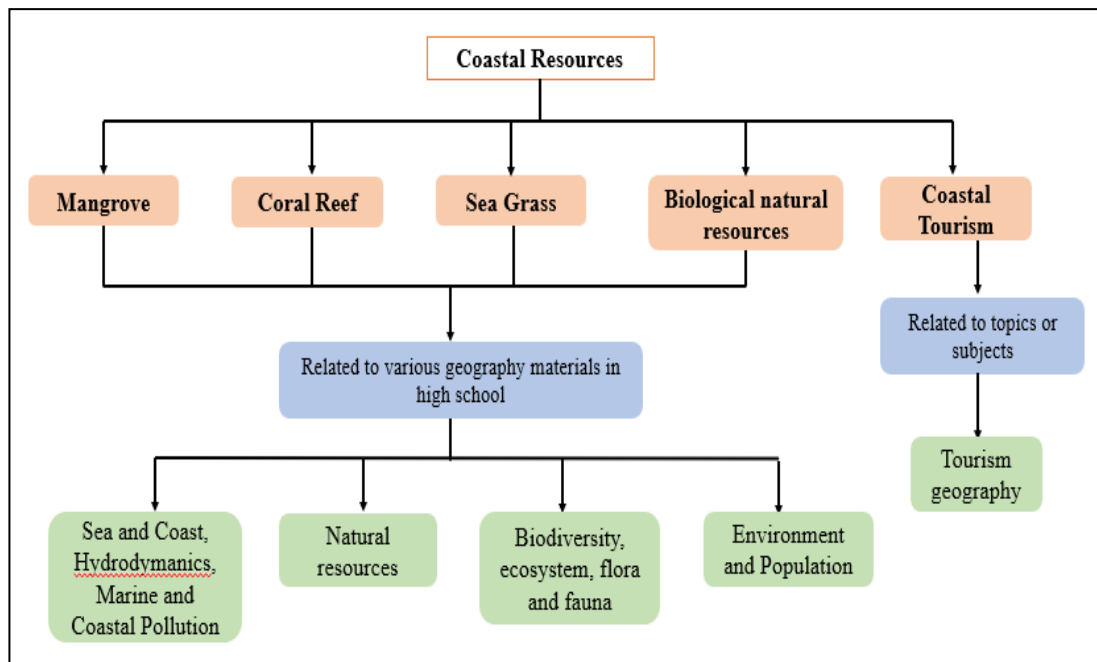


Figure 2. Mapping Coastal Resources as Learning Resources

Resources such as mangroves, coral reefs, seagrass, and living resources like fish, shrimp, crabs, and squid can serve as study materials for students living in coastal areas. Issues related to these coastal resources can be integrated into real-world problem-based learning processes. Meanwhile, resources related to marine tourism, offering activities such as beach tourism, diving, surfing, and water games, are part of geographical tourism studies. Marine tourism can also be connected to interdisciplinary topics such as economics and management. When selecting learning resources, it is essential to 1) Enrich and support the curriculum, 2) Consider the diversity of interests and perspectives, 3) Account for the students' levels of ability, learning styles, and maturity, 4) Reflect diverse perspectives on controversial issues ([Davies et al., 2008](#)). Coastal environmental issues are controversial and fall within the socio-scientific issues category. Furthermore, utilizing the natural environment enriches and supports the learning process. This study aims to assist researchers and practitioners in geography and geography education by providing additional information on coastal zone resources. Various subsequent studies can utilize the information from this research, including facilitating the development of knowledge assessment tests on coastal zone resources and serving as a reference for content materials in research focused on improving education related to coastal and marine resources. Specifically, this information can be used as a valuable reference by researchers working on coastal resources in the Southern Coastal District (West Sumatra, Indonesia).

