Eduvest – Journal of Universal Studies
Volume 4 Number 11, November, 2024
p- ISSN 2775-3735- e-ISSN 2775-3727

THE ROLE OF REGULATIONS IN SUPPORTING THE RESTORATION OF MANGROVE ECOSYSTEMS FOR THE ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT GOALS: A LITERATURE REVIEW

Ika Dian Anggraeni
Universitas Indonesia
Email: ikadianlegal@gmail.com

ABSTRACT

Mangrove ecosystems, among the world's most productive environments, provide critical ecological, economic, and social benefits while supporting Sustainable Development Goals (SDGs). However, these ecosystems face degradation due to deforestation, land conversion, pollution, and climate change. This study examines the pivotal role of regulations in mangrove restoration to achieve the SDGs, utilizing case studies from Indonesia and Thailand. It highlights successful regulatory frameworks, such as the implementation of Social Forestry policies in East Kalimantan and the Regional Regulation in Maros Regency, South Sulawesi. These frameworks integrate social, economic, and ecological pillars to promote sustainable mangrove management. By analyzing regulatory contributions to SDGs 6, 13, 14, and 15, this research emphasizes ecosystem-based management, community involvement, and international compliance as fundamental elements for effective restoration. The findings demonstrate that well-designed regulations can harmonize environmental protection with economic development, offering actionable insights for policymakers and stakeholders to ensure mangrove ecosystem sustainability.

KEYWORDS *Mangrove Restoration, Regulations, Ecosystem-Based Management, Climate Change, Social Forestry,*

How to cite: Ika Dian Anggraeni. (2024). The Role Of Regulations In Supporting The Restoration Of Mangrove Ecosystems For The Achievement Of Sustainable Development Goals: A Literature Review. Journal Eduvest. *4*(11): 10361-19378
E-ISSN: 2775-3727
Published by: https://greenpublisher.id/

INTRODUCTION

Mangrove ecosystems are one of the most productive ecosystems in the world, providing a wide range of ecological, economic, and social benefits. However, these ecosystems face significant threats from land conversion, pollution, and climate change. Restoration of mangrove ecosystems is crucial to restore their function and achieve the Sustainable Development Goals (SDGs). The role of regulations in supporting the restoration process is very important, both in terms of national and international policies.

Indonesia has more and more diverse mangrove forests than other countries. With a coverage of about 3.4 million hectares, Indonesia's mangrove forests cover >20% of the world's mangrove area (Kehutanan, 2021). Indonesia has 40 out of 54 true mangrove species in the world. Indonesia's mangroves also store nearly 4,000 tons of CO2 per hectare, or known as "blue carbon". And about half of Indonesia's mangrove forests (1.82 million hectares) are high-quality mangroves.

As a country with the second largest mangrove ecosystem in the world with an area of 3,364,080 hectares, it has suffered damage in the form of degradation and deforestation of mangroves covering an area of 756,183 hectares. So that the existence of mangrove ecosystems can be said to have faced various serious threats, including: infrastructure development, reclamation, aquaculture expansion, oil palm plantation expansion, environmental pollution, coastal erosion, changes in accretion, and other impacts of global warming and climate change. And this damage is projected to continue to increase from year to year (Murdiyarso, 2015).

Mangrove ecosystems face serious threats shown by deforestation, degradation and even the threat of losing these ecosystems. In addition to threats to natural factors, the most serious threats are triggered by conflicts of interest due to the overlap of policies, regulations and authorities between various stakeholders, ranging from the central, provincial, district/city levels to the community level in the community (Yuwono, 2023).

Quoted from the work report of the individual consultant service "Mangrove for Coastal Resilience Project" for the July-September 2023 period by Arief Yuwono, that the urgency based on field conditions and the existence of conflicts of interest between these stakeholders requires corrective actions based on ecosystem or landscape-based arrangements/regulations. This approach involves various related ministries/institutions and is implemented in an integrated manner, and covers the upstream to downstream areas. In the concept of regionality, these regulations are an integral part of Integrated Watershed Management and Integrated Coastal Zone Management as well as Environmental Protection and Management in general (PERS, 2021). In addition, this effort is intended to realize the Sustainable Development Principles that consider the balance of social, economic, and environmental aspects, while ensuring firm and clear legal certainty.

