BUKTI KORESPONDENSI

1. **Judul Artikel:** Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources
2. **Jurnal:** Brazilian Journal of Biology (Q2); SJR 0.330
3. **Penulis:** Totok Hendarto[1], and Eny Dyah Yuniwati[2]

   Universitas Dr. Soetomo Surabaya, Indonesia; Universitas Wisnuwardhana Malang, Indonesia
4. *Link Artikel:* https://www.scielo.br/j/bjb/a/qTgjBhCTQ8Jm8LMkTFq3ZcN/?lang=en

Berikut adalah urutan korespondensi berdasarkan tanggal:

No.	Perihal	Tanggal
1	Submission Acknowledgement	2 November 2023, 16:04
2	BJB-280083 Suggestions from evaluators (BJB-280083 Saran dari evaluator)	2 November 2023, 19:56
3	[BJB] Editor Decision ([BJB] Keputusan Redaksi)	30 November 2023, 17:27
4	Resubmit for Review	5 Desember 2023, 10:56
5	[BJB] Accept Submission BJB-280083 - 84.22	16 Januari 2024, 18:07
6	bjbAO280083_EN_Mr Totok Payment Invoice	23 Januari 2024, 10:55
7	bjbAO280083 Invoice	17 Februari 2024, 17:18
8	280083_EN_manuscritoverificacao (3)	27 Februari 2024, 20:59
9	bjbAO280083_EN_Pending issues	29 Maret 2024, 03:39
10	URGENT_EDITORIAL CUBO WAITS FOR YOUR RESPONSE_Revision Paper ID bjbAO280083	31 Maret 2024, 02:31
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13	ENC_BJB_ Accept Submission BJB-280083 - 84.22_check	11 September 2024, 17:20
14	bjbAO280083_EN_To return your corrections	20 April 2024, 00:31
15	bjbAO280083_EN_enviadoAutor Corection_04_20_2024 00.31 paper	20 April 2024, 00:31
16	5 dias waiting_bjb_Final proofreading_Article_bjbAO280083_EN_Request Correction n revision	24 April 2024, 10:00
17	6 dias waiting_bjb _ Final proofreading _Article bjbAO280083_EN_attention	25 April 2024, 10:00
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22	13 dias waiting_bjb_ Final proofreading_Article_bjbAO280083_EN_Mr Totok Confirmation	6 Mei 2024, 13:43
23	RE: RE: 13 dias waiting_bjb_Final proofreading_ Article_ bjbAO280083_EN	7 Mei 2024, 19:45
24	RE_ RE_ RE_ 13 dias waiting_bjb_Final proofreading _ Article_ bjbAO280083_EN_Mr. Totok	13 Mei 2024, 05:40
25	RE_ RE_ RE_ 13 dias waiting _ bjb *Final proofreading _ Article* bjbAO280083_EN_MR totok Paper	13 Mei 2024, 05:40
26	bjb_ Final proofreading completed_Article_bjbAO280083_EN	14 Mei 2024, 21:10
27	bjb _ Layout proof *Article* bjbAO280083_EN	16 Mei 2024, 00:49
28	01_PROVA_AUTOR_bjbAO280083_EN.papar	16 Mei 2024, 00:49
29	RE_bjb _ Layout proof _ Article: bjbAO280083_EN_Mr Totok	27 Mei 2024, 12:50

30	01_PROVA_AUTOR_bjbAO280083_EN_Mr Totok Paper	27 Mei 2024, 12:50
31	bjb *Layout proof completed _ Article* bjbAO280083_EN	27 Mei 2024, 19:58
32	bjb *Layout proof completed _ Article* bjbAO280083_EN_Waiting production process	28 Mei 2024, 11:14
33	RE_bjb *Final proofreading _ Article* bjbAO280083_EN	7 Juni 2024, 07:26
34	bjbAO280083_EN_enviadoAutor.docx_revisi_Paper	7 Juni 2024, 07:26
35	bjbAO280083_EN_for 170 days in activity Archive finished	7 Juni 2024, 07:26

Gmail enydyah yuniwati <nieyuniwati@gmail.com>

[BJB] Submission Acknowledgement

1 message

Rogério Pessa <noreply.ojs2@scielo.org> Thu, Nov 2, 2023 at 4:04 PM
To: Eny Dyah Yuniwati <nieyuniwati@gmail.com>

Hello,

Totok Hendarto has submitted the manuscript, "Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources: Ecosystem Services Based Mangrove Forest with Management Model " to Brazilian Journal of Biology.

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Rogério Pessa

Brazilian Journal of Biology

Rua Bento Carlos, 750

13560-660 São Carlos / SP - Brasil

Gmail enydyah yuniwati <nieyuniwati@gmail.com>

BJB-280083 Suggestions from evaluators

3 messages

Brazilian Journal of Biology <bjb@bjb.com.br> Thu, Nov 2, 2023 at 7:56 PM
To: totok.hendarto.unitomo@gmail.com
Cc: nieyuniwati@gmail.com

Dear Author **Totok Hendarto**

Title: ECOSYSTEM SERVICES BASED MANGROVE FOREST WITH MANAGEMENT STRATEGIES

We would like to inform you that your manuscript is being evaluated, we ask the authors to indicate 5 names of potential evaluators (with their e-mails) among specialists of recognized competence in the area for possible consultation.

Recommended referees should have no close academic links to any of the authors and they should not belong to the same institution of the authors.

Sincerely.

Profa. Dra. Takako Matsumura Tundisi
Editor Chief
Brazilian Journal of Biology

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enydyah yuniwati <nieyuniwati@gmail.com> Thu, Nov 2, 2023 at 8:25 PM
To: Brazilian Journal of Biology <bjb@bjb.com.br>
Cc: totok.hendarto.unitomo@gmail.com

Thank you for your information.
[Quoted text hidden]

Brazilian Journal of Biology <bjb@bjb.com.br> Thu, Nov 2, 2023 at 9:13 PM
To: enydyah yuniwati <nieyuniwati@gmail.com>

Dear Author,

We appreciate your contact.

We look forward to your suggestions for reviewer names!

Regards

Rogério Pessa

Manager Editor

Brazilian Journal of Biology

[Quoted text hidden]

Gmail enydyah yuniwati <nieyuniwati@gmail.com>

[BJB] Editor Decision

3 messages

Brazilian Journal of Biology <noreply.ojs2@scielo.org> Thu, Nov 30, 2023 at 5:27 PM
To: Totok Hendarto <totok.hendarto.unitomo@gmail.com>, Eny Dyah Yuniwati <nieyuniwati@gmail.com>

Totok Hendarto, Eny Dyah Yuniwati:

We have reached a decision regarding your submission to Brazilian Journal of Biology, "Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources: Ecosystem Services Based Mangrove Forest with Management Model ".

Our decision is to: **Resubmit for Review**

IMPORTANT: SEND A LIST OF CORRECTIONS MADE IN "OTHER DOCUMENTS"!
SEND THE COMPLETE ARTICLE (.doc) IN A SINGLE FILE, WITHOUT ANY TYPE OF MARKING OR CORRECTIONS.
URGENT: ALREADY ADD TO THE ARTICLE FILE: ORCID OF ALL AUTHORS AND A SHORT TITLE, THAT IS, A SHORT TITLE (FOR HEADER).

Reviewer A:
Recommendation: Accept Submission

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1 - General comments about the manuscript:

(Please comment about the originality, contribution relevance).

This is a very important paper that fits very well with the objectives of he manuscript. It is a very good paper. Ecosystem services of mangroves are not well known and this is a very welcomme publication.

2 - Evaluation:

Good paper.

3 - Final evaluation:

Excellent

4 - Final Decision:

Publish

Reviewer C:
Recommendation: Resubmit for Review

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1 - General comments about the manuscript:

(Please comment about the originality, contribution relevance).

Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources: Ecosystem Services Based Mangrove Forest with Management Model
Brazilian Journal of Biology
General comments
The review paper discussed many interesting points on the aforementioned topic but the result section missed some clarity and that needs to be addressed before any further consideration. Additionally, technical writing problems and language editing need serious revision. All the detailed comments and suggestions that need to be improved are presented below.
Specific comments
The title is not consistent in the Word file and in the journal online site. Thus, it needs to be modified as “Ecosystem Services-based Mangrove Forest with Management Model Strategies and Sustainability of Coastal Natural Resources”
Abstract
Lack of proper punctuation, for instance, lines 5 & 7.
Lack of quantitative data in the result section.
Replace “Keywords: Ecosystem, Strategies, Management.” with non-italicized and correct order “Keywords: Ecosystem, Management, Strategies.”
Introduction
Some writing technical problems need to be corrected. For instances:
Paragraph 3 and line 2: I missed this reference “(Purwanto et al., 2022) in the reference section. In addition, there is a lack of consistency in citation style.
#1. In other several places, the author/s used the name of the first author and others plus the year of publication without a comma, which is completely different from this one.
#2. I did not find this reference (Kusmana & Sukristijiono, 2016b) again in the reference section. Plus, where is 2016a in the me authors? Which one is correct “&” or “and” for two authors? Because the authors used both cases.
#3 Lack of proper citation: For example, paragraph 3, line 1 “In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of (Purwanto et al., 2022) coastline” was copied from “Indonesia is an archipelago country with more than 17,504 islands and about 95,181 km coastline

(Kusmana & Sukristijiono 2016).", this has been cited in other previous similar works in similar areas but not acknowledged in the current paper, i.e., A. Sofian, C. Kusmana, A. Fauzi, O. Rusdiana. (2019). Ecosystem services-based mangrove management strategies in Indonesia: a review. Aquaculture, Aquarium, Conservation & Legislation - International Journal of the Bioflux Society, 12(1):151-166.
Methods
Replace "Metode" with "Methods"
Why are some terms written in italicized form in many places?
Many editorial problems were shown in this section as common to other sections.
"Systematic Review"? Did you mean Results?
It seems just part of a method section and I did not see a clear result section of compiled findings in this review paper.
Discussion
I appreciate the discussion part although some editorial and conceptual problems need to be revised.
Pragraph1. Replace "13 lyana species" with "13 liana species".
Pragraph1. What "type" stands for herein? Is it a species or an unidentified individual? "… 14 types of grass, 8 types of herbs, 3 types of benalu, 36 types of epiphytes, 3 types of ferns"
Page 10, the last paragraph, scientific names should be italicized: Such as, "which include two species of Harra (Avicennia marina) and Chandal (Rhizophora mucronata)" with "which include two species of Harra (Avicennia marina) and Chandal (Rhizophora mucronata)"

2 - Evaluation:

Irrelevant results.

3 - Final evaluation:

Good

4 - Final Decision:

Reformulate

Brazilian Journal of Biology

Rua Bento Carlos, 750

13560-660 São Carlos / SP - Brasil

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enydyah yuniwati <nieyuniwati@gmail.com> Thu, Nov 30, 2023 at 9:00 PM
To: Brazilian Journal of Biology <noreply.ojs2@scielo.org>

Thank you for informing me.
[Quoted text hidden]

Totok Hendarto <totok.hendarto.unitomo@gmail.com> Tue, Dec 5, 2023 at 10:56 AM
To: Brazilian Journal of Biology <noreply.ojs2@scielo.org>
Cc: Eny Dyah Yuniwati <nieyuniwati@gmail.com>

Dear: Reviewers and Editorials

I have revised the article according to the results of the review, please proceed further so that the article can be accepted, as instructed by the reviewer that the article can be accepted with several revisions that I have adjusted

Orcid All Authors and Short Title has been added

Sincerelly,

Totok Hendarto
[Quoted text hidden]

Article Revision.docx
177K

Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

Totok Hendarto[1] and Eny Dyah Yuniwati[2]

[1] The Science of Management, Coastal and Marine Resources. Department of Fisheries Agribusiness, Faculty of Agriculture, Dr. Soetomo University, https://orcid.org/0000-0001-7257-7317, totok@unitomo.ac.id

[2] Department of Agrotechnology, Faculty of Agriculture, Wisnuwardhana University, Malang, https://orcid.org/0000-0001-8134-5841, nieyuniwati@gmail.com

Abstract

The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Researchgate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show tha mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: Ecosystem, Service-Based, Mangrove, Forest, Management, Strategies, Sustainability, Coastal, Natural Resources

Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara, 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister and others 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et. al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et. al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni [n.d.]). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et. al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et. al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et. al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et. al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline(Purwanto et al., 2022). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Kusmana & Sukristijiono, 2016) (Sofian et. al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et. al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail and others 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et. al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints

faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Sugiyono, 2016) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows : "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following image.