CONCLUSION

Using coastal resources as a learning source for students in the Pesisir Selatan District offers excellent potential to enrich knowledge and achieve the goals of geography learning. Identifying coastal resources such as mangrove forests, coral reefs, seagrass beds, living resources, and marine tourism provides contextual and problem-based learning opportunities. Mangroves, with their ability to resist erosion, coral reefs living in shallow, clear, and warm sea areas with specific characteristics, and seagrass beds as carbon absorbers, are highly relevant and exciting topics to study. The ecosystems and biodiversity in coastal areas are crucial considerations

in developing geography materials. Contextual and problem-based learning allows students to actively understand these concepts by incorporating direct experiences into their learning process. Moreover, utilizing coastal resources as a learning context can enhance students' understanding of environmental issues, nature conservation, and various aspects of geographical tourism.

REFERENCES

- Akram, H., Hussain, S., Mazumdar, P., Chua, K. O., Butt, T. E., & Harikrishna, J. A. (2023). Mangrove Health: A Review of Functions, Threats, and Challenges Associated with Mangrove Management Practices. *Forests*, 14(9), 1–38.
- Ambo-Rappe, R., La Nafie, Y. A., Marimba, A. A., Cullen-Unsworth, L. C., & Unsworth, R. K. (2019). Perspectives on seagrass ecosystem services from a coastal community. *IOP Conference Series: Earth and Environmental Science*, 370(1), 1–5.
- Amir, S. (1987). Classification of coastal resources: A Mediterranean case study. *Landscape and Urban Planning*, 14, 399–414.
- Atmowardoyo, H. (2018). Research Methods in TEFL Studies: Descriptive Research, Case Study, Error Analysis, and R & D. *Journal of Language Teaching and Research*, 9(1), 197–204.
- Baransano, H. K., & Mangimbulude, J. C. (2018). Eksploitasi dan Konservasi Sumberdaya Hayati Laut dan Pesisir di Indonesia. *Jurnal Biologi Papua*, 3(1), 39–45.
- Bassem, S. M. (2020). Water pollution and aquatic biodiversity. *Biodiversity International Journal*, 4(1), 10–16.
- Boström, C., Pittman, S., Simenstad, C., & Kneib, R. (2011). Seascape ecology of coastal biogenic habitats: Advances, gaps, and challenges. *Marine Ecology Progress Series*, 427, 191–217.
- Bustami, Y., Syafruddin, D., & Afriani, R. (2018). The Implementation of Contextual Learning to Enhance Biology Students' Critical Thinking Skills. *Jurnal Pendidikan IPA Indonesia*, 7(4), 451–457.
- Dahuri, R., Rais, J., Ginting, S. P., & Sitepu, M. J. (2021). *Pengelolaan sumber daya pesisir dan kelautan secara terpadu* (4th ed.). Pradnya Paramita.
- Daskin, M., Tiril, A., School of Tourism, Sinop University. Sinop, Turkey, Bozkurt, A., & School of Tourism, Adana Aylarslan Türkeş Science and Technology University, Adana, Turkey. (2020). Coastal tourism development in Sinop as an emerging rural destination: A preliminary study from the residents' perspective. *Tourism & Management Studies*, 16(2), 16–25.
- Davies, J., Richardson, S., Gaudet, K., Adams, L., Jollimore, K., MacKinnon, H., LeClair, E. M., Greenan, E., Thorkelson, M., Fontaine, L., & Fitzpatrick, C. (2008). *Evaluation and Selection of Learning Resources: A Guide*. Prince Edward Island.
- Davtyan, R. (2014, April). Contextual learning. In *ASEE 2014 zone I conference* (pp. 3-5).
- Department of Marine and Fisheries of West Sumatra Province. (2017). *Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil Provinsi Sumatera Barat*. Dinas Kelautan dan Perikanan Provinsi Sumatera Barat.
- Duffy, J. (2006). Biodiversity and the functioning of seagrass ecosystems. *Marine Ecology Progress Series*, 311, 233–250.
- Elegbede, I., MaxemilieNgo-Massou, V., Kies, F., Lekan, J. T., Deepeeka, K., Al Jufaili, S. M., & Oloko, A. (2023). Marine and Coastal Resources. In S. Idowu, R. Schmidpeter, N. Capaldi, L. Zu, M. Del Baldo, & R. Abreu (Eds.), *Encyclopedia of Sustainable Management* (pp. 1–5). Springer International Publishing.
- Elegbede, I. O., Akintola, S. L., Jimoh, A. A.-A., Jolaosho, T. L., Smith-Godfrey, S., Oliveira, A., Oladosu, A. O., Ramalho, D. C., Moruf, R. O., Afolabi, S., & Oloko, A. (2023). Blue Economy (Sustainability). In S. Idowu, R. Schmidpeter, N. Capaldi, L. Zu, M. Del Baldo, & R. Abreu (Eds.), *Encyclopedia of Sustainable Management* (pp. 1–9). Springer International Publishing.
- Freeman, L. A., Kleypas, J. A., & Miller, A. J. (2013). Coral Reef Habitat Response to Climate Change Scenarios. *PLoS ONE*, 8(12), 1–14. <https://doi.org/10.1371/journal.pone.0082404>
- Ghosh, T. (2011). Coastal Tourism: Opportunity and Sustainability. *Journal of Sustainable Development*, 4(6), 67–71.