This is in line with international commitments that have been ratified into the national legal and regulatory system to be used as the basis for the preparation of national and regional development policies, strategies, and programs. For example, global agreements include the United Nations Framework Convention on Climate Change (UNFCCC) with the Paris Agreement on Climate Change, the United Nations Convention on Biodiversity (CBD) and the Global Biodiversity Framework

2030 (GBF 2030), the United Nations Environment Assembly (UNEA) Commitments, the Sustainable Development Goals (SDGs), and the G20. Thus, protecting and managing mangrove ecosystems sustainably at the national level is in line with and strengthened with the targets/objectives to be achieved from various international agreements (LCDI, 2023).

Therefore, the restoration of mangrove ecosystems is crucial to restore their function and achieve the Sustainable Development Goals (SDGs). And regulations are needed to support this restoration process is very important, both in terms of national and international policies (SDGs, 2015).

RESEARCH METHODS

In this study, the method used is a case study, here are the case studies: Successful Regulatory Case Studies. Successful cases such as mangrove restoration in Thailand and Indonesia show how effective regulation and community support can facilitate restoration.

1. Implementation of Forest Management Policies in East Kalimantan, Indonesia

The implementation of the mangrove forest management policy carried out by the East Kalimantan Provincial Government in order to deal with the problem of damage to the Mahakam Delta mangrove forest is an effort made to recreate environmental sustainability, especially in the Mahakam Delta mangrove forest area. This research was carried out because of the problems that occurred in the Mahakam Delta mangrove forest area continuously. The problem that has occurred has been for quite a long time, this is due to the inaccuracy of previous policies and the overlap of authority and selfishness from stakeholders.

The purpose of this study is to analyze the current policy implementation carried out by the East Kalimantan Provincial Government in dealing with the problem of damage to the Mahakam Delta mangrove forest by using the policy implementation theory according to Van Metter and Van Horn with standard variables and policy objectives, resources, characteristics of implementing organizations, attitudes of implementers, communication of related organizations and implementation activities, as well as social, economic and political conditions.

The result of this study is that the implementation of policies carried out by the East Kalimantan Provincial Government can currently be said to be successful, although there are still indicators that need to be improved, such as resource variables.

The quality of human resources still needs to be improved to get good quality in the implementation of policy programs and time resources that require careful evaluation so that the time that has been made previously can be carried out according to the desired. In addition, from the results of the research carried out, it was found that there are still problems that occur in the private sector (Putri & Ardianto, 2023).

The government in implementing policies refers to the Regulation of the Minister of Environment and Forestry number 9 of 2021 concerning Social Forestry. The existence of policies related to Social Forestry focuses on social

justice in communities around forest areas while still paying attention to the preservation of the forest environment. In accordance with what has been said before, the Mahakam Delta KPHP as the government implementer at the site level in implementing the Mahakam Delta mangrove forest management policy refers to the standardization that has been set by the Central Government. Where the standard indicators set to implement the policy are:

a. Social Pillar, where in this pillar the Social Forestry policy must create an increase in welfare for the community around the forest area to achieve the fulfillment of basic rights of the community in a fair and equal manner to create a quality society.
b. Ecological Pillar, this is related to the ecosystem that is preserved and the large amount of biodiversity in the forest area.
c. The Economic Pillar focuses on the economic growth of communities in forest areas while still paying attention to environmental sustainability without damaging the environment.
d. Access distribution, this is done so that the community is given access to manage forest areas without damaging them. This is given so that there are no conflicts that occur as a result of the lack of community welfare and the absence of jobs so that urbanization will cause the gap in villages and cities to widen.
e. Assistance by extension workers and NGO assistants, where this aims to increase the capacity of the community around the forest area and improve the quality of the community.
f. Cooperation, which in addition to forming partners, also aims at investment and markets in order to encourage the success of a policy implementation.

2. Regulation of Regional Regulation of Maros Regency, South Sulawesi

In the Regional Regulation (Perda) of Maros Regency, South Sulawesi Number 3 of 2015 concerning the Preservation, Management and Utilization of Mangrove Forests, it is stipulated that the management of Mangrove Forests is based on principles, protection/conservation, control, and utilization, with the aim of ensuring the preservation of biological resources in coastal areas in an integrated manner, so that they can be used sustainably and prevent overuse in order to provide benefits and be prosperous community (Maros, 2015).

The scope of mangrove forest management includes:

a. determination of management policies;
b. management of Mangrove Forests consisting of:
    i. the establishment of rehabilitation plans;
    ii. management of protected mangrove forests;
    iii. management of river border mangrove forests;
    iv. Ditch Reservoir Administration.
c. mangrove forest arrangement;
d. permits for the Utilization of Mangrove Forests;
e. Supervision and control.