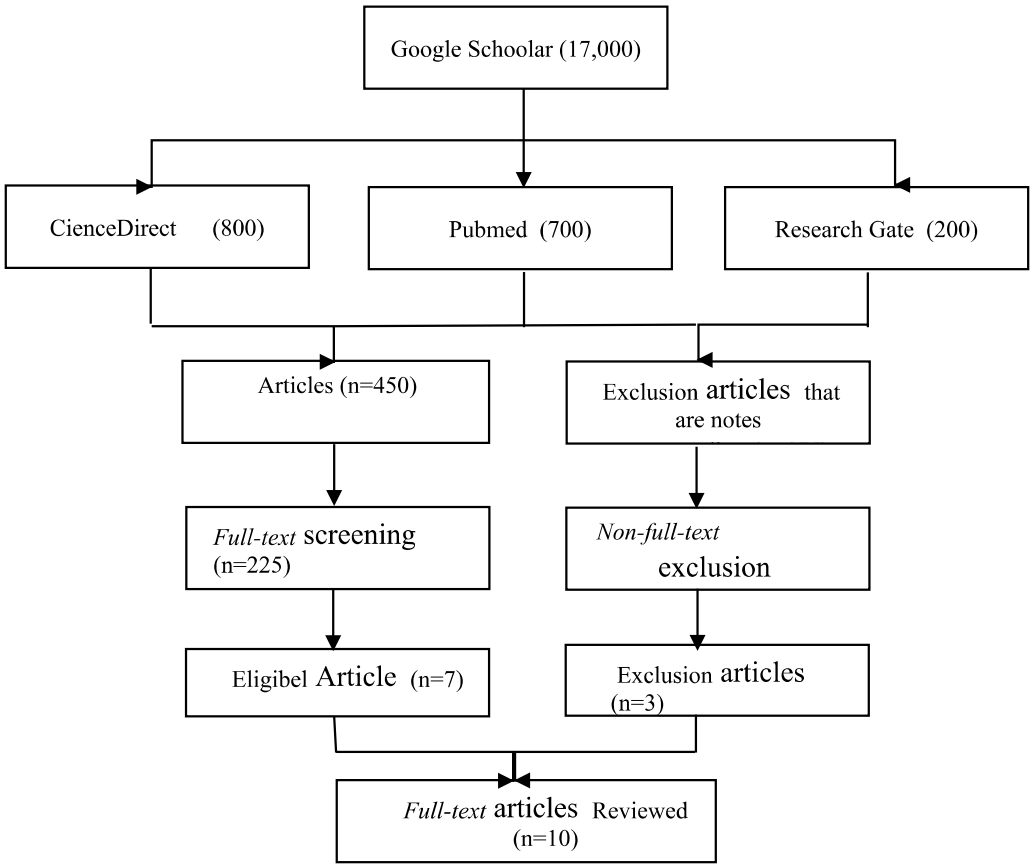

Figure 1. Search Results Diagram Flow and Article Selection

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies*.

Table 1.1. Previous research is reviewed

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi **Authors**: (Nie et. al., 2023) **Publish**: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976. **Link**: https://www.sciencedirect.com/science/article/pii/S0197397522002326	**Aim:** Assessing thevaluation of coastal wetland ecosystem services based on a modified selected experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi **Method**: *Field Research*, Experiment **Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the willingness of communities to pay per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta **Authors**: (Hilmi et. al., 2023) **Publish**: Proceedings ICMA-SURE-International Conference On Multidisciplinary Approaches For Sustainable Rural Development **Link**: http://jos.unsoed.ac.id/index.php/eprocicma/article/view/7783	**Aim**: Assess external, internal and ecosystem services to support mangrove rehabilitation planning on the north coast of Jakarta. **Method**: This research method uses IFAS analysis, EFAS and Buchard analysis. **Result**: Emangrove cosystem is ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fisheries and pond activities, pond activities, and social benefits. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts,

		increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests **Authors**: (Dashtbozorgi et. al., 2023) **Publish**: Regional Studies in Marine Science **Link**: https://www.sciencedirect.com/science/article/abs/pii/S2352485523000026	Aim: Mstudied ecosystems using InVEST modeling: The case of Iran's mangrove forests. **Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality **Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: (Rakotomahazo et. al., 2023) **Publish**: Marine Policy **Link**: https://www.sciencedirect.com/science/article/abs/pii/S0308597X22004973	**Aim**: Explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar **Method**: Semi-structured interview **Result**: A number of land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: (Limbong et. al., 2023) **Publish**: Journal of Sylva Indonesiana **Link**: https://talenta.usu.ac.id/Jsi/article/view/9154	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: results of Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation

		of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the position of institutional development of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: (Getzner and Islam, 2020) **Publish**: International Journal of Environmental Research and Public Health **Link**: https://www.mdpi.com/1660-4601/17/16/5830	**Aim**: Assessing the Role of Coastal Biodiversity Conservation on Sustainability and Environmental Care in Indonesia's South Malang Mangrove Ecosystem. **Method**: *Field Research* and Observationon **Result**: Therange of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: (Agustriani et. al., 2023) **Publish**: Journal of Hunan University Natural Sciences **Link**:	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire andInterview **Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444

	http://jonuns.com/index.php/journal/article/view/1275	ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas **Authors**: (Fauzi et. al., 2023) **Publish**: International Journal of Geo-Information **Link**: https://www.mdpi.com/2220-9964/12/2/75	**Aim**: Potential Loss of Value of Ecosystem Services Due to Expansion of Vessel Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: (Arkham et. al., 2023) **Publish**: Research Square **Link**: https://www.researchsquare.com/article/rs-2525875/v1	**Aim**: Economic value of mangrove ecosystem services in coastal areas of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and surrounding communities. It also collects some secondary data to support data analysis.

		Result: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: (Marlianingrum et. al., 2019) **Publish:** IOP Conference Series: Earth and Environmental Science **Link**: https://iopscience.iop.org/article/10.1088/1755-1315/241/1/012026/meta	**Aim**: Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang District, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) .(Kusmana & Sukristijiono, 2020)

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning

the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni 2018).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastu et. al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et. al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Fink, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et. al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et. al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas and others 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et. al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et. al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda and others 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the

government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et. al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et. al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (ReisFilho et. al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et. al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy*)*.

Research (Dashtbozorgi et. al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and

decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.

Research (Arkham et. al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie and others 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani and others 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection

and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et. al., (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated. Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable. Research (Hilmi and others 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove

rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et. al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et. al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis and others 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et. al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et. al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et. al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each

other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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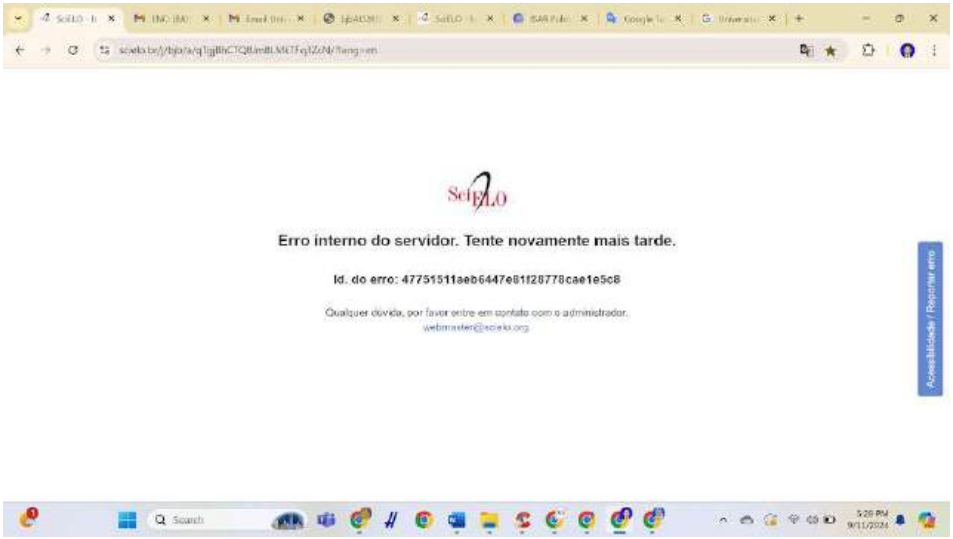

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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

Floresta de mangue baseada em serviços ecossistêmicos com estratégias de modelo de gestão, sustentabilidade dos recursos naturais costeiros

Totok Hendarto[1]* https://orcid.org/0000-0001-7257-7317 and Eny Dyah Yuniwati[2] https://orcid.org/0000-0001-8134-5841

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Received: November 2, 2023 – Accepted: January 16, 2024

Abstract

The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an

area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.
Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources

Resumo
Estratégias de Modelo de Gestão, Sustentabilidade dos Recursos Naturais Costeiros. Este projeto de pesquisa utiliza revisão sistemática, ou seja, pesquisa em bibliotecas que examina periódicos críticos e de qualidade, que foram filtrados com critérios de inclusão e usa vários bancos de dados Google Scholar, Pubmed, Science Direct e Researchgate como alfabetização neste estudo. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados de palavras-chave. Floresta de Mangue Baseada em Serviços Ecossistêmicos com Estratégias de Manejo, que foram filtrados em 10 periódicos de acordo com o tema e analisados por meio de revisão. Floresta de mangue baseada em serviços ecossistêmicos com estratégias de manejo. Os resultados da pesquisa mostram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). Florestas de mangais baseadas em serviços ecossistémicos com estratégias de gestão, que existem três componentes principais que devem ser considerados nos esforços para gerir e utilizar ecossistemas de mangais e recursos naturais costeiros, nomeadamente; 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue, e 3) os próprios recursos naturais (processos naturais) A gestão das florestas de mangais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de mangais, para que sejam bem mantidas e sustentáveis. Dos aspectos socioeconómicos, culturais e humanos, os recursos naturais são necessários para poder continuar as suas vidas, por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das actividades humanas como principais utilizadores dos recursos naturais.
Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais

Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara, 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister and others 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et. al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial

services for humans and the environment (Lee et. al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni [n.d.]). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et. al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et. al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et. al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et. al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline(Purwanto et al., 2022). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Kusmana & Sukristijiono, 2016) (Sofian et. al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et. al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail and others 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et. al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic

(Sugiyono, 2016) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows : "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following image.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies.*

Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) .(Kusmana & Sukristijiono, 2020)

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni 2018).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastu et. al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government

institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et. al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Fink, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et. al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et. al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas and others 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et. al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et. al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda and others 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et. al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et. al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (ReisFilho et. al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et. al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the

importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy*)*.

Research (Dashtbozorgi et. al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.

Research (Arkham et. al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support

the productivity of the habitat in them. In research (Nie and others 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani and others 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et. al., (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that

occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated. Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable. Research (Hilmi and others 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et. al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as

those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et. al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis and others 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et. al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et. al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et. al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove

ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Table 1. Previous research is reviewed

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No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi **Authors**: (Nie et. al., 2023) **Publish**: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976. **Link**: https://www.sciencedirect.com/science/article/pii/S0197397522002326	**Aim:** Assessing thevaluation of coastal wetland ecosystem services based on a modified selected experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi **Method**: *Field Research*, Experiment **Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the willingness of communities to pay per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta **Authors**: (Hilmi et. al., 2023) **Publish**: Proceedings ICMA-SURE-International Conference On Multidisciplinary Approaches For Sustainable Rural Development **Link**: http://jos.unsoed.ac.id/index.php/eprocicma/article/view/7783	**Aim**: Assess external, internal and ecosystem services to support mangrove rehabilitation planning on the north coast of Jakarta. **Method**: This research method uses IFAS analysis, EFAS and Buchard analysis. **Result**: Emangrove cosystem is ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fisheries and pond activities, pond activities, and social benefits. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and

		developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests **Authors**: (Dashtbozorgi et. al., 2023) **Publish**: Regional Studies in Marine Science **Link**: https://www.sciencedirect.com/science/article/abs/pii/S2352485523000026	Aim: Mstudied ecosystems using InVEST modeling: The case of Iran's mangrove forests. **Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality **Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: (Rakotomahazo et. al., 2023) **Publish**: Marine Policy **Link**: https://www.sciencedirect.com/science/article/abs/pii/S0308597X22004973	**Aim**: Explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar **Method**: Semi-structured interview **Result**: A number of land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: (Limbong et. al., 2023) **Publish**: Journal of Sylva Indonesiana **Link**: https://talenta.usu.ac.id/Jsi/article/view/9154	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: results of Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value,

		namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the position of institutional development of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: (Getzner and Islam, 2020) **Publish**: International Journal of Environmental Research and Public Health **Link**: https://www.mdpi.com/1660-4601/17/16/5830	**Aim**: Assessing the Role of Coastal Biodiversity Conservation on Sustainability and Environmental Care in Indonesia's South Malang Mangrove Ecosystem. **Method**: *Field Research* and Observationon **Result**: Therange of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: (Agustriani et. al., 2023) **Publish**: Journal of Hunan University Natural Sciences **Link**: http://jonuns.com/index.php/journal/articl	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire andInterview **Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The

	e/view/1275	annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas **Authors**: (Fauzi et. al., 2023) **Publish**: International Journal of Geo-Information **Link**: https://www.mdpi.com/2220-9964/12/2/75	**Aim**: Potential Loss of Value of Ecosystem Services Due to Expansion of Vessel Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: (Arkham et. al., 2023) **Publish**: Research Square **Link**: https://www.researchsquare.com/article/rs-2525875/v1	**Aim**: Economic value of mangrove ecosystem services in coastal areas of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and surrounding communities. It also collects some secondary data to support data analysis. **Result**: The estimated economic value of

		mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: (Marlianingrum et. al., 2019) **Publish:** IOP Conference Series: Earth and Environmental Science **Link**: https://iopscience.iop.org/article/10.1088/1755-1315/241/1/012026/meta	**Aim**: Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang District, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Figure 1. Search Results Diagram Flow and Article Selection

