JMarPT
Journal of Marine Problems and Threats
JMarPT 2(1): 18–33
ISSN 3048-037X

Institute for Advanced Science, Social and Sustainable Future
MORALITY BEFORE KNOWLEDGE

The contestation and implications of tin mining on environmental degradation

Andifa Khalida Azzara[1,*]
[1] *School of Environmental Science, Universitas Indonesia, Jakarta, 10430, Indonesia.*
*Correspondence: andifazzara@gmail.com

Received Date: January 21, 2025 Revised Date: February 26, 2025 Accepted Date: February 28, 2025

ABSTRACT

Background: Tin mining activities in Bangka Belitung have consistently increased each year, yet they often neglect or damage the environment—resulting in soil degradation, water pollution, ecosystem destruction with a consequent loss of biodiversity, and significant harm to marine ecosystems such as coral reefs. **Methods**: This qualitative study examines public attitudes toward tin mining, reviews the legal policies in effect, and assesses the environmental and social impacts through secondary data collected via literature reviews. **Findings:** The analysis reveals that the prevailing anthropocentric approach in both practice and legal frameworks has led to extensive environmental damage, exemplified by 1,435.64 hectares of unreclaimed land, and underscores that current mining operations prioritize human interests at the expense of environmental sustainability. **Conclusion**: The study concludes that a paradigm shift toward an ecocentric framework is urgently needed, one that emphasizes enhanced environmental education, increased community participation, and reformed legal policies to promote sustainable mining practices. **Novelty/Originality of this article:** This research presents a novel conceptual framework by integrating ecocentric principles into the evaluation of tin mining impacts, offering innovative policy recommendations for sustainable resource management in Bangka Belitung.

KEYWORDS: anthropocentrism; degradation; mining; legislation; land restoration.

1. Introduction

The increasingly modern era has led to a high demand for tin, which serves as a core material for designing various electronic devices as well as military equipment. Indonesia is the second-largest tin producer in the world, producing 74,100 tons of tin in 2022, a 33.9% increase compared to 2021, which reached 71,000 tons (Ahmad et al., 2022). Indonesia's tin production contributes 34% of the world's total tin supply. One of the largest tin producers globally is China, which produced 91,000 tons of tin in 2022 (Jamil et al., 2022). China contributes 47% to the world's total tin production, followed by Indonesia at 19%, Brazil at 15%, Australia at 9%, Bolivia at 8%, and Malaysia at 7% (Rusfiana & Hermawan, 2019). In Indonesia, tin-producing areas include Karimun Island, Kundur, Singkep, and Bangka Belitung, which are part of a shipping route known as the "Southeast Asian Tin Belt".

The Bangka Belitung Islands Province is renowned for its abundant tin resources and is recognized as the largest exporter, supplying around 80% of the world's tin demand. The region holds tin reserves of 80,000 tons, which have significant potential to boost foreign exchange earnings and contribute to economic development in Bangka Belitung. Tin mining

Cite This Article:
Azzara, A. K. (2025). The contestation and implications of tin mining on environmental degradation. *Journal of Marine Problems and Threats*, *2*(1), 18-33. https://doi.org/10.61511/jmarpt.v2i1.2025.1794

activities began in 1711 during the colonial era and were subsequently managed by the Indonesian government after independence through T and KT, while the remaining operations are managed by private companies and small-scale mining (Yulianti et al., 2020). Of the total area of 1,294,050 hectares in the Bangka Belitung Islands, 27.56% of the land is designated as Tin Mining Concession areas. Tin mining in Bangka Belitung is not limited to land-based operations, as offshore exploration for tin ore is also conducted. The extent of tin mining concessions on land and sea is summarized in the following table:

Table 1. The area of tin mining concessions (KP) in Bangka Belitung

Tin Company	Land (Ha)	Offshore	Total
T	330,664	143,136	473,800
KT	41,680		41,680
Other	12,826	4,058	16,884
Total	385,170	147,198	532,364

The mining companies conducting tin exploration in Bangka Belitung were initially managed by T before other companies took over. The Ministry of Industry and Trade's Decree No. 146/MPP/Kep/4/199, dated April 22, 1999, categorized tin as a free commodity (not regulated), allowing mining operators to conduct mining activities outside the designated mining concession areas. Tin mining then grew uncontrollably into illegal sand excavation, spreading across various locations, such as forests, plantations, and residential areas, narrowing the land available for other activities. The dominance of mining activities in the Bangka Belitung economy led to an increase in tin exploration focused solely on profit, disregarding the environmental damage caused. The reduction of green land due to tin excavation on land led to the conversion of these areas into deep excavations that, when it rained, would fill with water, creating abandoned mining pits. These pits became potential breeding grounds for endemic diseases, such as malaria. Abandoned mining pits contribute to around 64.12% of the land in Bangka Belitung being classified as critically or severely critical. Changes in the morphology and topography of the land affect groundwater and surface water, causing contamination. Former mining areas are prone to erosion, leading to droughts and landslides.