Meanwhile, the target of Mangrove Forest management is the integrated implementation of Mangrove Forest conservation efforts and compliance with its management including:

a. rehabilitation of damaged mangrove forests in absolute protected areas;
b. preserving mangrove forests in limited protected areas;
c. increasing public awareness of the importance of preserving mangrove forests;
d. the creation of sustainable management and controlled use of responsible community-based mangrove forests.

This management is carried out in an integrated manner by paying attention to the function of the care area for fish resources, spatial planning and community involvement. Mangrove Forest Management is carried out in an integrated manner by prohibiting logging in protected areas.

As for Maros Regency, South Sulawesi, it is regulated regarding the types of activities that can be carried out in mangrove forests, namely:

a. Absolute protected areas in the form of research activities while maintaining biodiversity;
b. Limited protected areas in the form of: research, tourism, trench pond cultivation, fishing, limited timber utilization, crab fisheries, bird cultivation, and medicinal plant cultivation.
c. The river border area is in the form of research and tourism.
d. The trench pond cultivation area is in the form of research and fish farming.

The use of mangrove forests can only be carried out in Limited Protected Areas while maintaining the minimum density of stands, the remaining normal and non-defective stands and clumps.

a. On mangrove forest stands with an age of 10 (ten) years, thinning, reduction of the number of trees/clumps and
b. leaving a normal stand, growing upright and not
c. disabled.
d. (2) A stand in a clump that can be cut down is a stand that
e. depressed and deformed.
f. (3) Thinning of mangrove forest stands is carried out every 5 (five) years very.

RESULT AND DISCUSSION

Regulatory Contribution to the Achievement of the SDGs

A. SDG 14: Life Underwater

Mangroves play an important role as a habitat for marine species. Good regulation can protect and restore these habitats, contributing to the achievement of SDG 14 on ocean ecosystems. In SDGs 14 regarding ocean ecosystems, there are several indicators related to mangrove ecosystems, namely:

A.1. Application of an ecosystem-based approach in the management of ocean areas

Based on an ecological perspective, an ecosystem-based approach considers the relationship between living organisms, habitats, physical and chemical conditions of ecosystems, emphasizing the importance of ecological integration, biodiversity and overall ecosystem health. Based on the management perspective, the ecosystem-based approach also refers to an integrated management strategy of the socio-ecological system that considers ecological, social and economic factors and implements the principles of sustainable development. Spatial-based management of the coast and sea supports the sustainable management of exclusive economic zones. Integrated Coastal Zone Management (ICZM) is the integrated management of coastal and marine areas through coordination across institutions and institutions, both marine and land. Marine Spatial Planning (MSP) focuses on EEZs, which integrate the needs and policies of the marine sector into a planning framework.

Indicators are achieved if the implementation of ocean management has been carried out through policy documents, guidelines or other technical documents at the national level that require ocean management with an ecosystem-based approach, based on annual data from the Ministry of Marine Affairs and Fisheries covering national and provincial areas.

The goal is to achieve the benefits of an ecosystem-based approach that is beneficial for biodiversity conservation, sustainable use, and a fair and equitable distribution of profits resulting from the utilization of genetic resources found in the sea.

A.2. Sustainable Management of 11 State Fisheries Management Areas of the Republic of Indonesia (WPPNRI)

The State Fisheries Management Area of the Republic of Indonesia (WPPNRI) is a fisheries management area for fishing, fish farming, conservation, research, and fisheries development which includes inland waters, archipelagic waters, territorial seas, additional zones, and Indonesia's exclusive economic zones.

The Ministry of Marine Affairs and Fisheries has developed an Indicator Assessment Module for Fisheries Management with an Ecosystem Approach (EAFM) in 2014, which covers habitat and ecosystem dimensions, fish resources, fishing techniques, economic, social and institutional. Fisheries management with an ecosystem approach is carried out in the Indonesian Fisheries Management Area (WPPNRI). Evaluation of the implementation of EAFM in WPPNRI was carried out using a composite index of all dimensions with the following score categories:

1. Bad (1 – 20)
2. Less (21 – 40)
3. Medium (41 – 60)
4. Good (61 – 80)
5. Very good (81 – 100)

This module is in the form of an annual report with the coverage of the national area and the State Fisheries Management Area of the Republic of Indonesia (WPPNRI).

A.3. Proportion catches (JTB) is the number of catches of 80% of the maximum sustainable yield – MSY.