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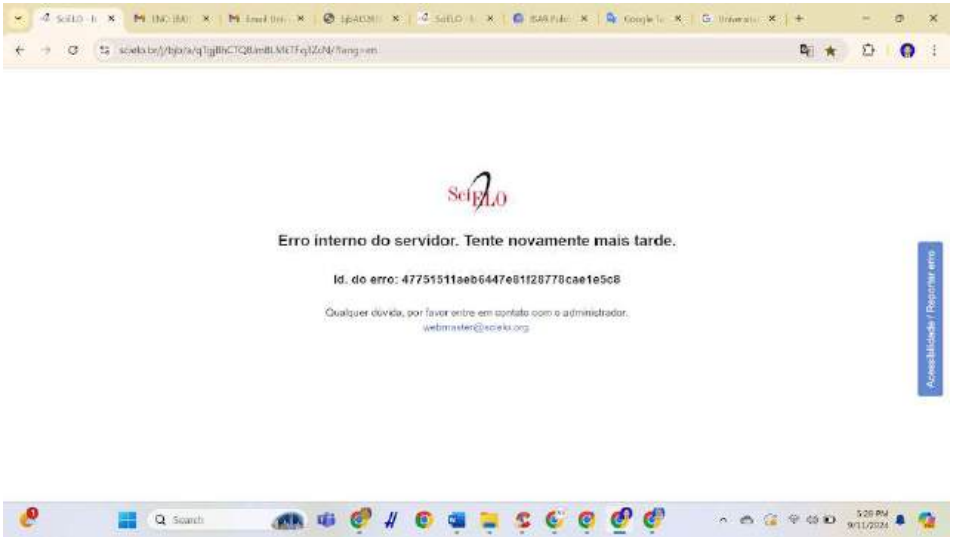

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Table 1. Previous Research is Reviewed

No	Identity	Summary
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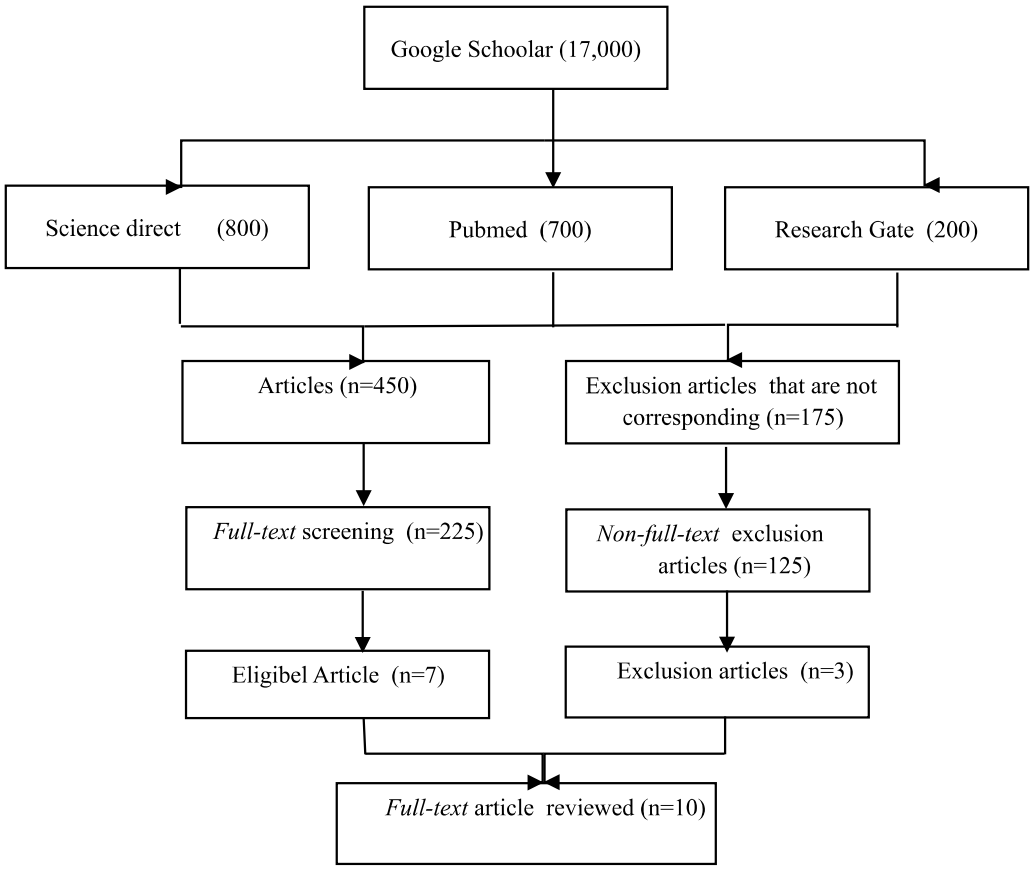
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: (Rakotomahazo and others 2023) **Publish**: Marine Policy **Link**: https://www.sciencedirect.com/science/article/abs/pii/S0308597X22004973	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar **Method**: Semi-Structured Interview **Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: (Limbong and others 2023) **Publish**: Journal of Sylva Indonesiana **Link**: https://talenta.usu.ac.id/Jsi/article/view/91	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: the result of the Internal Factor

	54	Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: (Getzner and Islam 2020) **Publish**: International Journal of Environmental Research and Public Health **Link**: https://www.mdpi.com/1660-4601/17/16/5830	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia. **Method**: *Field Research* and Observationon **Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove	**Aim**: Economic Valuation of Mangrove

	Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: (Agustriani and others 2023) **Publish**: Journal of Hunan University Natural Sciences **Link**: http://jonuns.com/index.php/journal/article/view/1275	Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire and Interview **Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas **Authors**: (Fauzi and others 2023) **Publish**: International Journal of Geo-Information **Link**: https://www.mdpi.com/2220-9964/12/2/75	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of Ship Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.

9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: (Arkham and others 2023) **Publish**: Research Square **Link**: https://www.researchsquare.com/article/rs-2525875/v1	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. **Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: (Marlianingrum and others 2019) **Publish:** IOP Conference Series: Earth and Environmental Science **Link**: https://iopscience.iop.org/article/10.1088/1755-1315/241/1/012026/meta	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use

		them.



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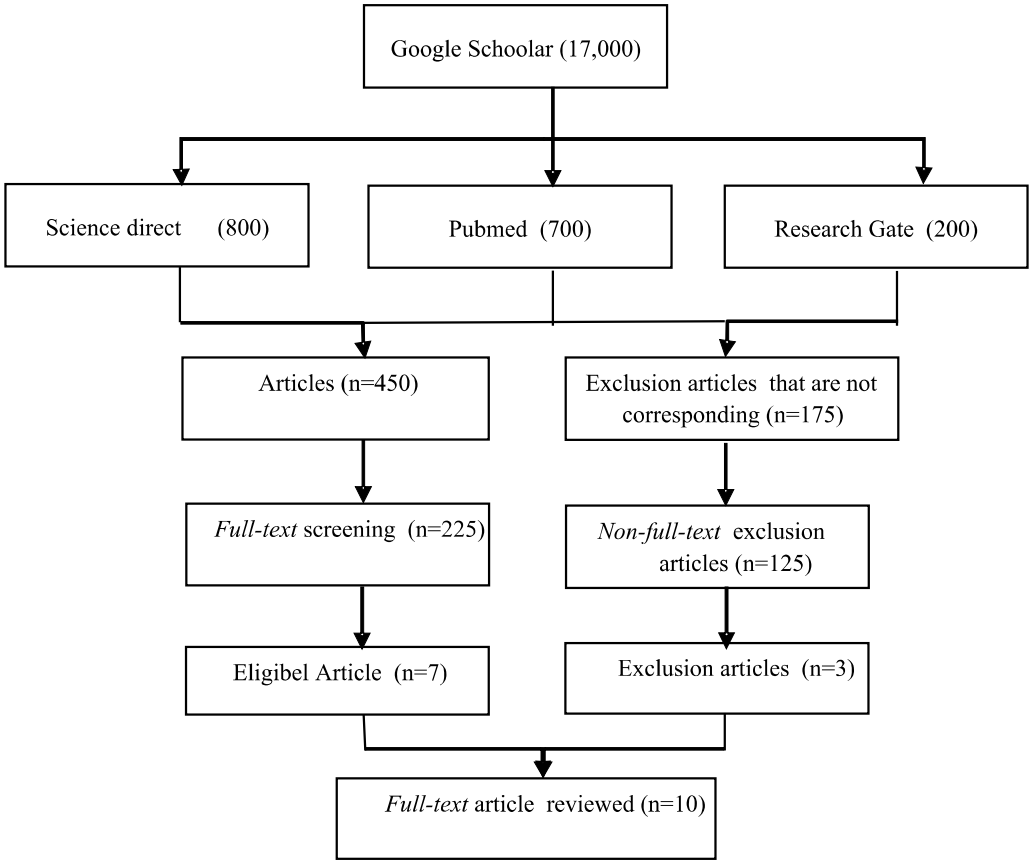

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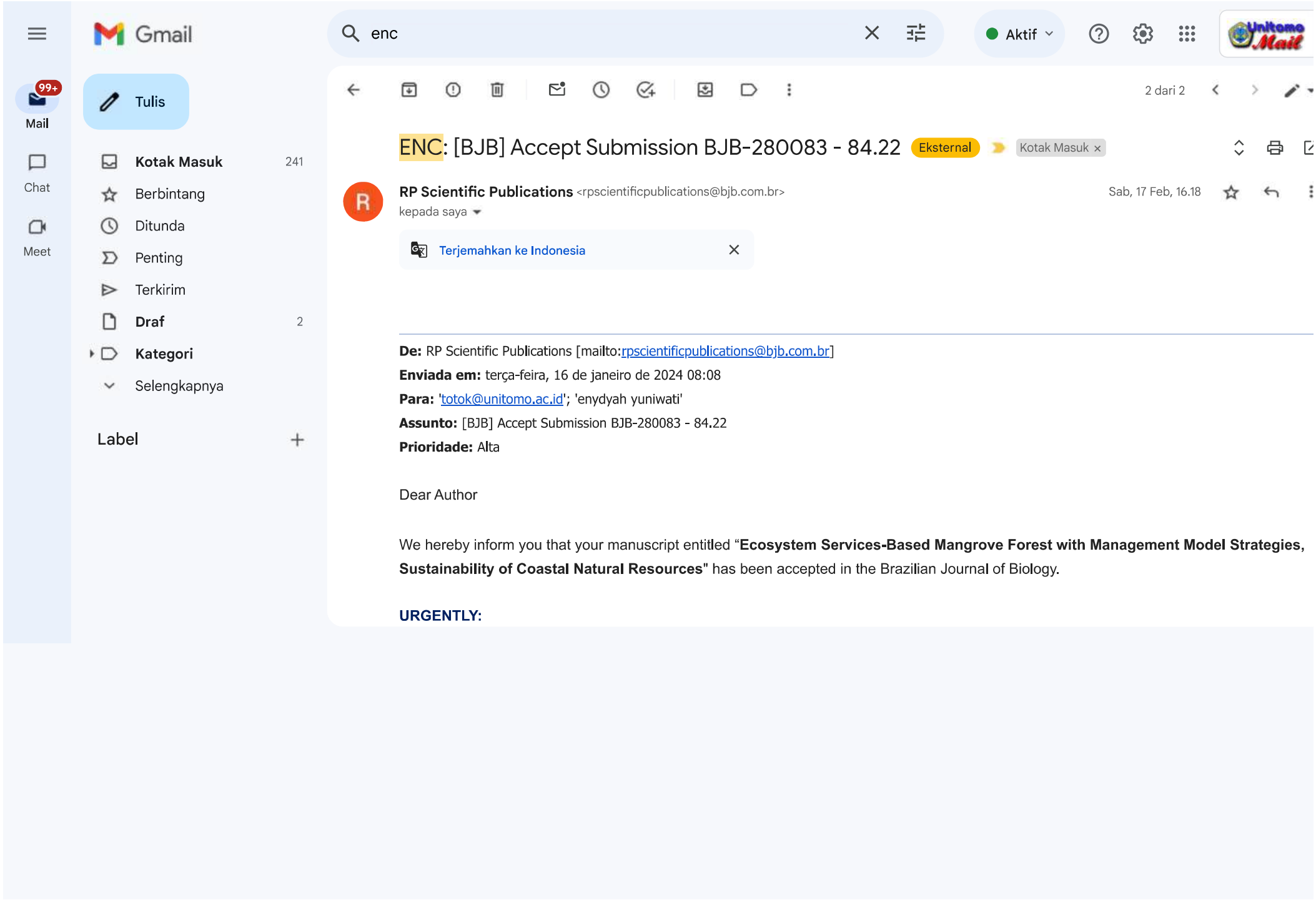
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Ecosystem services-based mangrove forest with management model strategies, sustainability of coastal natural resources

Serviços ecossistêmicos de florestas de manguezal com estratégias de modelo de manejo, sustentabilidade dos recursos naturais costeiros

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Abstract
The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources.