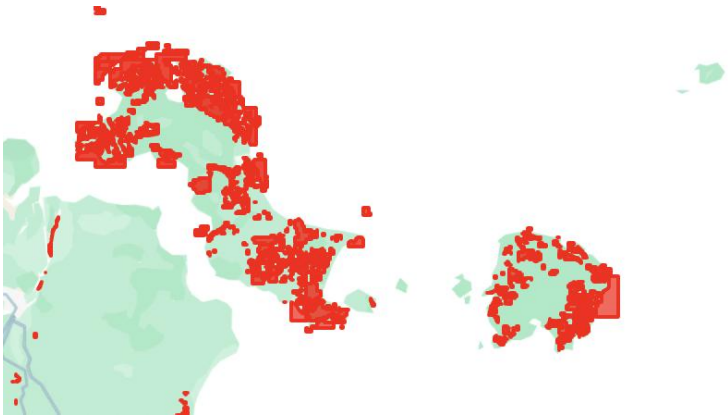

Fig. 1. The distribution of tin mining in Bangka Belitung

Inconventional mining has become the largest contributor to land and forest degradation, covering 150,000 hectares or 30% of Bangka Belitung's forest area (Rusfiana & Hermawan, 2019). Additionally, biological changes occur, disrupting flora, fauna, and microorganisms. Mining activities along the coast cause damage to coastal ecosystems due to mud from TI sites being discharged into river streams.

The environmental damage in Bangka Belitung caused by tin mining is partly due to the anthropocentric worldview held by humans. People view themselves as the center of the universe and believe that only humans have intrinsic value, while nature and everything within it are merely tools to satisfy human needs and interests (Murty & Yuningsih, 2022).

So far, human concern for nature has only been motivated by the need to ensure future human survival. Humans perceive nature merely as an object, a source of wealth that must be exploited for living purposes. Society's attitude toward tin mining is still dominated by economic interests, resulting in many conflicts related to mining activities. One example is the waters of Matras Beach, an area where local fishermen still use traditional equipment and which serves as a tourist destination. In 2015, two dredging ships entered the waters, prompting the fishermen from Matras Village to stage a peaceful protest at the Governor's Office of the Bangka Belitung Islands Province in December 2015 (Ulvianti et al., 2022).

As a result of this greed, Bangka Belitung is on the brink of an ecological crisis. Article 33, paragraph (3) of the 1945 Constitution of the Republic of Indonesia, Law No. 4 of 2009 on Mineral and Coal Mining, states that water, land, and natural resources contained within them are recognized by the state and should be used for the greatest benefit of the people. Considering that minerals and coal, as natural resources contained in the earth, are non-renewable, their management needs to be done as efficiently, transparently, sustainably, and environmentally responsibly as possible, ensuring fairness to benefit the people. In reality, tin mining in Bangka Belitung has not yet demonstrated environmentally responsible practices. The 271 trillion rupiah corruption case is one example of human anthropocentric behavior, where the resulting losses are ecological in nature. The ineffective enforcement of regulations and the lack of substantial land reclamation efforts after mining have led to environmental degradation in Bangka Belitung. The mandate of Law No. 4 of 2009 on mineral and coal downstreaming has been limited to experimental efforts with no remarkable outcomes. So, where does the government, as the legal stakeholder, stand in the face of the environmental crisis caused by tin mining in Bangka Belitung? Has the government applied a policy of allowing greedy miners to cause environmental destruction, as part of their anthropocentric mindset? Weak legal policies are one of the factors allowing anthropocentrism to persist in tin mining and environmental degradation.

The public's participation in mitigating environmental damage from tin mining activities depends on their level of knowledge about mining, including both its benefits and the impacts it generates. Educating people to shift their understanding from anthropocentrism to ecocentrism needs to be promoted at every level of society. The ecocentric paradigm holds that every form of life and living being has intrinsic value and therefore deserves moral consideration and care. Instilling an ecocentric perspective, where everything that happens is not centered around humans but around all living beings, is crucial for addressing environmental issues. This view encourages humans to make changes to save the environment. Public participation in efforts to mitigate environmental damage caused by tin mining depends on how much knowledge the community has about mining activities, including both the benefits that can be gained and the impacts caused. From the level of public knowledge, it can be understood how the community perceives the environmental damage that has occurred, as well as the dominant factors influencing their attitudes.

2. Methods

2.1 Tin mining in Bangka Belitung

The Bangka Belitung Islands is a province consisting of two islands, Bangka and Belitung, which borders South Sumatra Province. Bangka Belitung was established based on Law No. 27 of 2000 on the Formation of the Bangka Belitung Islands Province, dated November 21, 2000, with a land area of 16,424.14 km^2 and a water area of 65,301 km^2, making the total area 16,424.23 (www.babelprov.go.id).

This study uses a qualitative approach by presenting the natural background with the aim of interpreting the phenomena that occur (Moleong, 2012). Qualitative research is a type of research aimed at describing and analyzing phenomena, events, social activities,

attitudes, beliefs, and thoughts of individuals or groups (Sukamadinata, 2016). Based on this definition, it can be concluded that qualitative research is research that produces written descriptions of social phenomena, such as describing situations or activities, with the purpose of gathering information in-depth and comprehensively using various scientific methods. The method used in this study is a literature review, involving data and information collection techniques by examining written sources relevant to the object being studied (Nazir, 2015). The object to be examined is the attitudes of society as anthropocentric beings and the environmental damage caused by tin mining in Bangka Belitung, using a positivist paradigm approach. A conceptual approach with a normative approach is also used to examine the applicable laws. The data analysis technique is outlined to facilitate the analysis of data from the literature review and can be done in four stages, as follows: collecting data, in this stage, the researcher collects data in the form of journals, articles, and other literature to answer the research problem; identifying data.; describing data, clearly presenting the relevant literature; concluding data: This is done based on all the data that has been gathered.