- Hasim, H. (2021). Mangrove Ecosystem, Seagrass, Coral Reef: Its Role in Self-Purification and Carrying Capacity in Coastal Areas. *International Journal Paper Advance and Scientific Review*, 2(1), 37–49.
- Hasyim, M. A. (2019). Pemanfaatan Lingkungan Sekitar Sebagai Sumber Belajar Ilmu Pengetahuan Sosial. *Elementeris : Jurnal Ilmiah Pendidikan Dasar Islam*, 1(1), 12–32.
- Hoek, L. S. V. D., & Bayoumi, E. K. (2017). Importance, Destruction, and Recovery of Coral Reefs. *IOSR Journal of Pharmacy and Biological Sciences*, 12(02), 59–63.
- Irfan, S., & Alatawi, A. M. M. (2019). Aquatic Ecosystem and Biodiversity: A Review. *Open Journal of Ecology*, 09(01), 1–13.
- Kabil, M., Priatmoko, S., Magda, R., & Dávid, L. D. (2021). Blue Economy and Coastal Tourism: A Comprehensive Visualization Bibliometric Analysis. *Sustainability*, 13(7), 1–25.
- Karniati, R., Sulistiyono, N., Amelia, R., Slamet, B., Bimantara, Y., & Basyuni, M. (2021). Mangrove ecosystem in North Sumatran (Indonesia) forests serves as a suitable habitat for mud crabs (*Scylla serrata* and *S. olivacea*). *Biodiversitas Journal of Biological Diversity*, 22(3), 1489–1496.
- Kathiresan, K., & Bingham, B. L. (2001). Biology of mangroves and mangrove Ecosystems. In *Advances in Marine Biology*, 40, 81–251. Elsevier.
- Kurniawan, E., Eva, B., Dafip, M., & S, S. (2020). A teaching-based technology in geography learning. *Cypriot Journal of Educational Sciences*, 15(4), 766–776.
- Maryani, E. (2022). *Geografi Di Era Digital*. CV. Jendela Hasanah.
- Maryeni, S., & Saputri, W. (2022). Perikanan Pantai Wilayah I Carocok Anau Tarusan Kabupaten Pesisir Selatan Sumatera Barat. *SEMAH : Jurnal Pengelolaan Sumberdaya Perairan*, 6(2), 122–129.
- Milon, J., & Alvarez, S. (2019). Coastal Resources Economics and Ecosystem Valuation. *Water*, 11(11), 1–4.
- Nalatilfitroh, N., & Banowati, E. (2021). Relevansi Pemanfaatan Potensi Desa Wisata Candirejo Kabupaten Magelang Sebagai Sumber Belajar Geografi SMA. *Edu Geography*, 9(3), 168–174.
- Nikijuluw, V. P. (2017). Coastal Resources Conservation in Indonesia: Issues, Policies, and Future Directions. *Sumatra Journal of Disaster, Geography and Geography Education*, 1(1), 15–23.
- Phillips, R. C., & Milchakova, N. A. (2003). Seagrass Ecosystems. *Морський Екологічний Журнал*, 2(11), 29–39.
- Prasad, H., Desai, A. Y., & Temkar, G. S. (2023). Coral Reef: Their Importance, Threats And Conservation Strategies. *Annals of the New York Academy of Sciences*, 1162(1), 1–6.
- Rahmawati, S., Hernawan, Udhi. E., McMahon, K., Prayudha, B., Prayitno, Hanif. B., Wahyudi, A. J., & Vanderklift, M. (2019). *Blue Carbon in Seagrass Ecosystem*. Gajah Mada University Press.
- Ramadhan, A., Lindawati, L., & Kurniasari, N. (2017). Nilai Ekonomi Ekosistem Terumbu Karang Di Kabupaten Wakatobi. *Jurnal Sosial Ekonomi Kelautan dan Perikanan*, 11(2), 133–146.
- Ramawati, I. (2016). Pemanfaatan Lingkungan Sekitar Sebagai Sumber Pembelajaran Untuk Meningkatkan Kemampuan Berpikir Kritis. *Jurnal Geografi Gea*, 16(1), 66–87.
- Ridge, J. T., Gray, P. C., Windle, A. E., & Johnston, D. W. (2020). Deep learning for coastal resource conservation: Automating detection of shellfish reefs. *Remote Sensing in Ecology and Conservation*, 6(4), 431–440.
- Rumahorbo, B. T., Hamuna, B., & Dimara, L. (2019). Kondisi Ekosistem Terumbu Karang di Perairan Tablasupa Kabupaten Jayapura dan Nilai Manfaat Ekonominya. *ACROPORA: Jurnal Ilmu Kelautan dan Perikanan Papua*, 1(2), 58–63.
- Seitz, R. D., Wennhage, H., Bergström, U., Lipcius, R. N., & Ysebaert, T. (2014). Ecological value of coastal habitats for commercially and ecologically important species. *ICES Journal of Marine Science*, 71(3), 648–665.
- Sotiriadis, M., & Shen, S. (2020). *Blue Economy and Sustainable Tourism Management in Coastal Zones: Learning from Experiences* (pp. 1–13). Asian Development Bank Institute.
- Stryzhak, O., Akhmedova, O., & Aldoshyna, M. (2020). The Prospects of the marine and coastal tourism development in Ukraine. *E3S Web of Conferences*, 153, 1–10.