Resumo
Este estudo analisa os serviços ecossistêmicos fornecidos por florestas de manguezal e propõe estratégias de manejo para a sustentabilidade dos recursos naturais costeiros. A metodologia utilizada foi a revisão sistemática, ou seja, pesquisa bibliográfica que examina periódicos críticos e de qualidade, revisados por pares em bancos de dados como Google Scholar, Pubmed, Science Direct e Researchgate. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados com as palavras-chave “Serviços Ecossistêmicos de Florestas de Manguezal com Estratégias de Manejo”. Após filtragem de acordo com o tema, foram analisadas 10 publicações científicas. Os resultados da pesquisa mostraram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-

1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). O estudo também identificou três componentes principais a serem considerados no manejo e utilização dos ecossistemas de manguezais e recursos naturais costeiros: 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá; 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue; e 3) os próprios recursos naturais (processos naturais). O manejo dos manguezais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de manguezais, para que sejam bem mantidas e sustentáveis. Do ponto de vista socioeconômico, cultural e humano, os recursos naturais são necessários para poder continuar as suas vidas. Por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das atividades humanas, uma vez que o ser humano é o principal usuário desses recursos.

Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais.

1. Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara et al., 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister et al., 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni et al., 2023). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline (Purwanto et al., 2022 [[Q1: Q1]]). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Kusmana and Sukristijiono, 2016 [[Q2: Q2]]; Sofian et al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail et al., 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

2. Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Sugiyono, 2016 [[Q3: Q3]]) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows: "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following Figure 1.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies* (Table 1).

3. Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) (Kusmana and Sukristijiono, 2020 [[Q4: Q4]])

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni, 2017).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham, 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastuti et al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Finkl, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas et al., 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda et al., 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (Reis Filho et al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy).

Research (Dashtbozorgi et al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.

Research (Arkham et al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie et al., 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific

development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani et al., 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et al. (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated. Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable. Research (Hilmi et al., 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and

accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi, 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis et al., 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

4. Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three

components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Table 1. Previous research is reviewed.

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi **Authors**: Nie et al. (2023) **Publish**: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976.	**Aim:** evaluation of coastal wetland ecosystem services based on a modified experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi **Method**: *Field Research*, Experiment **Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area is 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; their level of contribution is the same. Regarding the preferred model, based on correction, people's willingness to pay a per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The related values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta **Authors**: Hilmi et al. (2023) **Publish**: Proceedings ICMA-SURE-International Conference On Multidisciplinary Approaches For Sustainable Rural Development	**Aim**: external, internal and ecosystem services factors to support mangrove rehabilitation planning on the north coast of Jakarta. **Method**: This research method uses IFAS analysis, EFAS and Buchard analysis. **Result**: Emangrove cosystems are ecotourism, conservation, wildlife sanctuaries, tidal flood reduction, abrasion and accretion, intrusion reduction, land subsidence reduction, economic income, fisheries and pond activities, pond activities, and social. benefits. Mangrove rehabilitation strategies are weaknesses-opportunities strategies (minimizing weaknesses, seizing opportunities, and avoiding threats. Mangrove rehabilitation planning strategies are mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests **Authors**: Dashtbozorgi et al. (2023) **Publish**: Regional Studies in Marine Science	**Aim**: ecosystem using InVEST modeling: The case of Iran's mangroves Selatan. **Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality **Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area

		increased by 586.45 ha while the first two quality categories, including poor and low classes, increased. Based on habitat quality assessments in 2010, the two classes of poor, low habitat quality, are estimated to be around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output map obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of the target ecosystem and can help them adopt more effective management strategies for the conservation of these ecosystems.
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: Rakotomahazo et al. (2023) **Publish**: Marine Policy	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar **Method**: Semi-Structured Interview **Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: Limbong et al. (2023) **Publish**: Journal of Sylva Indonesiana	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: the result of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports

		the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: Getzner and Islam (2020) **Publish**: International Journal of Environmental Research and Public Health	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia. **Method**: *Field Research* and Observationon **Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: Agustriani et al. (2023) **Publish**: Journal of Hunan University Natural Sciences	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire and Interview **Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of

	Expansion in Indonesian Marine Protected Areas **Authors**: Fauzi et al. (2023) **Publish**: International Journal of Geo-Information	Ship Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: Arkham et al. (2023) **Publish**: Research Square	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. **Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: Marlianingrum et al. (2019) **Publish:** IOP Conference Series: Earth and Environmental Science	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have

		a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Figure 1. Search results and article selection.

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Subject	17 dias waiting | bjb | Final proofreading | Article: bjbAO280083_EN
Sent at	05/06/2024 10:00
Read at	05/06/2024 13:42
Message	Dear Author, the **deadline** set for us to receive corrections for the article "**Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources**" sent in the previous message **has been exceeded.** We ask that you respond to us as soon as possible. **ATENTION!** • The feedback file **must be in docx format.** We ask that you carefully follow the guidelines located **in the box on the first page of the attached file.** • We **will only continue the production** of the article **after we receive the revised document** and with all pending issues resolved. • **If the response deadline is exceeded**, you will receive **daily charges** in your inbox and **we will contact the journal editors.** • After your return, you will receive a new file in PDF, in which **layout** issues (visual layout of the text) must be observed. **We send the attached file for resolution of pending issues. You can also access it through the previous message through the system.** Thank you for your attention and we count on your collaboration. Best Regards, *Copyediting Team*

reply

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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

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Author	RE: bjb | Layout proof | Article: bjbAO280083_EN *not read*	06/23/2024 18:51 Archived
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Subject	RE: 13 dias waiting | bjb | Final proofreading | Article: bjbAO280083_EN
Sent at	05/06/2024 13:43
Read at	05/07/2024 19:44
Message	Dear editorial I am sorry because I am get info for 2 days So, what i can do to procces publication my article? Thanks

reply

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Subject	RE: RE: 13 dias waiting | bjb | Final proofreading | Article: bjbAO280083_EN
Sent at	05/07/2024 19:45
Read at	05/13/2024 05:09
Message	Dear Author, You are receiving a Proofreading file for your article “Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources” to its publication in Brazilian Journal of Biology. To ensure the fast publication of your article, **reply to this message within 2 days.** **ATENTION!** • The feedback file **must be in docx format.** We ask that you carefully follow the guidelines located **in the box on the first page of the attached file.** • We **will only continue the production** of the article **after we receive the revised document** and with all pending issues resolved. • **If the response deadline is exceeded**, you will receive **daily charges** in your inbox and **we will contact the journal editors.** • After your return, you will receive a new file in PDF, in which **layout** issues (visual layout of the text) must be observed. **To return your corrections, reply using the button in the system and attach the corrected proof.** Best Regards, *Copyediting Team*
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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

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Messages 31

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From	Subject	Date
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Subject	RE: RE: RE: 13 dias waiting | bjb | Final proofreading | Article: bjbAO280083_EN
Sent at	05/13/2024 05:40
Read at	05/13/2024 18:05
Message	Dear Mrs Barbara Editorial I sent the latest article according to the revision instructions and I have corrected it
Attachments	• Final Draft.docx 129.8 KB 05/13/2024 05:40

reply

From	Subject	Date
Bárbara	RE: RE: 13 dias waiting | bjb | Final proofreading | Article: bjbAO280083_EN Read at 05/13/2024 05:09	05/07/2024 19:45 Copyediting Proofs
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ARTICLE PROOFREADING

Your article has been standardized to the journal format and is ready for review.
We will help you with this process! For a good review, follow the steps below:

1. Solve all pending issues listed in the **PENDING ISSUES** field of this document. if it's empty, just go to step 2.
2. Check if all the information on the first page is correct (authors' names, affiliations, ORCIDs, among others) and adjust if necessary.
3. Read your article carefully and make any adjustments that you feel necessary in the writing. All modifications must be made directly to the text!
4. Save the document in docx and reply the message with the attachment.

Here's what you can't do on this test:

- Add authors or change their order of presentation;
- Change the title;
- Change values in tables;
- Delete or change entire paragraphs;
- Remove or change styles, formatting, and color markup.

Any changes above will be submitted for approval of the editorial board.

Don't worry about the layout! Later we will send the final version in PDF for your approval, with all the figures and elements.

PENDING ISSUES:

[[Q1: The in-text citation "Purwanto et al., 2022" is not in the reference list. Please correct the citation, add, or delete the citation. Note: citations without reference will be deleted. Q1]]

Add the reference to the list: Purwanto, Ris Hadi, Budi Mulyana, Ryan Adi Satria, Emad Hassan Elawad Yasin, Ilham Satria Raditya Putra, and others. 2022. 'Spatial Distribution of Mangrove Vegetation Species, Salinity, and Mud Thickness in Mangrove Forest in Pangarengan, Cirebon, Indonesia', *Biodiversitas*, 23.3 (Society for Indonesian Biodiversity): 1383–91 <https://doi.org/10.13057/biodiv/d230324>

[[Q2: The in-text citation "Kusmana and Sukristijiono, 2016" is not in the reference list. Please correct the citation, add the reference to the list, or delete the citation. Note: citations without reference will be deleted. Q2]]

Add the reference to the list: Kusmana, Cecep, and Sukristijiono Sukristijiono. 2016. 'MANGROVE RESOURCE USES BY LOCAL COMMUNITY IN INDONESIA', Journal of

Natural Resources and Environmental Management, 6.2: 217–24
<https://doi.org/10.19081/jpsl.2016.6.2.217>

[[Q3: The in-text citation "Sugiyono, 2016" is not in the reference list. Please correct the citation, add the reference to the list, or delete the citation. Note: citations without reference will be deleted. Q3]]

add the reference to the list: Sugiyono. 2016. 'Metode Penelitian Kuantitatif, Kualitatif Dan R&D', Bandung: Alfabeta https://doi.org/10.1016/j.drudis.2010.11.005

[[Q4: The in-text citation "Kusmana and Sukristijiono, 2020" is not in the reference list. Please correct the citation, add the reference to the list, or delete the citation. Note: citations without reference will be deleted. Q4]]

correct the citation "Kusmana and Sukristijiono, 2016"

[[Q5: Reference "RODRÍGUEZ, 2018" is not cited in the text. Please add an in-text citation or the reference will be deleted. Q5]]

add an in-text citation

10.1590/1519-6984.280083
Strategies, sustainability of coastal natural resources
Hendarto, T. and Yuniwati, E.D.
Original Article
e280083
84
2024

Ecosystem services-based mangrove forest with management model strategies, sustainability of coastal natural resources

Serviços ecossistêmicos de florestas de manguezal com estratégias de modelo de manejo, sustentabilidade dos recursos naturais costeiros

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Received: November 2, 2023 – Accepted: January 16, 2024

Abstract
The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an

area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources.

Resumo

Este estudo analisa os serviços ecossistêmicos fornecidos por florestas de manguezal e propõe estratégias de manejo para a sustentabilidade dos recursos naturais costeiros. A metodologia utilizada foi a revisão sistemática, ou seja, pesquisa bibliográfica que examina periódicos críticos e de qualidade, revisados por pares em bancos de dados como Google Scholar, Pubmed, Science Direct e Researchgate. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados com as palavras-chave "Serviços Ecossistêmicos de Florestas de Manguezal com Estratégias de Manejo". Após filtragem de acordo com o tema, foram analisadas 10 publicações científicas. Os resultados da pesquisa mostraram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). O estudo também identificou três componentes principais a serem considerados no manejo e utilização dos ecossistemas de manguezais e recursos naturais costeiros: 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá; 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue; e 3) os próprios recursos naturais (processos naturais). O manejo dos manguezais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de manguezais, para que sejam bem mantidas e sustentáveis. Do ponto de vista socioeconômico, cultural e humano, os recursos naturais são necessários para poder continuar as suas vidas. Por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das atividades humanas, uma vez que o ser humano é o principal usuário desses recursos.

Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais.

1. Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara et al., 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister et al., 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni et al., 2023). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline (Purwanto et al., 2022 [[Q1: Q1]]). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the

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potential of mangrove ecosystems in Indonesia is quite large today (Kusmana and Sukristijiono, 2016 [[Q2: Q2]]; Sofian et al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail et al., 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

2. Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Sugiyono, 2016 [[Q3: Q3]]) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword “Ecosystem Services Based Mangrove Forest with Management Strategies” which is detailed as follows: “Ecosystem Services” ” Mangrove Forest” “Management Strategies” with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following Figure 1.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies* (Table 1).

3. Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) (Kusmana and Sukristijiono, 2020 [[Q4: Q4]])

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni, 2017).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham, 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastuti et al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in

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the concept of sustainable development (Basyuni et al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Finkl, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas et al., 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda et al., 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (Reis Filho et al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy*)*.

Research (Dashtbozorgi et al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area

increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.

Research (Arkham et al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie et al., 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani et al., 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et al. (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated. Mangrove ecosystem is

one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable (Rodríguez, 2018). Research (Hilmi et al., 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi, 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis et al., 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself

(natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

4. Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Table 1. Previous research is reviewed.

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi **Authors**: Nie et al. (2023) **Publish**: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976.	**Aim:** evaluation of coastal wetland ecosystem services based on a modified experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi **Method**: *Field Research*, Experiment **Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area is 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; their level of contribution is the same. Regarding the preferred model, based on correction, people's willingness to pay a per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The related values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta	**Aim**: external, internal and ecosystem services factors to support mangrove rehabilitation planning on the north coast of Jakarta.

	Authors: Hilmi et al. (2023) **Publish**: Proceedings ICMA-SURE-International Conference On Multidisciplinary Approaches For Sustainable Rural Development	**Method**: This research method uses IFAS analysis, EFAS and Buchard analysis. **Result**: Emangrove cosystems are ecotourism, conservation, wildlife sanctuaries, tidal flood reduction, abrasion and accretion, intrusion reduction, land subsidence reduction, economic income, fisheries and pond activities, pond activities, and social. benefits. Mangrove rehabilitation strategies are weaknesses-opportunities strategies (minimizing weaknesses, seizing opportunities, and avoiding threats. Mangrove rehabilitation planning strategies are mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests **Authors**: Dashtbozorgi et al. (2023) **Publish**: Regional Studies in Marine Science	**Aim**: ecosystem using InVEST modeling: The case of Iran's mangroves Selatan. **Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality **Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low classes, increased. Based on habitat quality assessments in 2010, the two classes of poor, low habitat quality, are estimated to be around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output map obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of the target ecosystem and can help them adopt more effective management strategies for the conservation of these ecosystems.
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: Rakotomahazo et al. (2023) **Publish**: Marine Policy	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar **Method**: Semi-Structured Interview **Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.

5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: Limbong et al. (2023) **Publish**: Journal of Sylva Indonesiana	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: the result of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: Getzner and Islam (2020) **Publish**: International Journal of Environmental Research and Public Health	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia. **Method**: *Field Research* and Observationon **Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: Agustriani et al. (2023)	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire and Interview

	Publish: Journal of Hunan University Natural Sciences	**Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas **Authors**: Fauzi et al. (2023) **Publish**: International Journal of Geo-Information	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of Ship Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: Arkham et al. (2023) **Publish**: Research Square	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. **Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision

		of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: Marlianingrum et al. (2019) **Publish:** IOP Conference Series: Earth and Environmental Science	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Figure 1. Search results and article selection.

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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

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Original Article

Ecosystem services-based mangrove forest with management model strategies, sustainability of coastal natural resources

Serviços ecossistêmicos de florestas de manguezal com estratégias de modelo de manejo, sustentabilidade dos recursos naturais costeiros

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Abstract

The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources.

Resumo

Este estudo analisa os serviços ecossistêmicos fornecidos por florestas de manguezal e propõe estratégias de manejo para a sustentabilidade dos recursos naturais costeiros. A metodologia utilizada foi a revisão sistemática, ou seja, pesquisa bibliográfica que examina periódicos críticos e de qualidade, revisados por pares em bancos de dados como Google Scholar, Pubmed, Science Direct e Researchgate. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados com as palavras-chave “Serviços Ecossistêmicos de Florestas de Manguezal com Estratégias de Manejo”. Após filtragem de acordo com o tema, foram analisadas 10 publicações científicas. Os resultados da pesquisa mostraram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). O estudo também identificou três componentes principais a serem considerados no manejo e utilização dos ecossistemas de manguezais e recursos naturais costeiros: 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá; 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue; e 3) os próprios recursos naturais (processos naturais). O manejo dos manguezais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de manguezais, para que sejam bem mantidas e sustentáveis. Do ponto de vista socioeconômico, cultural e humano, os recursos naturais são necessários para poder continuar as suas vidas. Por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das atividades humanas, uma vez que o ser humano é o principal usuário desses recursos.

Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais.

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1. Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara et al., 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister et al., 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni et al., 2023). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline (Purwanto et al., 2022). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Kusmana and Sukristijiono, 2016; Sofian et al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail et al., 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

2. Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Sugiyono, 2016) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows: "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following Figure 1.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies* (Table 1).

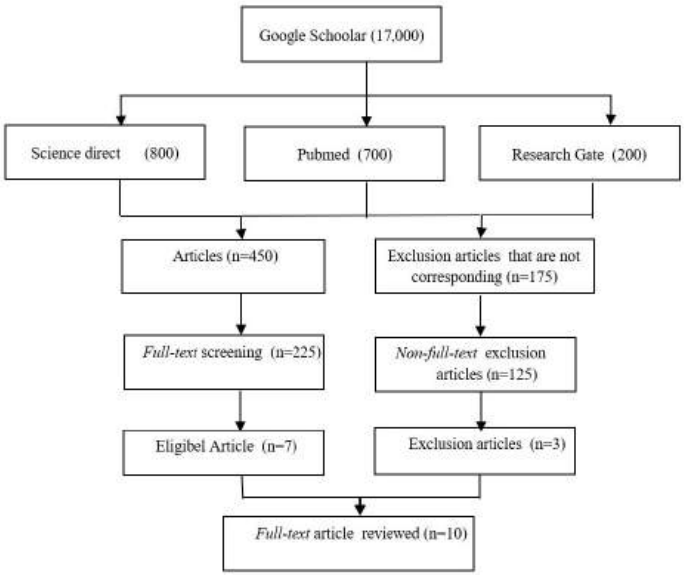

Figure 1. Search results and article selection.

Table 1. Previous research is reviewed.

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi	**Aim:** evaluation of coastal wetland ecosystem services based on a modified experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi
	Authors: Nie et al. (2023)	**Method**: *Field Research*, Experiment
	Publish: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976.	**Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area is 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; their level of contribution is the same. Regarding the preferred model, based on correction, people's willingness to pay a per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The related values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta	**Aim**: external, internal and ecosystem services factors to support mangrove rehabilitation planning on the north coast of Jakarta.
	Authors: Hilmi et al. (2023)	**Method**: This research method uses IFAS analysis, EFAS and Buchard analysis.
	Publish: Proceedings ICMA-SURE- International Conference On Multidisciplinary Approaches For Sustainable Rural Development	**Result**: Emangrove cosystems are ecotourism, conservation, wildlife sanctuaries, tidal flood reduction, abrasion and accretion, intrusion reduction, land subsidence reduction, economic income, fisheries and pond activities, pond activities, and social. benefits. Mangrove rehabilitation strategies are weaknesses-opportunities strategies (minimizing weaknesses, seizing opportunities, and avoiding threats. Mangrove rehabilitation planning strategies are mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests	**Aim**: ecosystem using InVEST modeling: The case of Iran's mangroves Selatan.
	Authors: Dashtbozorgi et al. (2023)	**Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality
	Publish: Regional Studies in Marine Science	**Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low classes, increased. Based on habitat quality assessments in 2010, the two classes of poor, low habitat quality, are estimated to be around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output map obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of the target ecosystem and can help them adopt more effective management strategies for the conservation of these ecosystems.

Table 1. Continued...

No	Identity	Summary
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar
	Authors: Rakotomahazo et al. (2023)	**Method**: Semi-Structured Interview
	Publish: Marine Policy	**Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia
	Authors: Limbong et al. (2023)	**Method**: qualitative with interviews; while the analysis method used is SWOT analysis.
	Publish: Journal of Sylva Indonesiana	**Result**: the result of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia.
	Authors: Getzner and Islam (2020)	**Method**: *Field Research* and Observationon
	Publish: International Journal of Environmental Research and Public Health	**Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia
	Authors: Agustriani et al. (2023)	**Method**: Questionnaire and Interview
	Publish: Journal of Hunan University Natural Sciences	**Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of Ship Activities in Indonesian Marine Protected Areas.
	Authors: Fauzi et al. (2023)	**Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework.
	Publish: International Journal of Geo-Information	**Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.

Table 1. Continued...

No	Identity	Summary
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia
	Authors: Arkham et al. (2023)	**Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis.
	Publish: Research Square	**Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
	Title: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia.
10	**Authors**: Marlianingrum et al. (2019)	**Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS.
	Publish: IOP Conference Series: Earth and Environmental Science	**Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

3. Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) (Kusmana and Sukristijiono, 2020).

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni, 2017).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham, 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastuti et al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Finkl, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels

of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas et al., 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda et al., 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (Reis Filho et al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy).

Research (Dashtbozorgi et al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt

more effective management strategies for the conservation of these ecosystems.

Research (Arkham et al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie et al., 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani et al., 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et al. (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013–2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated.

Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable (Rodríguez, 2018). Research (Hilmi et al., 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi, 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis et al., 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

4. Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Original Article

Ecosystem services-based mangrove forest with management model strategies, sustainability of coastal natural resources

Serviços ecossistêmicos de florestas de manguezal com estratégias de modelo de manejo, sustentabilidade dos recursos naturais costeiros

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Abstract

The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources.

Resumo

Este estudo analisa os serviços ecossistêmicos fornecidos por florestas de manguezal e propõe estratégias de manejo para a sustentabilidade dos recursos naturais costeiros. A metodologia utilizada foi a revisão sistemática, ou seja, pesquisa bibliográfica que examina periódicos críticos e de qualidade, revisados por pares em bancos de dados como Google Scholar, Pubmed, Science Direct e Researchgate. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados com as palavras-chave “Serviços Ecossistêmicos de Florestas de Manguezal com Estratégias de Manejo”. Após filtragem de acordo com o tema, foram analisadas 10 publicações científicas. Os resultados da pesquisa mostraram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). O estudo também identificou três componentes principais a serem considerados no manejo e utilização dos ecossistemas de manguezais e recursos naturais costeiros: 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá; 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue; e 3) os próprios recursos naturais (processos naturais). O manejo dos manguezais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de manguezais, para que sejam bem mantidas e sustentáveis. Do ponto de vista socioeconômico, cultural e humano, os recursos naturais são necessários para poder continuar as suas vidas. Por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das atividades humanas, uma vez que o ser humano é o principal usuário desses recursos.

Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais.

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1. Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara et al., 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister et al., 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni et al., 2023). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline (Purwanto et al., 2022). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Kusmana and Sukristijiono, 2016; Sofian et al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail et al., 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

2. Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Sugiyono, 2016) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows: "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following Figure 1.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies* (Table 1).

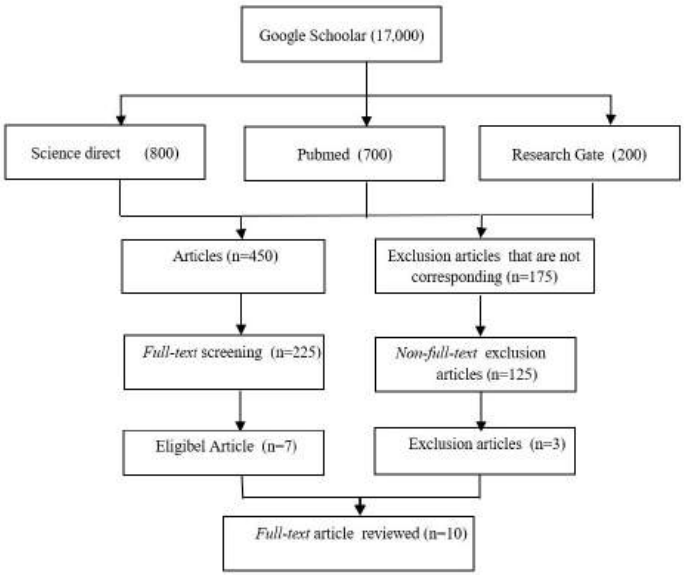

Figure 1. Search results and article selection.

Table 1. Previous research is reviewed.