By the following calculation, the proportion of marine fish catches that are within safe biological limits is the total catch of fish species in a certain period of time divided by the number of fish species caught allowed in the same time period multiplied by one hundred percent and expressed in percent units (%).

$$PTI = \frac{THTIT}{JTB} \times 100\%$$

Information:

PTI = Proportion of marine fish species caught within safe biological limits
THTIT = Total catch of fish species in a given period of time
JTB = Number of catches allowed

With the aim of benefiting from monitoring the sustainability of fish resources and the continuity of fishing business. The data is sourced from the Annual Report of the Ministry of Maritime Affairs and Fisheries with the coverage of the national administrative area and the National Fisheries Management Area of the Republic of Indonesia.

A.4. Total area of marine marine protected areas

Marine marine conservation areas include marine conservation areas and marine national parks. Aquatic conservation areas are protected water areas, managed with a zoning system, to realize sustainable management of fish resources and their environment. Marine National Park is a nature conservation area that has an original ecosystem, managed with a zoning system that is used for research, science, education, supporting cultivation, tourism, and recreation. The number of marine marine conservation areas is the total area of territorial marine conservation areas in a certain period of time expressed in hectares. The achievement of the area of marine marine conservation areas is in accordance with Aichi's target, which is 32.5 million ha or 10% of Indonesia's water area of 325 million ha.

By the following calculation method,

The area of the centrally managed marine conservation area in a certain period of time is added to the area of the regionally managed marine conservation area in a certain period of time.

$$JLKKP = LKPN + LKPD$$

Note:

JLKPP = Number of marine conservation areas
LKPN = Area of centrally managed marine conservation areas in a certain period of time
LKPD = Area of marine conservation areas managed by the region in a certain period of time

It aims to monitor the sustainability of marine and fishery resources in order to maintain the balance of the environment, biodiversity, and aquatic ecosystems as well as the availability of optimal and sustainable management of conservation areas.

This data is sourced from several sectors, namely, the Ministry of Marine Affairs and Fisheries: Marine and Fisheries Statistics, the Ministry of Environment and Forestry: Environment and Forestry Statistics, Provincial Governments and Regency/City Regional Governments: Annual Report.

A.5. Level of implementation of legal/regulatory/policy/institutional frameworks that recognise and protect access rights for small-scale fisheries

Small fishermen are fishermen who fish to meet their daily needs, both those who do not use fishing boats and those who use fishing boats with a maximum size of 10 (ten) gross tons (GT), as well as fishing in waters which are traditional fisheries rights that have been used for generations in accordance with local culture and wisdom. According to FAO-UN (2018) based on the Rio+20 para 175 document, in ensuring the recognition and protection of access rights for small-scale fisheries, there are 3 (three) main conditions, namely:

1. Appropriate legal, regulatory and policy frameworks;
2. Specific initiatives to support small-scale fisheries; and
3. Relevant institutional mechanisms that allow the participation of small-scale fisheries organizations in relevant processes.

Indicators are achieved if there are laws/regulations/policies/institutions that recognize and protect access rights for small-scale fisheries that have been approved and are still in effect when data is collected. With data sources from the Ministry of Maritime Affairs and Fisheries covering national and provincial areas.

The objective is to monitor the availability of legal/regulatory/policy/institutional frameworks that recognize and protect access rights for small-scale fisheries.

A.6. Availability of policy frameworks and instruments related to the implementation of UNCLOS (the United Nations Convention on the Law of the Sea).

The United Nations Convention on the Law of the Sea (UNCLOS) is an international agreement resulting from the Third United Nations Conference on the Law of the Sea (UNCLOS III) which lasted from 1973 to 1982. and management of marine natural resources.

Indicators are achieved if there are laws related to the implementation of UNCLOS that have been ratified and are still in force when data is collected, which is an indication of the existence of a policy framework and instruments for the conservation and sustainable use of the ocean and its resources. This data source comes from the Ministry of Maritime Affairs and Fisheries with national coverage.

The goal is the availability of policy frameworks and instruments related to the implementation of UNCLOS to show Indonesia's commitment to responsible and sustainable management of marine and coastal resources.

B. SDG 15: Life on Land

Mangrove restoration also supports terrestrial biodiversity. Policies that support mangrove protection and rehabilitation contribute to the achievement of SDG 15.