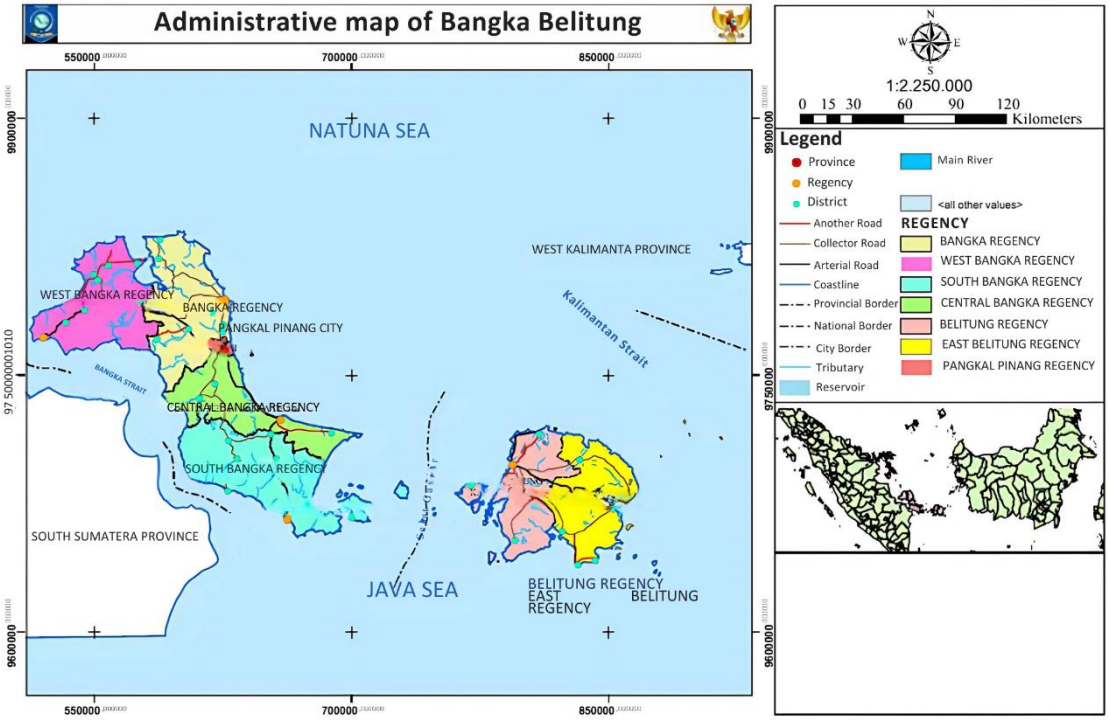

Fig. 2. Administrative map of Bangka Belitung

It can be concluded that a literature review provides theoretical support for the researcher in structuring a discussion that aligns with the research variables, which can be obtained from findings reinforced by data analysis results from primary data, such as journals, articles, and previous studies. The research method used is a literature review with a Systematic Literature Review (SLR). Literature review analysis involves examining patterns and trends in the published literature on social enterprises and sustainability (Luc, 2022). This allows for the uncovering of new insights in a specific field while explaining a new area of study. A literature review is a statistical method used to describe situations in a specific field of study and to find important information for various purposes, such as exploring research opportunities and supporting scientific activities (Mohadab et al., 2020). Literature review analysis is a useful tool for identifying and analyzing the scientific achievements of authors, articles, and journals through keyword analysis. The diagram below shows the flowchart of the literature review process. The first step in data collection for this study is determining the primary database used, which is Scopus. The second step

involves selecting keywords, namely “Tin” and “Anthropocentric Paradigm.” The third step is setting the research timeframe, which is 2000-2023.