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi	**Aim:** evaluation of coastal wetland ecosystem services based on a modified experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi
	Authors: Nie et al. (2023)	**Method**: *Field Research*, Experiment
	Publish: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976.	**Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area is 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; their level of contribution is the same. Regarding the preferred model, based on correction, people's willingness to pay a per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The related values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta	**Aim**: external, internal and ecosystem services factors to support mangrove rehabilitation planning on the north coast of Jakarta.
	Authors: Hilmi et al. (2023)	**Method**: This research method uses IFAS analysis, EFAS and Buchard analysis.
	Publish: Proceedings ICMA-SURE- International Conference On Multidisciplinary Approaches For Sustainable Rural Development	**Result**: Emangrove cosystems are ecotourism, conservation, wildlife sanctuaries, tidal flood reduction, abrasion and accretion, intrusion reduction, land subsidence reduction, economic income, fisheries and pond activities, pond activities, and social. benefits. Mangrove rehabilitation strategies are weaknesses-opportunities strategies (minimizing weaknesses, seizing opportunities, and avoiding threats. Mangrove rehabilitation planning strategies are mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests	**Aim**: ecosystem using InVEST modeling: The case of Iran's mangroves Selatan.
	Authors: Dashtbozorgi et al. (2023)	**Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality
	Publish: Regional Studies in Marine Science	**Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low classes, increased. Based on habitat quality assessments in 2010, the two classes of poor, low habitat quality, are estimated to be around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output map obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of the target ecosystem and can help them adopt more effective management strategies for the conservation of these ecosystems.

Table 1. Continued...

No	Identity	Summary
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar
	Authors: Rakotomahazo et al. (2023)	**Method**: Semi-Structured Interview
	Publish: Marine Policy	**Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia
	Authors: Limbong et al. (2023)	**Method**: qualitative with interviews; while the analysis method used is SWOT analysis.
	Publish: Journal of Sylva Indonesiana	**Result**: the result of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia.
	Authors: Getzner and Islam (2020)	**Method**: *Field Research* and Observationon
	Publish: International Journal of Environmental Research and Public Health	**Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia
	Authors: Agustriani et al. (2023)	**Method**: Questionnaire and Interview
	Publish: Journal of Hunan University Natural Sciences	**Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity Expansion in Indonesian Marine Protected Areas	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of Ship Activities in Indonesian Marine Protected Areas.
	Authors: Fauzi et al. (2023)	**Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework.
	Publish: International Journal of Geo-Information	**Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.

Table 1. Continued...

No	Identity	Summary
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia
	Authors: Arkham et al. (2023)	**Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis.
	Publish: Research Square	**Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
	Title: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia.
10	**Authors**: Marlianingrum et al. (2019)	**Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS.
	Publish: IOP Conference Series: Earth and Environmental Science	**Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

3. Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) (Kusmana and Sukristijiono, 2020).

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni, 2017).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham, 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastuti et al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Finkl, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels

of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas et al., 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda et al., 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (Reis Filho et al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy).

Research (Dashtbozorgi et al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt

more effective management strategies for the conservation of these ecosystems.

Research (Arkham et al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie et al., 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani et al., 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et al. (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013–2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated.

Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable (Rodríguez, 2018). Research (Hilmi et al., 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi, 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis et al., 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

4. Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

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[[Q4: The in-text citation "Kusmana and Sukristijiono, 2020" is not in the reference list. Please correct the citation, add the reference to the list, or delete the citation. Note: citations without reference will be deleted. Q4]]

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Strategies, sustainability of coastal natural resources
Hendarto, T. and Yuniwati, E.D.
Original Article
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Ecosystem services-based mangrove forest with management model strategies, sustainability of coastal natural resources

Serviços ecossistêmicos de florestas de manguezal com estratégias de modelo de manejo, sustentabilidade dos recursos naturais costeiros

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Abstract
The purpose of this research is to examine; Ecosystem Services Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources. This research design uses systematic review namely library research that examines quality and critical journals, which have been filtered with inclusion criteria and uses several Google Scholar, Pubmed, Science Direct and Research gate databases as literacy in this study. A search of 2018-2023 articles returned 17,000 keyword results. Ecosystem Services Based Mangrove Forest with Management Strategies, which were filtered into 10 journals according to the theme and analyzed by reviewing them. Ecosystem Services Based Mangrove Forest with Management Strategies. The research results show that mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activity(social processes) provide socialization or understanding to the community about the importance of protecting mangrove forests and the benefits that the community will receive 2) the economy(economic processes) take advantage of the existing potential by planting mangrove trees, and 3) the natural resources themselves(natural processes) Mangrove forest management includes establishing protected forest areas for mangrove forest conservation so that they are well maintained and sustainable. From the socio-economic, cultural and human aspects, natural resources are needed to be able to continue their lives, on the other hand, the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

Keywords: ecosystem, service-based, mangrove, forest, management, strategies, sustainability, coastal, natural resources.

Resumo
Este estudo analisa os serviços ecossistêmicos fornecidos por florestas de manguezal e propõe estratégias de manejo para a sustentabilidade dos recursos naturais costeiros. A metodologia utilizada foi a revisão sistemática, ou seja, pesquisa bibliográfica que examina periódicos críticos e de qualidade, revisados por pares em bancos de dados como Google Scholar, Pubmed, Science Direct e Researchgate. Uma pesquisa de artigos de 2018-2023 retornou 17.000 resultados com as palavras-chave "Serviços Ecossistêmicos de Florestas de Manguezal com Estratégias de Manejo". Após filtragem de acordo com o tema, foram analisadas 10 publicações científicas. Os resultados da pesquisa mostraram que os serviços ecossistêmicos de mangue com uma área de 88.556 ha foram de Rp 6.961.126.186.194 ano-

1 (US$ 467.974.555,06 ano-1) ou Rp 78.607.444 ha-1-1 (US$ 5.284,5 ha-1ano-1). O estudo também identificou três componentes principais a serem considerados no manejo e utilização dos ecossistemas de manguezais e recursos naturais costeiros: 1) a atividade social (processos sociais) proporciona socialização ou compreensão à comunidade sobre a importância de proteger os manguezais e os benefícios que a comunidade receberá; 2) a economia (processos econômicos) aproveita o potencial existente plantando árvores de mangue; e 3) os próprios recursos naturais (processos naturais). O manejo dos manguezais inclui o estabelecimento de áreas florestais protegidas para a conservação das florestas de manguezais, para que sejam bem mantidas e sustentáveis. Do ponto de vista socioeconômico, cultural e humano, os recursos naturais são necessários para poder continuar as suas vidas. Por outro lado, a existência ou sustentabilidade dos recursos naturais costeiros está muito dependente das atividades humanas, uma vez que o ser humano é o principal usuário desses recursos.

Palavras-chave: ecossistema, baseado em serviços, manguezal, floresta, manejo, estratégias, sustentabilidade, costeiro, recursos naturais.

1. Introduction

Mangroves provide a vast ecosystem for living things such as fish, shrimp, and communities (Niagara et al., 2021). Coastal development has changed land use, resulting in a massive conversion of mangroves into settlements. This also damages mangrove ecosystems so that they interfere with environmental and socio-economic functions (Hofmeister et al., 2019). The role of mangrove ecosystems is closely related to the quality of seawater close to the coast (Kelleway et al., 2020) because mangrove conversion will have an impact on commercial fisheries throughout the surrounding area as well as on their economic value. Mangrove ecosystems play an important role ecologically and economically because they have substantial services for humans and the environment (Lee et al., 2019) such as household needs (forest products and various mangrove products), livelihoods, coastal protection, habitat provision, storm protection, and water quality maintenance (Strain et al., 2022).

In recent decades, mangrove ecosystems have been under constant pressure due to diverse human activities and high rates of population growth. Indonesia is known as the country with the largest mangrove forest in the world, with an area of 3,112,989 ha or 22.6% of the world's mangrove forest area (Mayarni et al., 2023). On the other hand, Indonesia's mangroves also experience the highest deforestation rate (Saputra et al., 2020), with total deforestation in the last three decades of 40%, caused by logging, land conversion for agriculture, shrimp and lianya ponds (Sari et al., 2021). The use of mangroves to meet community needs tends to be intensive and not in accordance with conservation principles. The rapid expansion of shrimp ponds has raised environmental issues about the conversion of ecologically important mangrove areas. Deforestation of mangroves and expansion of aquaculture have resulted in the occurrence of sedimentary organic matter in recent decades. They can change the quality of ocean waters (Jennerjahn et al., 2022). This impact is felt by coastal residents, especially by fishing communities who depend on mangroves for their lives (Hidayat and Dessy, 2021). Several studies show that mangrove and fishery ecosystems have a strong linkage, especially in supporting economic activities in the fisheries sector, not only in capture fisheries but also marine aquaculture in coastal areas (Oktamalia et al., 2018).

In Indonesia, it is an archipelagic country with more than 17,504 islands and surrounding 95,181 km of coastline (Sayuti, 2023; Triebner et al., 2019) [[Q1: Q1]]). Indonesia has 3.1-3.7 million hectares of mangrove forest area or more than 20% of the world's mangrove forest area with high species diversity. Thelargest concentration of mangrove forests is in Papua and Sumatra (Vincentius, 2020). In addition, areal potential for planting mangrove species is around 7.8 million hectares (Vincentius, 2020). Indonesia's mangroves have a special function because they are located between terrestrial and marine ecosystems, and support various types of human needs, especially for local communities in mangrove forests and their surroundings This fact shows that the potential of mangrove ecosystems in Indonesia is quite large today (Bender & Tekle, 2019; Chen & Shih, 2019a; Lyimo et al., 2023) [[Q2: Q2]]; Sofian et al., 2019)

In current conditions, local governments face problematic problems related to mangrove activities (Wahyudin et al., 2020). There are concerns from fishermen, crab hunters, and marine farmers about declining income, which is thought to be related to the increase in shrimp ponds in Indonesia (Vincentius, 2020). All have an important role and involve many parties and community groups who depend on shrimp ponds, fishermen, marine cultivation, and the existence of mangroves (Kinasih and Purnaweni, 2019). Mangroves have an indispensable role to play as a balancer. Authorities will need strategies to manage them so that all fisheries and economic activities that rely on ecosystem services can run sustainably (Ismail et al., 2021).

As an ecosystem, mangroves are known to have various ecological functions (Islam and Bhuiyan, 2018). In mangrove management that is beneficial to the economy and ecology, the main problem faced in mangrove forest management is determining the optimal level of management, viewed from both forms of benefits (economic and ecological) (Wahyudin et al., 2020).

In this study, we aim to conduct a comprehensive analysis of the complex constraints faced in mangrove ecosystem management and provide strategic recommendations for sustainable mangrove management in Indonesia. We try to fill the gap between existing policies and implementation at a significant field level. for constructive mangrove management and to support Indonesia's blue carbon agenda.

2. Methods

The method used in writing this article is systematic review, which is literature research that critically examines knowledge, ideas, or even findings in quality health journals, compiled and compiled theoretically and methodologically for a particular topic (Choirudin et al., 2021; Darmayanti et al., 2023) [[Q3: Q3]]) . The strategy used in article search is to use research articles that match the topic in the Google Scholar, Pubmed, Science Direct and Researchgate data base.

This systematic review is limited to literature searches in the last 5 years using the keyword "Ecosystem Services Based Mangrove Forest with Management Strategies" which is detailed as follows: "Ecosystem Services" " Mangrove Forest" "Management Strategies" with question determination following PICO techniques. Where every question P is mangrove with or without strategi, I is mangrove conservation n, C is conservation management, O is pprocesses Ecosystem Services Based Mangrove Forest with Management Strategies. The inclusion criteria in this literature review are full-text articles, in Indonesian and English published in the last 5 years, research articles It includes two or more search keywords in the database. The flow of journal review is adjusted to the following Figure 1.

Full-text articles are examined to select research journals that match the sample inclusion criteria. A total of 10 articles were obtained that met the relevant inclusion and abstract criteria for analysis on *Ecosystem Services Based Mangrove Forest with Management Strategies* (Table 1).

3. Discussion

Indonesia is an archipelagic country with more than 17,504 islands (28 large islands and 17,475 small islands) with an estimated coastline length of 95,181 km, which is overgrown with mangroves from several meters to several kilometers. An estimated 3.2 million hectares grow widely on five major islands (Java, Sumatra, Kalimantan, Sulawesi, Papua) with diverse community types consisting of about 157 species (52 species of trees, 21 species of shrubs, 13 liana species, seven species of palms, 14 species of grasses, 8 species of herbs, 3 species of benalu, 36 species of epiphytes, 3 species of ferns) ((Ali et al., 2022; Chen & Shih, 2019b; Susanti, 2021) [[Q4: Q4]])

In response to the huge loss of mangroves, several regulations on mangrove conservation and management were enacted in Indonesia. Law Number 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems became the basis for the concept of mangrove conservation in Indonesia. According to Law No. 27 of 2007 which was amended into Law No. 1/2014, concerning the Management of Coastal Areas and Small Islands, Indonesia allows logging practices in mangrove areas that comply with the preservation of coastal ecological functions. The issuance of this policy was followed up by Presidential Regulation Number 73 of 2012 concerning the National Strategy for Mangrove Ecosystem Management, which regulates mangrove forest management norms, standards, principles, criteria, and indicators. The government also issued Presidential Regulation Number 73 of 2015 concerning the Implementation of Management of Coastal Areas and Small Islands at the National Level with the aim of managing coastal areas and national small islands in a harmonious, synergistic, integrated, and sustainable manner (Anggraeni, 2017).