In SDGs 15 regarding terrestrial ecosystems, there are several indicators related to mangrove ecosystems, namely:

B.1. Proportion of forest area to total land area

A forest is a unified ecosystem in the form of a stretch of land containing biological natural resources dominated by trees in the natural communion of their environment, which cannot be separated from each other. Forest cover is a forest and non-forest area covered with vegetation, excluding public waters, such as large rivers and lakes in an area. Forest cover data is geospatial data that describes land cover conditions on a scale of 1:250,000 as a result of remote sensing image interpretation. Data source comes from the Ministry of Environment and Forestry: Statistics of the Ministry of Environment and Forestry, with national and provincial coverage

The proportion of forest cover is the result of the area of forest cover divided by the total land area multiplied by one hundred percent, expressed in percent units (%).

Formula:

$$PTH = \left[\frac{LTH}{TLD}\right] x\ 100\%$$

Information:
PTHL = Forest cover proportion
LTH = Forest cover area
TLD = Total land area

Aiming to monitor the development of forest cover is one way to find out the occurrence of forest destruction. This is expected to improve forest management through sustainable forest management, including protection, restoration,

reforestation, as well as increasing efforts to prevent forest degradation and contribute to global efforts to address climate change.

B.2. Proportion of degraded land to total land area

Land degradation is defined as the reduction or loss of biological and economic productivity and complexity of rainfed farmland, irrigated farmland, or range, grassland, forests and forest lands resulting from a combination of pressures, including land use and management practices. Degraded land is found inside and outside forest areas. Especially for land outside forest areas, it can be seen through indicators of the implementation of agricultural land conservation and rehabilitation. Forest and land rehabilitation is an effort to restore, maintain and improve the function of forests and land so that their carrying capacity, productivity and role in supporting the life support system are maintained.

How to Calculate:

The proportion of degraded land to the total land area is calculated from the land that is categorized as degraded divided by the total land area multiplied by one hundred percent.

Formula:

$$PLK = \frac{LTD}{TLD} x\ 100\%$$

Information:

PLTD = Proportion of forest and land area

LTD = Area of degraded forests and land

TLD = Total land area

With the benefit of monitoring the increase in critical land area to monitor the condition of forest and land destruction to determine targeted rehabilitation activities. The source of this data comes from the Ministry of Environment and Forestry, the Statistics division of the Ministry of Environment and Forestry, and the Ministry of Agriculture, the Statistics division of the Ministry of Agriculture with the coverage of national and provincial administrative areas.

B.3. Legislative, administrative and policy frameworks to ensure a fair and equitable distribution of benefits.

This indicator is defined as the number of countries that have adopted legislative, administrative and policy frameworks to ensure a fair and equitable distribution of benefits. This refers to the efforts of countries to implement the Nagoya Protocol on Access to Genetic Resources (SDGs) and the Fair and Equitable Sharing of Benefits from Their Utilization to the Convention on Biological Diversity (2010) and the International Agreement on Plant Genetic Resources for Food and Agriculture (2001). The Nagoya Protocol covers genetic

resources and traditional knowledge associated with genetic resources, as well as the benefits arising from their utilization by establishing core obligations for the Contracting Parties to take actions regarding access, benefit sharing, and compliance. The objective of the International Agreement is the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of benefits from their use, in line with the Convention on Biological Diversity.

How to calculate:

Indicators achieved if the availability of legislation, administration and policy frameworks are met is an indication of the adoption of legislative, administrative and policy frameworks to ensure a fair and equitable distribution of benefits. Data sources are from the Ministry of Environment and Forestry, KPP and the Ministry of Agriculture which covers the national area.

The benefit is to measure the availability of policies to ensure a fair and equitable distribution of benefits from the use of genetic resources, which is outlined by the government in the form of regulations.

B.4. Aichi Biodiversity Utilization Plan 2 of the Strategic Plan

This indicator measures progress towards the national targets set in accordance with Target 2 of the Strategic Plan for Biodiversity 2011-2020. In 2020, biodiversity values have been integrated into national development and poverty reduction strategies, as well as planning processes and are being incorporated into national accounting systems and reporting systems.

In IBSAP 2015-2020, kehati is divided into three categories, namely:

Ecosystem diversity is the diversity of shapes and arrangements of landscapes, land, and waters where living creatures or organisms interact and form relationships with their physical environment;

Species diversity is the diversity of types of organisms that occupy an ecosystem on land and in waters;

Genetic diversity is the diversity of individuals within a kind.

How to Calculate:

- 0.0 no national target reflecting Aichi Biodiversity Target 2
- 0.2 national target exists, but away from it
- 0.4 national targets exist, but no progress
- 6 national targets exist and progress exists, but at an insufficient level
- 0.8 national targets exist and progress is on track to achieve them
- National targets exist and progress is on track to pass them.