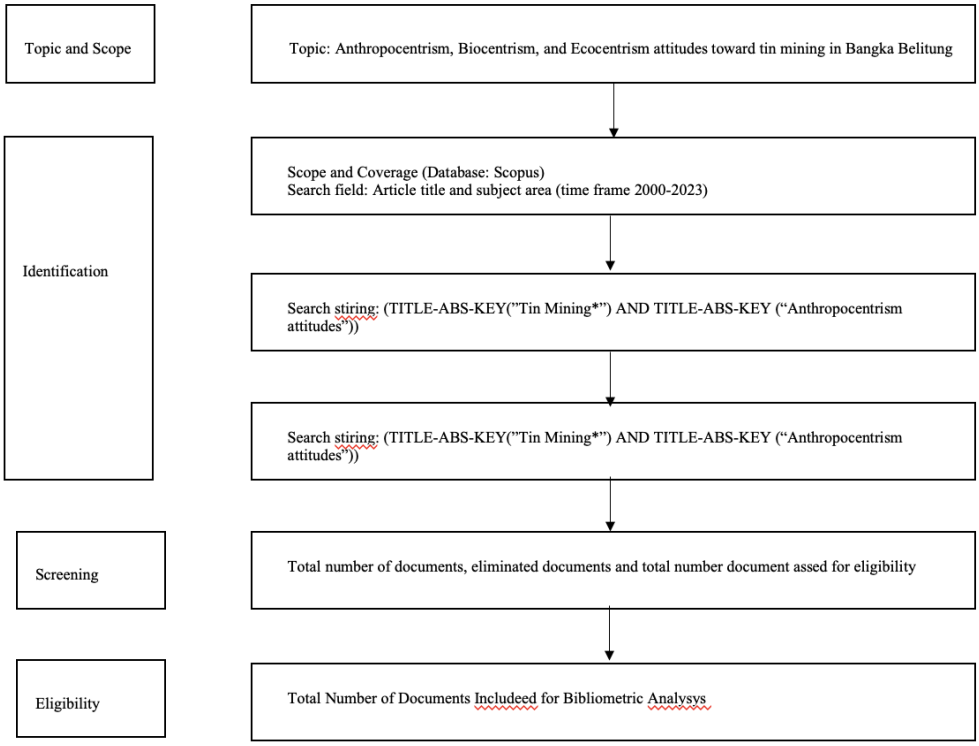

Fig. 3. Data collection process

The journals used consist of journals and other references. The total number of journals used is 41, with 9 regulations and 3 other references, as shown in the table below.

Table 2. Amount of bibliography

Year	Journal	Regulation	Other references	Total
2000-2005	3	2		5
2006-2011	2	-		2
2012-2018	6	4		10
2019-2024	30	3	3	36

3. Results and Discussion

3.1 The Contestation of tin mining

Anthropocentrism is an environmental ethics theory that views humans as the center of the universe's system. Humans and their interests determine the ecosystem's order in policies that involve interactions with nature. The highest value is placed on humans and their interests, with only humans holding value and receiving attention, while nature serves merely as a tool to fulfill human needs (Sutoyo et al., 2010). This concept of anthropocentrism still applies to tin mining activities in Bangka Belitung, especially illegal mining operations that lack permits. Illegal mining disregards the principles of green mining, as it does not require reclamation of land after mining. Furthermore, illegal mining is not monitored by local authorities, which severely harms the land in Bangka Belitung, leading to environmental degradation through new land clearing, loss of biodiversity, and environmental pollution caused by tin mining, resulting in ecosystem loss. The anthropocentric attitude of the community is driven not only by economic factors but also by other factors, such as the flood of illegal tin in the market, which causes the global tin price to drop. Additionally, the illegal extraction of tin ore and metal, which is exported

abroad, perpetuates the anthropocentric mindset (Haryadi, 2015). The uncertainty of policies regarding small-scale mining, along with weak enforcement and oversight, strengthens the community's anthropocentric attitude toward tin mining. Moreover, the community's low awareness of tin mining issues contributes to the increasing prevalence of anthropocentric behaviors that damage the environment.

In general, attitudes can be categorized into two types: personal attitudes and social (community) attitudes. Personal attitude is the thought process of an individual that allows them to interpret a specific situation (Rifqi, 2020). Personal attitude involves forming impressions based on observation or reasoning about something that affects both the physical and psychological aspects. On the other hand, social attitude refers to the process of forming impressions, opinions, or feelings toward something that involves the directed use of information (Secord et al., 2000). According to the study by Ferianda (2023) on Community Attitudes Toward Environmental Damage Caused by Tin Mining in Bangka Belitung, the community's attitude toward tin mining in Bangka Belitung can be seen from several factors that can serve as indicators, including the level of community knowledge, education, and occupation. These factors are believed to influence environmental damage and the anthropocentric attitudes toward tin mining.

Table 3. Community attitudes based on knowledge, education, and occupation

	Knowledge	Education	Occupation
Low	1	38	38
Medium	18	42	42
High	71	10	10

Based on the data, the community with high knowledge about tin mining activities exhibited varying attitudes toward environmental damage caused by tin mining. In Ferianda's study (2024), it was found that out of 90 respondents, the community's knowledge level was categorized as high, yet their attitudes toward environmental damage were still low. This indicates that, fundamentally, the community is less concerned about the environmental degradation caused by tin mining activities. The level of education can serve as a benchmark in research because education plays a significant role in shaping individuals' thought processes when addressing an issue. This shows that people with different levels of education tend to have varying attitudes toward environmental damage caused by tin mining. Regarding occupation, those with lower attitudes were primarily laborers. This is considered understandable, as many laborers are directly involved in mining activities, which often leads them to prioritize economic interests. Nevertheless, people with various occupations have different perspectives on the environmental damage caused by mining. Based on research on community attitudes in Bangka Belitung, it shows that knowledge, education, and occupation significantly influence people's attitudes toward mining activities. Knowledge, in particular, plays a central role in shaping attitudes that still lean toward anthropocentrism. Therefore, early education about the importance of environmental sustainability must be promoted within the community. Campaigns and active socialization should continue regularly across all sectors to address environmental damage caused by mining and reduce anthropocentric attitudes within the community (Dwi et al., 2020).