There are two key sectors that play an important role in mangrove management in Indonesia, namely the forestry and fisheries and marine sectors. The forestry sector is authorized to manage all state mangrove forests, while mangroves outside forest areas are the authority of the fisheries and marine sector (Kathiresan and Bingham, 2001). Therefore, existing mangrove management policies are generally influenced by the interests and authorities of the two sectors which sometimes conflict and overlap (Damastuti et al., 2022). Complex social and economic conditions in mangrove areas, accompanied by unclear boundaries between different authorities, have created overlaps in law enforcement and responsibility between government institutions (Chow, 2018). To manage mangrove ecosystems sustainably and improve the welfare of coastal communities (Suman, 2019), effective policy implementation must be supported by various action plans or strategies prepared based on strategic issues in the concept of sustainable development (Basyuni et al., 2018) . However, there are major challenges in mangrove management that must be overcome with specific strategies and require programs as a measure of achieving sustainable mangrove management goals (Arifanti, 2020).

Communities play a key role in determining the success of sustainable forest management (Makowski and Finkl, 2018). The dependence of coastal communities on these ecosystems can encourage them to restore and preserve them using their local wisdom (Camacho et al., 2020). Willingness to participate in an activity is also correlated with education level and income; those with higher levels of education and more stable incomes become more easily involved and can play a role as key community actors in mangrove restoration and protection activities (Mafi-Gholami et al., 2020).

From a socio-economic perspective, sustainable mangrove management is fraught with challenges due to (a) different understandings of the value and benefits of mangrove ecosystems and the urgency of rehabilitation efforts; (b) local involvement has not been optimal; (c) the majority of families living around mangrove ecosystems are classified as low-income families; (d) the sustainable use of mangrove ecosystems has not been developed; and (e) high population growth rates and economic needs have triggered changes in land use and land cover (Biswas et al., 2018). Problems in understanding the ecological value of mangroves can lead to the conception that damage or loss of mangrove resources is not always considered a loss (Abidin et al., 2021). Community participation in mangrove management becomes difficult to achieve, on the contrary, participation is easier to ensure when the benefits to be received can be felt directly, locally, and tangibly (Rafique, 2018). Therefore, information about the benefits/values of mangrove forests both directly and indirectly needs to be disseminated to increase public awareness of the ecological role of mangrove forests (Yando et al., 2021).

Special strategies are also needed, such as offering several incentive scheme options, to increase the willingness of communities to engage in mangrove management. Law enforcement and compliance are other challenges in encouraging community participation. Unclear sanctions/penalty mechanisms lead to low levels of compliance (Hasnanda et al., 2018). Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves (Biswas et al., 2018).

In the end, incentives should not only encourage local communities to replant new mangroves, but they should also maintain newly planted and old mangroves (Gaoue and Yessoufou, 2019). The form of community involvement in mangrove management varies depending on regional conditions and community typology (Mozumder et al., 2018). One example of mangrove management that pays attention to community participation in mangroves is widely known as community-based mangrove management (CBMM) (R,odríguez 2018). CBMM is currently needed to ensure the success of mangrove resources and is considered an important factor in minimizing disturbance while ensuring sustainable use of mangrove resources. The community is also involved in mangrove rehabilitation projects, for example providing mangrove seedlings, working in mangrove nurseries, and planting mangroves (Reis Filho et al., 2019).

Mangrove forest management is an important aspect in efforts to preserve the environment in coastal areas. In social activities (social processes) it is necessary to provide socialization or understanding to the community about the importance of maintaining mangrove forests. In research (Limbong et al., 2023), mangroves can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, communities or farmer groups need to be equipped with capacity building about the importance of mangrove ecosystems and their impact on their livelihoods. This study aims to identify the condition of mangrove forests in the research area and determine the institutional development strategy of forest farmer groups in coastal areas in the Production Forest Management Unit. The research method used is qualitative method with interview; while the analysis method used is SWOT analysis. Based on the results of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the *internal environment score* (IFAS) value, namely the strength factor minus the weakness factor, a horizontal x axis value of 0.054-0.047 = 0.007 is obtained. Based on the results of the *External Factor Analysis Summary* (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) reduced by the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports the SO (aggressive development strategy*)*.

Research (Dashtbozorgi et al., 2023) as one of the most fertile ecosystems on earth, mangrove forests provide many goods and services for mankind. Mangroves are located in southern Iran on the coast of the provinces of Sistan and Baluchistan, Hormozgan and Bushehr, which includes two species Harra (*Avicennia marina*) and Chandal (*Rhizophora mucronata*) The purpose of this study is to describe the condition of mangrove forests *using Integrated Valuation of Ecosystem Services and Tradeoffs* (InVEST) between 2010 and 2021 from the southern coast of Iran. The INVEST model uses land use and land cover maps to estimate habitat quality. The source of the threat, the maximum distance of impact, the state of degradation, and sensitivity to the threat were also estimated with local expert opinion for each type of land cover. Urban and rural development, road networks, docks, oil and non-oil industries, agriculture, and aquaculture activities, were identified as sources that threaten the long-term survival of mangroves. The output map of the INVEST habitat quality model includes habitat degradability and quality maps, which are classified into four categories: poor, low, medium, and high, to better understand quality changes. The results show that the quality of mangrove habitat has decreased significantly despite the increased area. The target habitat area increased by 586.45 ha while the first two quality categories, including poor and low grades, increased. Based on habitat quality assessments in 2010, two habitat quality classes are poor, low, estimated at around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output maps obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of target ecosystems and can help them adopt more effective management strategies for the conservation of these ecosystems.

Research (Arkham et al., 2023) mangrove ecosystem in Bintan Regency provides many benefits both directly and indirectly for the surrounding community. Mangrove ecosystem services are also diverse and play a role in the adaptation and mitigation process in facing climate change. Oil pollution that occurs every year in Bintan Regency has a negative impact both ecologically and economically. This study aims to estimate the value of mangrove ecosystem services in the East and North Coast Areas of Bintan Island that can be used as a basis for management of the area. The data collection method used is a survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. The results of the study stated that the estimated economic value of mangrove ecosystem services was Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as a basis for mangrove conservation policies and strategies and community welfare, as well as consideration in making claims related to damage to coastal and marine environments due to oil spills and others that often occur in Bintan.

In the benefits of economic processes, mangroves have a very important role to support the productivity of the habitat in them. In research (Nie et al., 2023) that in e valuation of the value of coastal wetland ecosystem services is very important for scientific

development and effective use of coastal wetland resources. It has beenproven that the addition of attribute cut-offs in the preferred experimental evaluation (CE) framework increases the validity of evaluation results. However, whether this increase is due to an increase in questionnaires or an increase in utility equations is indistinguishable from this framework. In this study, a cut-off modified selection model was used to assess two key elements of the modified selection model that differed from the traditional model. This is a CE questionnaire that leads to a cut-off and a CE utility equation that incorporates a cut-off. Each pair of elements is analyzed separately. Both are used to evaluate the impact of the validity of the results, and quantitatively evaluate the value of mangrove wetland ecosystem services in the Beibu Bay area, Guangxi, China. The results showed that: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area was 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; Their contribution rate is the same. Regarding the preferred model, based on correction, the public's willingness to pay a per-capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The corresponding values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively.

Research (Agustriani et al., 2023) Assessment of ecosystem services can provide significant improvements for policymakers to monitor changes in mangrove ecosystems in coastal ecosystems. Therefore, this study aims to measure the value of ecosystem services in Sembilang National Park (TNSL), Banyuasin Regency, South Sumatra, Indonesia. Data collection using questionnaires and in-depth interviews with target respondents fishermen, farmers, and stakeholders living in mangrove ecosystem areas. Total Economic Value (TEV) is used as an approach to calculate various mangrove service values. Several methods have been developed to estimate the value of ecosystem services. In this study, the market price method, benefit transfer method, reimbursement method, and travel cost method are applied to estimate the value of benefits for provision, arrangement, support, and cultural services. The results showed that the TEV of mangrove ecosystem services with an area of 88,556 ha was Rp 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp 78,607,444 ha-1-1 (US$ 5,284.5 ha-1year-1). The annual benefit values for provision, arrangement, support, and cultural services are Rp 267,301,712,200, Rp 6,401,520,094,447, Rp 292,120,962,048, and Rp 183,417,500, respectively. The value of the benefits of regulatory services (shoreline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in SNP. To avoid the loss of value of these mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of mangrove working groups in South Sumatra Province. Therefore, the novelty of this study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.

Research Fauzi et al. (2023) Sustainable Development Goal (SDG) number 14 relates to the preservation of sustainable marine ecosystems by establishing marine protected areas (MPAs). However, studies have reported massive damage to Indonesia's marine ecosystems due to pollution of shipping, anchors, and fishing nets. Thus, this study estimates the potential loss of value of ecosystem services due to the expansion of vessel activities in the Indonesian MPA. The study is divided into three stages. The first stage is modeling the expansion zone of vessel activity based on kernel density. The second stage is modeling the value of marine ecosystem services through semantic harmonization, reclassification, and spatial harmonization. The last stage is the overlay of the ship expansion zone model, the marine ecosystem service value model, and the Indonesian MPA. The results of this study show that Indonesia's marine neritic zone has an ecosystem service value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is in the MPA. However, the increase in vessel activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can help policymakers determine priority conservation areas based on the threat of vessel activity and the value of ecosystem services.

Research Marlianingrum et. al. (2019) explains that ecosystems are very important for human life, but until now parts of the ecosystem as resource assets that contribute to the country's economy have not been further evaluated. Mangrove ecosystem is one of the ecosystems that grows on alluvial deposits in coastal areas and river estuaries. They have a very important role to support fisheries productivity as a habitat for breeding and spawning aquatic biota. Based on these conditions, this research is directed to explore ecosystem services with ecological economic value to improve mangrove sustainability. Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 Ha with a total economic value of Rp20,486,986,843.00. The conversion of mangrove ecosystems into some land changes will have an impact on the habitats that live in them and also have a negative impact on the income of coastal communities that use them, so they must be managed carefully. Economic valuation based on ecosystem services can improve sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Mangrove forest management is an important aspect in environmental conservation efforts, namely the natural resources themselves *(natural processes)* mangrove forest management including yaitu, forming a protected forest area for mangrove conservation to remain well maintained and sustainable. Research (Hilmi et al., 2023) Mangrove ecosystems on the North Coast of Jakarta have many services and functions both ecological, social, economic, and service functions, including tidal flood reduction, land subsidence reduction, pollution reduction, ecotourism, and others. However, the mangrove ecosystem on the North Coast of Jakarta has suffered severe damage, so it requires efforts and activities to rehabilitate it. This study aims to develop a strategy for mangrove ecosystem rehabilitation on the North Coast of Jakarta to reduce coastal disasters and support ecosystem services. This research method uses IFAS, EFAS analysis, and Buchard analysis. The results showed that mangrove ecosystem ecosystem services are ecotourism, conservation, wildlife reserves, reduction of tidal flooding, abrasion and

accretion, reduction of intrusion, reduction of land subsidence, economic income, fishing and aquaculture activities, pond activities, and social activities. benefit. The mangrove rehabilitation strategy is a weakness-opportunity strategy (minimizing weaknesses, exploiting opportunities, and avoiding threats. The mangrove rehabilitation planning strategy is mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources, and developing carbon.

Research Rakotomahazo et al. (2023) Although ecosystems have emerged since the 1980s to manage mangrove forest ecosystems, their application to mangroves is still new, and evidence of their effectiveness is questionable against the complex legal status of mangroves. This study explores the policy and institutional context of Payment for Ecosystem Services (PES) applied in the mangroves of Southwest Madagascar. We used Policy content analysis to examine the interaction between Madagascar's sectoral policies and the PES design framework developed under the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism of the United Nations Framework Convention on Climate Change. In addition, semi-structured interviews with national and local stakeholders were conducted to identify i) institutional interactions between PES and mangroves and ii) challenges faced in implementing PES in mangroves. We found that land-use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support PES implementation. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited capacity of local governments are major challenges for the implementation of PES schemes in mangroves. This has led to low motivation to collaborate on mangrove conservation efforts among local community members. We emphasize that the existence of mangrove PES initiatives such as those in Baie des Assassins can be a catalyst for Madagascar to develop clear policies, laws, and institutions to support the effective implementation of PES schemes in mangroves.