With data source from the Ministry of Environment and Forestry: National Report on CBD. The goal is to monitor the progress of achieving the national target set in accordance with Target 2 of Aichi Biodiversity.

B.5. Official development assistance for the conservation and sustainable use of biodiversity

Grants are a gift in the form of money, goods, or services from one party to another that aims to advance or support the achievement of the goals of a program that is being implemented. Registered grants for the development of the forestry sector and water resource conservation are funds (money) that have been registered by the Ministry of Finance.

How to Calculate:

The amount of funds that have been allocated for the development of the forestry sector and water resources conservation refers to and/or is found in the attachment to the indicative ceiling of expenditure of Ministries/Institutions for the current Fiscal Year.

Data sources come from the National Development Planning Agency (BAPPENAS) and the Ministry of Finance (Environmental Fund Management Agency).

With the benefit of monitoring the amount of funds allocated for the development of the forestry sector and water resource conservation from year to year.

C. SDG 13: Addressing Climate Change

Mangroves absorb carbon and reduce the impact of climate change. Regulations that support mangrove restoration help achieve SDG 13.

In SDGs 13 regarding Climate Change Management, there are several indicators related to mangrove ecosystems, namely:

1. The realization of the implementation of greenhouse gas (GHG) inventory, as well as the monitoring, reporting and verification of GHG emissions reported in the Biennial Update Report (BUR) and National Communications documents;
2. Calculation of the role of mangrove ecosystems in the potential for emission reduction and/or greenhouse gas (GHG) emission intensity compared to the amount of GHG emissions per year;
3. The number of formal education units and institutions/communities concerned about the mangrove ecosystem; and
4. The amount of public funds for climate change funding, including the restoration of mangrove ecosystems.

D. SDG 6: Clean Water and Sanitation

Mangroves play a role in maintaining water quality through filtration. Regulations that support mangroves contribute to the achievement of SDG 6.

In SDGs 6 related to clean water and sanitation, mangrove ecosystems play a role in the filtration of groundwater and surface water quality, this certainly plays a role in changes in the level of water resources in the ecosystem from time to time.

The success of the implementation of SDGs 6 is also influenced by the integrated management of water resources as well as the role of institutions and management instruments. Indicators of clean water and sanitation that affect mangrove ecosystems include:

D.1. Percentage of households using safely managed drinking water services.

The percentage of households using safely managed drinking water services is measured by the percentage of households using an improved basic drinking water source, the location of the source is in or out of the house, available whenever necessary and the quality of the water source meets the drinking water quality requirements. According to the Regulation of the Minister of Health, drinking water is water that has gone through a treatment process or without a treatment process that meets health requirements and can be drunk immediately. Indicator recording is carried out through a 5 (five) access ladder approach, namely:

1.) unavailable access is when households use surface water sources (rivers, lakes, reservoirs, ponds, irrigation) directly without treatment;
2.) Inadequate access is when households use water sources that come from unprotected wells and/or unprotected springs;
3.) Limited Eligible Access is if the household uses a proper water source with a water intake time of more than 30 minutes;
4.) Basic decent access is if the household uses a decent water source with a collection time of 30 minutes or less; and
5.) Safe access is if the household uses a proper water source, the location of the source is in or in the yard of the house, available whenever needed, and the quality of the water source meets the drinking water quality requirements.

A decent source of drinking water is if the household uses the main source of drinking water in the form of taps, piping, retail piping, yard taps, public hydrants, protected water, and rainwater reservoirs. Protected water includes drilled/pumped wells, protected wells, and protected springs. For households that use drinking water sources in the form of bottled water or refillable water, households are categorized as having access to drinking water that is suitable for bathing/washing from taps, drilled/pumped wells, protected wells, protected springs, and rainwater.

Quality drinking water (decent) is protected drinking water including tap water (taps), public taps, public hydrants, water terminals, rainwater catchments (PAH) or springs and protected wells, drilled wells or pump wells, which are at least 10 m away from sewage disposal, waste storage and garbage disposal. Excludes bottled water, water from mobile sellers, water sold through tanks, well water and protected springs. The proportion of households with sustainable access to decent drinking water is the comparison between households with access to quality (decent) drinking water sources and all households, expressed as a percentage.

How it is calculated:

The number of households that have access to safely managed drinking water services at a given time divided by the total number of households in the same period is expressed in percent (%).