The attitude of the community that drives contestation is the process or dynamics of competition between individuals, groups, or institutions to gain power, influence, or legitimacy in a particular field (Islami et al., 2024). The issues at hand, including the rejection of mining activities by residents, have escalated over time. Over the past five years, there have been 14 conflicts caused by tin mining, involving communities in 42 villages (Riyanto et al., 2024). The main motive behind the opposition from anti-mining groups in the tin mining conflict in the waters of Matras Beach, for example, is concern over environmental damage and the shrinking of fishing areas. When the environment is damaged, it disrupts the traditional fishing zones and affects the fishermen's catch, which

over time could lead to poverty. The fish catch has decreased by up to 1.2 million tons per year (Ulvianti et al., 2022).

Mining has created environmental problems, and human responses to the ecological crisis are seen as ecological resistance (Hynman, 2003). The landscape changes in Bangka Belitung due to tin mining have become increasingly striking, with the mining activities being greedy, uncontrolled, short-term profit-oriented, and lacking in reclamation (Nugroho & Yanto, 2024). In fact, tin mining areas have expanded into the sea, historical sites, residential areas, agricultural and plantation lands, protected forests, green corridors, conservation areas, cemeteries, and various public facilities. For example, beach areas that were once tourist destinations have turned into potential sites for the operation of 1,000 floating tin mines. As a result, these areas can no longer be used for tourism due to the damage to the beaches. Protected forest areas have also been subject to tin mining (Nugraha & Purwanto, 2020). The use of dredger ships or suction barges several miles from the shoreline has caused sand to be dredged from the sea, and the waste is dumped directly into the water, leading to sedimentation that covers coral reefs, causing them to die. The death of coral reefs results in a decline in fish resources in the waters of Bangka Belitung. Furthermore, Lepar Island, which is part of a conservation area in Central Bangka Regency, has been converted into a tin mining site and later turned into oil palm and pepper plantations, transforming into a 'tin garden' (Manik, 2020). The widespread environmental damage is caused by land grabbing for mining. Environmental destruction has reached a critical point, with around 30% of the forest in Bangka severely damaged in 2004, with 5% of that damage attributed to mining activities (Erman, 2010). In addition, tin mining activities upstream have triggered river siltation, causing sedimentation, with water levels as low as 20 cm during normal tidal conditions.

The widespread and expanding tin mining in Bangka Belitung has led to uncontrolled environmental damage. This environmental degradation in Bangka Belitung is due to the excessive exploitation of natural resources without efforts for maintenance and environmental conservation. One way to address the ecological crisis caused by anthropocentric attitudes is by utilizing economic strategies in tin exploration activities. These economic strategies can be implemented in several ways, including: encouraging consumers to avoid wasting natural resources; this involves educating the public on the importance of using natural resources wisely and promoting sustainable consumption practices to reduce waste. By fostering awareness and encouraging more efficient use of resources, consumers can play a significant role in minimizing environmental degradation; making it difficult for business operators to avoid consequences for actively contributing to environmental sustainability; imposing fees or taxes on waste generated to ensure that business operators are responsible for managing their waste. This approach encourages businesses to reduce waste production and adopt environmentally friendly practices, as they will face financial consequences if they fail to properly manage or dispose of their waste. The revenue generated from these taxes or fees could be allocated to environmental conservation efforts or used to fund waste management programs; implementing a Deposit-Refund System, a deposit-refund system involves consumers paying a deposit when purchasing a product, which is refunded when the product or its packaging is returned for recycling or proper disposal. This system encourages responsible consumer behavior and promotes recycling by providing an economic incentive. It helps reduce waste and encourages the reuse of materials, as consumers are motivated to return items to receive their deposit back. This method can be particularly effective for products that have a high potential for recycling, such as bottles, cans, or certain types of packaging. Requiring businesses to submit environmental performance funds as a guarantee that they will carry out reclamation or environmental conservation activities

This approach mandates that businesses involved in activities with potential environmental impact, such as mining or industrial operations, allocate funds specifically for environmental recovery efforts. The funds serve as a financial guarantee, ensuring that businesses will take responsibility for the restoration of ecosystems or the conservation of natural resources affected by their activities. By setting aside this financial commitment, it

helps ensure that businesses prioritize environmental sustainability and comply with regulations for ecological protection (Widodo & Syari'udin, 2024)