- Suryawati, E., & Osman, K. (2018). Contextual Learning: Innovative Approach towards the Development of Students' Scientific Attitude and Natural Science Performance. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(1), 61–76.
- Susiloningtyas, D., Handayani, T., & Amalia, A. N. (2018). The Impact of Coral Reefs Destruction and Climate Change in Nusa Dua and Nusa Penida, Bali, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 145, 1–8.
- Tangke, U. (2010). Ekosistem padang lamun (Manfaat, Fungsi dan Rehabilitasi). *Agrikan: Jurnal Agribisnis Perikanan*, 3(1), 9–29.
- Tegar, D., & Gurning, R. O. S. (2018). Development of Marine and Coastal Tourism Based on Blue Economy. *International Journal of Marine Engineering Innovation and Research*, 2(2), 128–132.
- Uar, N. D., Murti, S. H., & Hadisusanto, S. (2016). Kerusakan Lingkungan Akibat Aktivitas Manusia Pada Ekosistem Terumbu Karang. *Majalah Geografi Indonesia*, 30(1), 88–95.
- Uneputty, P. A., Haumahu, S., & Mamesah, J. A. B. (2023). Pelestarian Sumber Daya dan Lingkungan Pesisir dan Laut. *Open Community Service Journal*, 2(2), 84–90.
- Whitfield, A. K. (2017). The role of seagrass meadows, mangrove forests, salt marshes and reed beds as nursery areas and food sources for fishes in estuaries. *Reviews in Fish Biology and Fisheries*, 27(1), 75–110.
- Wibowo, W. S. (2019). The Natural Environment As A Learning Source For Science: Implementation Strategy. *Journal of Science Education Research*, 3(1), 63–66.
- Zurba, N. (2018). *Pengenalan Padang Lamun Suatu Ekosistem yang Terlupakan*. UNIMAL PRESS.