Formula:

Drinking water services that are managed safely (properly)

$$PAMSA = \frac{JRTAMSA}{JRT} \; x \; 100\%$$

Information:
PAMSA : Percentage of households that use drinking water services that are safely managed, located in or in the yard, and water is available year-round.
JRTAMSA : The number of households using drinking water services that are safely managed, located in or in the yard, and water is available throughout the year.
JRT : Total number of households.

The data sources come from BPS: National Socio-Economic Survey (Susenas) and the Ministry of Health: through the Drinking Water Quality Supervision (PKAM) survey. By aggregation covering administrative areas: national, provincial, district/city; area of residence: urban and rural; gender of the head of the household; and income (expenditure) groups. The frequency is divided into, Susenas KOR: Annual; Health and Housing Module Success: 3 years; Drinking Water Quality Survey: implemented in 2020; and PKAM: Annual.

The goal is to monitor the proportion of households that use safely managed drinking water sources based on the assumption that the water source can provide basic needs that can meet the daily water needs of the community and meet the quality requirements of drinking water. The basic daily needs of drinking water as defined in Government Regulation No. 122/2015 concerning the Drinking Water Supply System are water to meet the needs of drinking, cooking, bathing, washing, washing, washing, and worship. Meanwhile, the quality of drinking water is in accordance with the Minister of Health Regulation Number 492 of 2010 concerning Drinking Water Quality Requirements. This indicator is used in the preparation of the 2020-2024 RPJMN.

D.2. Percentage of liquid industrial liquid waste that is safely treated

The percentage of industrial liquid waste that is safely treated is a comparison of wastewater produced by industry that is managed safely based on the level of management compared to the amount of wastewater produced by industry. This indicator measures the volume of industrial liquid waste produced that is safely treated before being discharged into the environment. The liquid waste in question is wastewater that is disposed of after being used in an industrial production process that has no value for reuse (wastewater from the final disposal of water recycling

systems). Used air-conditioning water, sanitary wastewater and surface runoff from industry are not included in the calculation of this indicator.

The proportion of wastewater produced by industrial activities along with the concentration of parameters in it is carried out through a swapantau approach which is reported online and periodically through the SIMPEL (Electronic Environmental Reporting Information System) application, which is part of the Company Performance Rating Assessment Program in Environmental Management (PROPER).

Industrial compliance control of liquid waste quality standards is part of PROPER, with the aim of encouraging industry compliance with environmental regulations. The SIMPEL application is carried out based on the Regulation of the Minister of Environment and Forestry Number P.87/2016 concerning the Electronic Reporting System for Environmental Licensing for Businesses and/or Activities. However, it should be noted that the data on the SIMPEL application does not yet represent the entire industrial population in Indonesia.

How it is calculated:

The formula for calculating the proportion of safely treated industrial liquid waste is measured in units of 1000 m3/day:

Formula:

$$PLCI = \frac{JLCIK}{JLCI} \; x \; 100\%$$

Information:

PLCI : Percentage of industrial liquid waste that is safely managed

JLCIA : The amount of industrial liquid waste safely managed (reported)

JLCI : Total industrial liquid waste (reported)

The data is sourced from the Ministry of Environment and Forestry: Industry Data that is swapped through the SIMPEL Application and reports it periodically. By aggregating administrative areas: national, provincial, and regency/city. Types of industries according to economic activities: agriculture, mining and quarrying, manufacturing, electric power, construction, and services. And wastewater treatment: primary, secondary, tertiary.

This indicator is used to monitor waste generated by industrial activities. The data generated from these indicators can be used to inform stakeholders to make appropriate policies to accelerate progress towards reducing water pollution, minimizing the release of hazardous chemicals from industry and improving wastewater treatment and reuse.

D.3. Quality of surface water as raw water

The Water Quality Index (IKA) is calculated from the results of the pollution index conversion. Water pollution is the entry or introduction of living things,

substances, energy, and/or other components into water by human activities so that they exceed the predetermined water quality standards. The IKA calculation is carried out based on the Determination of Water Quality Status. IKA calculations have the concept that the higher the pollutant index, the worse the water quality. This calculation is based on the value of the sample results against the quality standards of each parameter. There are 7 (seven) parameters used in calculating the water quality index (IKA), which are considered to represent the real condition of surface water quality, namely: TSS (total suspended solids); DO (dissolved oxygen); BOD (biochemical oxygen demand); COD (chemical oxygen demand) T-P (total phosphate); fecal coli and total coli. The IKA value is influenced by various variables, including:

1. reducing the burden of pollution and restoration efforts on several water sources;
2. availability and fluctuations in water discharge affected by changes in land use and local weather, regional and global climate factors;
3. water use; and
4. as well as the rate of erosion and sedimentation.