In addition, actions to prevent environmental damage from mining in Bangka Belitung can apply the principle of prevention, which involves scientifically-based measures to ensure that any environmental management activity or natural resource use does not lead to environmental degradation or harm to other organisms. By implementing this principle, the Bangka Belitung government should conduct scientific studies to assess the extent to which tin mining activities harm the environment. Additionally, regulatory frameworks must be established to ensure that exploitation is not excessive, and rules should be set for the reclamation of mining areas. For mining in marine areas, it is crucial to ensure that mining does not harm fish-catching areas or coral reefs (Nugraha & Purwanto, 2020). Moreover, it should be made clear that mining activities involving dredgers or suction vessels must ensure that waste materials such as sand and slurry from mining do not create sediment that suffocates coral reefs or damages marine life. Another principle is the "polluter pays" principle, which calls for the allocation of pollution prevention costs through measures that encourage rational steps in the utilization of limited natural resources. In the implementation of this principle, the Bangka Belitung regional government must firmly set a nominal reclamation cost for each unit area of mining, both on land and at sea. Mining operations should be well-monitored, and the funds generated should be allocated for the reclamation of former mining areas until they are restored. Another principle that can be applied is sustainable development (inter and intragenerational equity principle), which asserts that each generation has the right to inherit and occupy the Earth in a condition that has not been harmed by previous generations. Furthermore, the current generation has an obligation to pass on the condition of the Earth and its resources as they were acquired and enjoyed. In practice, the application of this principle requires that tin miners take responsibility to ensure that mining activities do not leave environmental damage. For example, the lack of reclamation of former mining sites, leaving them open as pits, can eventually lead to the creation of mosquito breeding grounds, which contribute to the spread of malaria (Ryzzky et al., 2023).

The principle of restoration can be applied to address the problems arising from mining activities in Bangka Belitung. Restoration consists of reclamation activities related to soil recovery and revegetation (replanting trees). Restoration is an effort to repair or restore damaged land to recreate or approximate its original structure and function. The Society for Ecological Restoration International defines restoration as the process of aiding the recovery of ecosystems that have been degraded, damaged, or destroyed. Restoration interventions are designed to assist natural recovery processes. Ecological restoration aims first to restore localized sites that have been disturbed or degraded, such as former mining areas. Second, it aims to increase productivity on degraded production lands. Third, it seeks to enrich the conservation value of protected landscapes. Finally, it aims to restore ecological processes within a broader landscape (Sutomo, 2011). The restoration principle should be improved in post-tin mining areas in Bangka Belitung. This is because the mining sector significantly contributes to deforestation, with approximately 400,000 hectares of mined land, 65% of which is barren, and 35% forms pits (*kolong*). Restoration efforts have been undertaken since 1992-2008, covering 2,000 hectares of mining land, and plans for further reclamation are set at 1,600 hectares per year (Holili et al., 2023). However, there are challenges to restoring mined land in Bangka Belitung, such as illegal miners re-opening reclaimed lands. Weak law enforcement and the community's heavy dependence on tin mining have led to further exploitation of land previously mined by PT Timah Tbk and PT Kobatin. Both unreclaimed and reclaimed lands are being mined again by the community for remaining tin deposits. This hinders the recovery of post-mining lands because these areas need to be reclaimed and revegetated, which requires additional time and cost (Safitri et al., 2024). To control the negative impacts of mining on the environment and prevent further degradation, reclamation of mining land is crucial. Proper planning is essential for successful reclamation efforts. The following considerations must be taken into account during reclamation planning: prepare reclamation plans before mining operations begin,

ensuring they are structured and in compliance with regulations (Setiawan & Kusumawardani, 2020). Ensure the area being reclaimed matches the size of the mining area. Relocate and store topsoil in a designated area for revegetation, where fertile topsoil should be preserved and reused to restore vegetation in the mining area. Restore or repair damaged natural drainage patterns to prevent flooding and further environmental damage. Remove or reduce toxic materials to safe levels before disposal. Restore the land to its original condition or to meet its intended use. Minimize erosion during and after the reclamation process. Remove any unused mining equipment. Loosen compacted surfaces, and where this is not possible, plant pioneer species whose roots can penetrate hard soil. Immediately replant with appropriate species once mining activities are finished, as per the local government's rehabilitation plan. Prevent the introduction of harmful pests and weeds. Control measures must be taken to ensure the land is not overtaken by invasive species that could harm new vegetation. Monitor and manage the reclamation area according to the expected outcomes (Nugraha et al., 2020).

Each mining site has specific conditions that influence the implementation of reclamation. The reclamation process includes the following activities: land preparation, erosion and sedimentation control, topsoil management. Land preparation involves securing the post-mining land, shaping the land, and managing or placing low-grade mining materials that have not been utilized. Securing the land is crucial to reduce risks from mining activities, such as open pits, landslides, and environmental pollution. This can be done by closing mining pits, controlling acid mine drainage, shaping the land, and managing or placing low-grade mining materials in designated areas; revegetation or utilization of reclaimed land for other purposes.

Erosion is the process of soil loss due to water, wind, or human activities. The methods to control erosion can be Vegetative Techniques: Planting cover crops like grasses, trees, and shrubs to stabilize the soil. Mechanical Techniques: Creating terraces on sloped land to reduce surface runoff. Managing catchment areas is essential to integrate land management upstream and downstream to reduce erosion and sedimentation rates. Monitoring, maintenance, and community education for soil and water conservation are also critical.

Managing topsoil in mined areas is essential for reclamation as it helps restore soil fertility and supports vegetation growth. Topsoil contains nutrients, microorganisms, and organic materials necessary for plant development. The process includes Identification of Topsoil: Identifying, removing, and storing topsoil for future use in reclamation. Storage and Maintenance: Properly storing topsoil to preserve its fertility and ensuring its appropriate use when restoring vegetation.