Research Getzner and Islam (2020) Mangrove forests are essential for maintaining and improving ecosystem services that benefit local and regional communities, and the global environment. Scholars have long studied the merits of mangrove ecosystem services. However, the number of recent primary studies monetizing ecosystem services is somewhat limited. This paper ascertains the value of ecosystem services from 66 primary valuation studies with a total of 250 observations. The results show that the range of values is substantially wide. This range cannot be adequately explained by various study differences, because the explanatory power of econometric estimates is low. The main factors influencing the value of ecosystem services are elicitation methods, the types of ecosystem services considered, and the conservation status of each mangrove forest as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, the results also warn against direct benefit transfers between sites. The substantial diversity of specific locations and countries warrants the application of separate original assessment studies.

In the last three decades, increasing understanding of mangroves has significance for the environment and livelihoods has encouraged various rehabilitation initiatives (Lubis and Wahyudi, 2019). The earliest rehabilitation efforts were initiated in the 1960s by Hutan Negara (Marlianingrum et al., 2019). However, *the top-down* strategy implemented has not been stopped by human encroachment into rehabilitated areas (Damastuti and de Groot, 2019). Lack of community participation is thought to be the cause of ongoing disruption (Lewis et al., 2019). Therefore, it is necessary to involve local communities in their rehabilitation and management strategies (Arifanti et al., 2022). Currently, community participation has become the main approach in mangrove rehabilitation and management applied (Setyaningrum et al., 2020). The Ministry of Environment and Forestry, for example, has implemented community-based mangrove rehabilitation activities (Turisno et al., 2018).

Based on the description above, it can be seen that there are several strategies of Ecosystem Services Based Mangrove Forest with Management Strategies, including 1) social activities (social processes) provide socialization or understanding to the community of the importance of maintaining mangrove forests and the benefits obtained by the community 2) economic processes (economic processes) Utilizing the existing potential by making economic benefits, and 3) Natural Resources itself (natural processes) mangrove forest management including yaitu, forming a protected forest area for mangrove conservation so that it is well maintained and sustainable. These three components are bound together and influence each other. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

4. Conclusion

Mangroves are highly productive ecosystems with various social, economic and environmental functions. Mangroves have an important role globally in mitigating climate change, mangrove ecosystems are one of the threatened resources in coastal areas, and mangroves are under intense pressure from competing resource use. If mangrove destruction in Indonesia continues, there will be a loss of ecosystems that have many ecological, social, and economic benefits.

Mangroves in Indonesia have faced direct human-caused threats including deforestation and conversion of forests to other land uses. Despite facing anthropogenic and non-anthropogenic disturbances, mangroves provide great benefits and support livelihoods for millions of coastal communities in Indonesia. On the other hand, maintaining the natural and important function of mangroves in contributing to climate change mitigation and coastal adaptation.

Ecosystem Services Based Mangrove Forest with Management Strategies, that there are three main components that must be considered in efforts to manage and utilize mangrove ecosystems and coastal natural resources, namely; 1) social activities (social processes), 2) economic (economic processes) and 3) natural resources themselves (natural processes). These three

components are bound together and influence each other. Local willingness to participate in mangrove management depends on (1) effective law enforcement; (2) accountable and transparent financial management; (3) fair distribution of profits; (4) rights and obligations of equitable distribution; (5) co-financing from the government or project; (6) annual income level; (7) and whether one's livelihood depends directly on mangroves. From socio-economic, cultural and human aspects need natural resources to be able to continue their lives, on the other hand the existence or sustainability of coastal natural resources is very dependent on human activities as the main users of natural resources.

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Table 1. Previous research is reviewed.

No	Identity	Summary
1	**Title:** Evaluation of coastal wetland ecosystem services based on modified choice experimental model: A case study of mangrove wetland in Beibu Gulf, Guangxi **Authors**: Nie et al. (2023) **Publish**: A Journal for the Study of Human Settlements Established at the UN Habitat Conference, Vancouver, 1976.	**Aim:** evaluation of coastal wetland ecosystem services based on a modified experimental model: A case study of mangrove wetlands in Beibu Bay, Guangxi **Method**: *Field Research*, Experiment **Result**: In 2021, the total value of mangrove wetland ecosystem services in the Beibu Bay area is 1.181 billion yuan. In the modified CE model, both the improvement of the questionnaire and the improvement of the utility equation contribute to an increase in the validity of the evaluation results; their level of contribution is the same. Regarding the preferred model, based on correction, people's willingness to pay a per capita value for strengthening mangrove protection is (in order): increased biodiversity, mangrove forest cover, water quality, and landscape appreciation. The related values are 53.89-yuan, 47.00-yuan, 35.46-yuan, and 17.29-yuan, respectively. The results provide a scientific basis for the formulation of policies for ecological management of coastal wetlands by the government.
2	**Title**: The External, Internal Factor and Ecosystem Services to Support Mangrove Rehabilitation Planning in North Coast of Jakarta **Authors**: Hilmi et al. (2023) **Publish**: Proceedings ICMA-SURE-International Conference On Multidisciplinary Approaches For Sustainable Rural Development	**Aim**: external, internal and ecosystem services factors to support mangrove rehabilitation planning on the north coast of Jakarta. **Method**: This research method uses IFAS analysis, EFAS and Buchard analysis. **Result**: Emangrove cosystems are ecotourism, conservation, wildlife sanctuaries, tidal flood reduction, abrasion and accretion, intrusion reduction, land subsidence reduction, economic income, fisheries and pond activities, pond activities, and social. benefits. Mangrove rehabilitation strategies are weaknesses-opportunities strategies (minimizing weaknesses, seizing opportunities, and avoiding threats. Mangrove rehabilitation planning strategies are mangrove rehabilitation, mangrove revitalization, supporting the creative economy, developing greenbelts, increasing human resources and developing blue carbon.
3	**Title:** Ecosystem services valuation using InVEST modeling: Case from southern Iranian mangrove forests **Authors**: Dashtbozorgi et al. (2023) **Publish**: Regional Studies in Marine Science	**Aim**: ecosystem using InVEST modeling: The case of Iran's mangroves Selatan. **Method**: Qualitative with model INVEST using land use and land cover maps to estimate habitat quality **Result**: Thequality of mangrove habitat has decreased significantly despite the increased area. The target habitat area

		increased by 586.45 ha while the first two quality categories, including poor and low classes, increased. Based on habitat quality assessments in 2010, the two classes of poor, low habitat quality, are estimated to be around 0.72, and 8.42 ha, which changed to 3.04 ha, and 9.72 ha respectively in 2021. The output map obtained in this study can help local managers and decision makers to have an idea of what is happening to the quality of the target ecosystem and can help them adopt more effective management strategies for the conservation of these ecosystems.
4	**Title**: Exploring the policy and institutional context of a Payment for Ecosystem Services (PES) scheme for mangroves in southwestern Madagascar **Authors**: Rakotomahazo et al. (2023) **Publish**: Marine Policy	**Aim**: explores the policy and institutional context related to Ecosystem Service Payment (PES) implemented in the mangroves of Southwest Madagascar **Method**: Semi-Structured Interview **Result**: Bahwa land use, fisheries, and environmental planning policies related to mangrove management are coherent with the framework and support the implementation of PES. The lack of a clear legal framework and coordination between sectoral ministries, weak government organization due to political instability, and limited local government capacity are major challenges to the implementation of PES schemes in mangroves.
5	**Title**: Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia **Authors**: Limbong et al. (2023) **Publish**: Journal of Sylva Indonesiana	**Aim**: Forest Farming Strengthening Strategy for Sustainable Mangrove Forest Management in Coastal Areas, Deli Serdang, Indonesia **Method**: qualitative with interviews; while the analysis method used is SWOT analysis. **Result**: the result of the Internal Factor Analysis Summary (IFAS) analysis with a strength factor value of 0.054 and a weakness factor value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x horizontal axis 0.054-0.047 = 0.007 is obtained. Based on the results of the External Factor Analysis Summary (EFAS) analysis, the opportunity factor has a value of 0.054 with the threat has a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunity) minus the threat factor, obtained the Y value vertically. The identification of internal (IFAS) and external (EFAS) factors shows that the institutional development position of forest farmer groups in coastal areas is in quadrant one (I) or is in an aggressive position that supports

		the SO (aggressive development strategy) development strategy.
6	**Title:** Ecosystem Services of Mangrove Forests: Results of a Meta-Analysis of Economic Values **Authors**: Getzner and Islam (2020) **Publish**: International Journal of Environmental Research and Public Health	**Aim**: Assessing the Role of Coastal Biodiversity Conservation towards Sustainability and Environmental Concern in the Mangrove Ecosystem of South Malang, Indonesia. **Method**: *Field Research* and Observationon **Result**: Kis substantially wide in value. This range cannot be adequately explained by the various study differences, since the explanatory power of econometric estimates is low. The main factors that influence the value of ecosystem services are the method of elisitation, the type of ecosystem services considered, and the conservation status of each mangrove as a Ramsar site. The results emphasize the significant economic value of mangrove ecosystem services and the importance of conservation management. However, those results also warn against direct transfer of benefits between sites. The substantial diversity of specific locations and countries guarantees the application of separate original assessment studies.
7	**Title**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia **Authors**: Agustriani et al. (2023) **Publish**: Journal of Hunan University Natural Sciences	**Aim**: Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park, South Sumatra, Indonesia **Method**: Questionnaire and Interview **Result**: That the mangrove ecosystem with an area of 88,556 ha is Rp. 6,961,126,186,194 year-1 (US$ 467,974,555.06 year-1) or Rp. 78,607,444 ha-1year-1 (US$ 5,284.5 ha-1year-1). The annual benefit value for provision, regulation, support, and cultural services is IDR 267,301,712,200, IDR 6,401,520,094,447, IDR 292,120,962,048, and IDR 183,417,500, respectively. The value of the benefits of regulatory services (coastline protection and carbon sequestration) dominates the TEV of mangrove ecosystems in the SNP. To avoid the loss of value of mangrove services, conservation and restoration must receive high priority in mangrove management and planning in the future. The results of this study can be used as basic data for local governments in managing mangrove ecosystems through the establishment of a mangrove working group in South Sumatra Province. Therefore, the novelty of the study lies in the first economic valuation in the SNP using the TEV approach, as illustrated.
8	**Title**: Potential Loss of Ecosystem Service Value Due to Vessel Activity	**Aim**: Potential Loss of Ecosystem Service Value Due to Expansion of

	Expansion in Indonesian Marine Protected Areas **Authors**: Fauzi et al. (2023) **Publish**: International Journal of Geo-Information	Ship Activities in Indonesian Marine Protected Areas. **Method**: This research comprehensively covers three main aspects: vessel zone expansion modeling, marine ecosystem service value (MESV) modeling, and MESV potential loss in the MPAs. Figure 2 illustrates the research framework. **Result**: Indonesia's marine neritic zone has an ecosystem services value of USD 814.23 billion, of which USD 159.87 billion (19.63%) is within the MPA. However, the increase in ship activity that occurred in 2013-2018 has the potential to cause a loss of ecosystem service value of USD 27.63 billion in 14 protected areas. These results can assist policymakers in determining priority conservation areas based on the threat of ship activity and the value of ecosystem services.
9	**Title**: Economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Authors**: Arkham et al. (2023) **Publish**: Research Square	**Aim**: The economic value of mangrove ecosystem services in the coastal area of Bintan Island, Indonesia **Method**: Survey using questionnaires on fishermen, tourists, tour managers, and the surrounding community. It also collects some secondary data to support data analysis. **Result**: The estimated economic value of mangrove ecosystem services is Rp. 135,663,899,478.30 / year from a mangrove area of 4,354.11 ha. The economic value consists of the provision of services by 61%, regulatory services by 21%, supporting services by 2%, and cultural services by 16%. This estimate can be used as the basis for mangrove conservation policies and strategies and community welfare, as well as considerations in making claims related to damage to the coastal and marine environment due to oil spills and others that often occur in Bintan.
10	**Title**: Economic analysis of management option for sustainable mangrove ecosystem in Tangerang District, Banten Province, Indonesia **Authors**: Marlianingrum et al. (2019) **Publish:** IOP Conference Series: Earth and Environmental Science	**Aim**: An Economic Analysis of Sustainable Mangrove Ecosystem Management Options in Tangerang Regency, Banten Province, Indonesia. **Method**: Total Economic Value (TEV) is formulated as follows: TEV = PS + SS + RS + CS. **Result**: Analysis of 2017 data on mangrove ecosystems in Tangerang Regency, Banten shows that the total economic value of mangrove ecosystems per hectare is Rp. 49,260,590.16. Analysis of optimal resource allocation can be concluded that the optimal mangrove area is 415.89 ha with a total economic value of IDR 20,486,986,843.00. The conversion of mangrove ecosystems into several land changes will have an impact on the habitats that live in them and also have

		a negative impact on the income of coastal communities who use them, so they must be managed carefully. Economic valuations based on ecosystem services can improve the sustainable management of mangrove ecosystems and provide welfare for coastal communities that use them.

Figure 1. Search results and article selection.

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Ecosystem Services-Based Mangrove Forest with Management Model Strategies, Sustainability of Coastal Natural Resources

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