The method of calculating the Water Quality Index Value is obtained by transforming the pollution index value by multiplying the weight of the index value by the percentage of quality standard compliance. The percentage of quality standard compliance is obtained from the result of summing sample points that meet quality standards to the number of samples in percent. The index weights are given the following limits: 70 to meet quality standards, 50 to be lightly polluted, 30 to moderately polluted, and 10 to be heavily polluted. Based on the data source of the Ministry of Environment and Forestry with administrative areas from the national and provincial governments.

This indicator is used to assess the quality of water bodies and the suitability of the water body's designation due to pollution. Pollution index information can also be used to improve the quality of water bodies if there is a decrease in quality due to the presence of pollutant compounds.

D.4. Level of implementation of integrated water resources management (Q-100)

The degree of indicators for the implementation of Integrated Water Resources Management (IMWR) is calculated in percent (%) from 0 (implementation has not yet started) to 100 (fully implemented).

There are four dimensions that underlie the implementation of IWRM in Indonesia, namely:

1. supporting environment,
2. institutions and participation,
3. funding, and
4. management instruments.

Indicator 6.5.1 data is collected through questionnaires and responses, and consolidated through consultation between relevant stakeholders, such as Ministries and Institutions involved in water resources management as well as stakeholders such as NGOs, academics and businesses.

Policies, laws and regulations and planning are environmental factors that support the implementation of IWRM. The role of political, social, economic and administrative/bureaucratic institutions has a considerable role and can provide support for the implementation of IWRM, including in encouraging management instruments. Various sources of funding need to be mobilized and provided in the development and management of water resources (beyond funding for drinking water and sanitation).

How it is calculated:

The level of implementation of integrated water resources management is measured through the IMWR questionnaire method.

Calculation method:

1. The questionnaire consists of 32 questions covering 4 components of IWRM.
2. Each question is given a score between 0 and 100, with 6 categories:
3. The weighted average of the question scores in each of the four components is calculated to give a score of 0 - 100 for each component.
4. The component score is averaged (unweighted) to give the indicator score, expressed as a percentage between 0 and 100.

Data sources are from the Ministry of Public Works and Public Housing and the Ministry of Environment and Forestry. With national and provincial administrative areas.

This indicator is used to support the national planning process to advance the implementation of the IWRM so that it can achieve the targets that have been set by implementing integrated water resources management at all levels.

CONCLUSION

Regulations play a crucial role in supporting the restoration of mangrove ecosystems and the achievement of the SDGs. Recommendations are: 1. Strengthening regulations and law enforcement for mangrove protection. 2. Mangrove forest management in law enforcement is still not fully effective implemented by the government and the community. For this reason, it is necessary to improve and strengthen law enforcement regulations, especially for supervision of mangrove forest management in coastal areas. 3. Increase the participation of the community and the private sector in restoration. 4. Conduct further research to evaluate the impact of regulations on the SDGs.

REFERENCES

Kehutanan, K. L. H. dan. (2021). *Kementerian Lingkungan Hidup dan Kehutanan, Peta Mangrove Nasional, 2021*.

LCDI. (2023). *https://lcdi-indonesia.id/grk-pesisir-dan-laut/*.

Maros, P. K. (2015). *Perda Kabupaten Maros, Sulawesi Selatan Nomor-03-Tahun-2015-Tentang-Pelestarian-Mangrove, Bab II pasal 2-4.*

Murdiyarso. (2015). *Murdiyarso dkk. 2015.dalam Translation - PAD M4CR bahan regulasi dll*.

PERS. (2021). *SIARAN PERS Nomor: SP.350/HUMAS/PP/HMS.3/10/2021 PPID KLHK*. https://ppid.menlhk.go.id/berita/siaran-pers/6225/peta-mangrove-nasional-tahun-2021-baseline-pengelolaan-rehabilitasi-mangrove-nasional

Putri, R. D., & Ardianto, H. T. (2023). Implementasi Kebijakan Pengelolaan Hutan Mangrove oleh Pemerintah Provinsi Kalimantan Timur dalam Menangani Permasalahan Kerusakan Hutan Mangrove Delta Mahakam. *Journal of Politic and Government Studies*, *12*(3), 406–429.

SDGs. (2015). *https://sdgs.bappenas.go.id/metadata-indikator-sdgs/ SDGs 15*.

Yuwono, A. (2023). *Laporan Pekerjaan Jasa Konsultan, "Mangrove for Coastal Resilience Project" periode Juli-September 2023,*.