Revegetation is done by securing the area, improving the topsoil, and adding organic material such as compost and manure to enhance the soil's structure and fertility. Plant species should be chosen based on their suitability to the degraded soil. Examples include: acacia, grows quickly, tolerates poor soil, and improves soil fertility through nitrogen-fixing bacteria; sengon, a fast-growing plant with strong roots, suitable for soils with low heavy metal content; lamtoro, adds nitrogen to the soil and serves as a cover crop.

These reclamation efforts help restore the ecosystem and prevent further degradation of the land after mining activities. Monitoring and maintaining the reclaimed areas are crucial to ensure their success (Nugraha et al., 2020). Efforts for rehabilitating post-mining land, viewed from a technical aspect, aim to restore the soil's condition to stabilize it and reduce the risk of erosion (Sujitno, 2017). From an ecosystem perspective, reclamation efforts are aimed at returning the ecosystem to its original state. In this context, revegetation is an effort that encompasses these aspects. Reclamation is almost identical to revegetation. In 2023, the tin mining company PT T carried out land reclamation on 299.47 hectares. Cumulatively, from 2015 to 2023, the company has reclaimed 3,183 hectares, planting fruit trees such as oranges, avocados, cashews, and oil palms (Sustainability report PT. T 2023). The planting methods chosen depend on the size and nature of the site as well as the available plant species. These methods include direct seeding, planting seedlings, and grafting. However, the success rate of all planting methods will decrease if proper maintenance is not carried out. Therefore, it is essential to perform the following actions

such as fencing or protecting each tree: Protection through fencing is needed to safeguard young shoots from animals, traffic, and pedestrians. Surrounding fences equipped with windbreaks can enhance the success of the revegetation program.

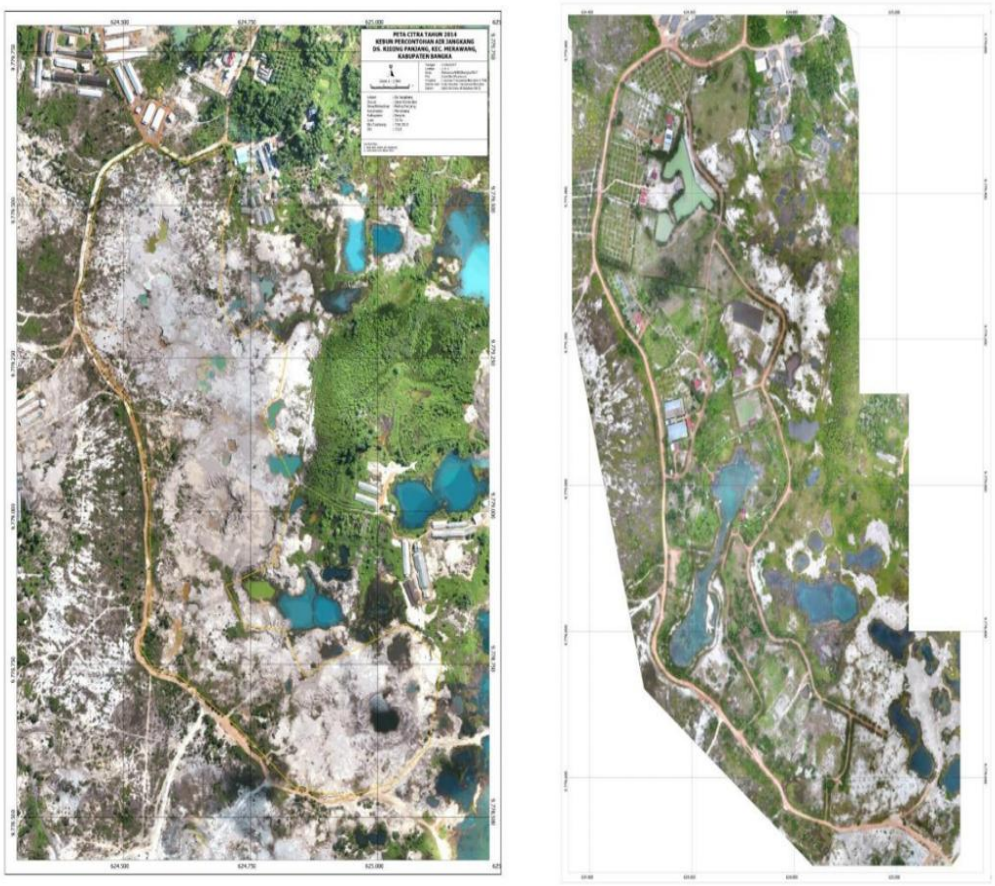

Fig. 3 Map before and after the reclamation of tin mining land by PT. T (Ryzzky et al., 2023)

Avoid excessive irrigation, during the dry season, excessive watering should be avoided in areas that have been seeded until the rainy season arrives. Gradual reduction of watering for seedlings, the watering of seedlings should be reduced gradually to prevent over-reliance on external watering. Use of fertilizers, additional seeds, or replanting, Fertilizing, adding seeds, or replanting are necessary to ensure the growth and survival of vegetation in the area.

Table 4. Reclamation data by PT Timah Tbk in 2020

No	Areas	IUP Land (Ha)	Open Land (Ha) 1992-2020	Reclamation (Ha) 1922-2020	Hadn't been reclaimed (Ha)
1	Bangka	62,068.01	5,997.01	5,239.92	757.09
2	Bangka Barat	48,785.20	2,415.94	2,041.10	374.84
3	Bangka Tengah	1,845.20	1,513.09	1,482.50	30.59
4	Bangka Selatan	23,906.82	522.19	519.3	2.89
5	Belitung	13,262.80	730.6	652.8	77.8
6	Belitung Timur	30,355	2,251.50	2,073.88	177.62
7	Lintas Kabupaten	88,492.48	3,335.16	3,329.35	14.81
Total		288,716.15	16,765.49	15,329.85	1,435.64

Pest damage, Insects and pests can be common issues, and these need to be managed as part of the rehabilitation process. These maintenance steps are crucial to ensure the successful revegetation and restoration of the ecosystem in post-mining land areas (Syahrudin, 2021). The land reclamation program carried out by PT. T with planting in 2023

has reclaimed an area of 299.47 hectares, and in 2024, it is expected to increase to 396.5 hectares (Sustainability Report PT. T).

3.1 Implications of the legislation on tin mining in Bangka Belitung

In Law No. 32 of 2009 on Environmental Management and Protection, Article 67 states that everyone is obligated to preserve the function of the environment and control pollution and/or environmental damage. Furthermore, Article 68 stipulates that anyone conducting business and/or activities is required to provide information related to environmental protection and management in a correct, accurate, transparent, and timely manner, ensure the sustainability of environmental functions, and comply with the provisions regarding environmental quality standards and/or criteria for environmental damage.

Based on the regulations above, it is clear that every citizen has an obligation to protect the environment and take preventive and control actions if environmental damage and pollution occur. Especially with the tin mining activities conducted on both land and sea, which require follow-up for supervision, prevention, and control of environmental damage. Furthermore, in order to reduce anthropocentric attitudes toward tin mining activities, Article 70 clarifies that humans have the space to actively participate in environmental conservation, which includes: the community has equal rights and opportunities to play an active role in the protection and management of the environment. The community's role includes: social supervision, providing suggestions, opinions, proposals, objections, complaints, and/or providing information and/or reports. The role of the community is aimed at: increasing awareness in the protection and management of the environment, enhancing the independence, empowerment of the community, and partnerships; developing the skills and leadership within the community, promoting community readiness to conduct social supervision, developing and maintaining local culture and wisdom in environmental conservation.

Environmental protection and management is a systematic and integrated effort to preserve the functions of the environment in order to prevent pollution and/or environmental damage. This includes planning, utilization, control, maintenance, supervision, and law enforcement. With the existence of obligations and community participation, it is expected that anthropocentric attitudes in humans can be reduced, as these attitudes claim that the quality of the environment is declining due to tin mining, which threatens the survival of humanity. Certainly, these obligations and policies should be applied across all aspects of human society and consistently implemented by all stakeholders. This will create a systematic pattern that raises awareness that environmental protection is not only the responsibility of the government, but also of all business actors and individuals themselves (Nugroho & Yanto, 2024).

Table 3. Community attitudes based on knowledge, education, and occupation

Policy	Point	Implication
Law No. 11 of 1967	The main provisions of mining regulations in Indonesia were established through this law, which was enacted by the New Order government and characterized by a centralized approach. Tin mining was solely managed by the central government, and even PT. Timah Tbk utilized military forces to protect mining areas.	1. Emergence of public resentment in the region: There was a sense of inequality among the local people, as the profits from the region's natural resources were only enjoyed by the central government and the Province of South Sumatra (at the time, Bangka Belitung was part of South Sumatra Province). 2. Monopoly in tin mining: Tin mining was monopolized by two companies: state-owned PT. Timah Tbk and privately-owned PT. Kobatin.

Enforcement of regional autonomy	The region has the right to manage its own internal affairs.	1. The local government urged the central government to have shares in PT. Timah Tbk. 2. A demand for the return of former mining areas. 3. A demand for the replacement of the director of PT. Timah Tbk, who was at that time from Java, with a local figure.
Ministry of Trade and Industry No. 558/1998	The general provisions in the field of export do not categorize tin as a regulated and monitored export commodity. This means that tin, unlike other minerals or commodities, may not be subject to the same level of export controls or oversight, potentially leading to challenges in managing the environmental and economic impacts of its extraction and trade. The lack of specific regulations could also make it difficult to ensure sustainable practices within the tin mining industry, particularly in regions like Bangka Belitung.	Illegal Tin Mining (TI) started to emerge and increase every year. These illegal miners carry out their activities without proper environmental procedures.
Law No. 22/1999	Anything not regulated by the central government becomes the authority of the region through a decentralization mechanism	The tin commodity is an item that allows it to be managed by the region.
Law No. 6/2021	Regarding the Management of General Mining and the Procedures and Licensing for Mining Business	The community conducts mining freely. The community is allowed to mine anywhere and at any time.

(Asparita et al., 2021)

In the context of mining, the obligation for environmental protection is outlined in the Mining Law (*Undang-Undang Mineral dan Batu Bara*) No. 4 of 2009, which states that mining activities must be environmentally conscious. Article 2 specifies that mineral and/or coal mining must be managed sustainably, considering social, economic, and environmental factors for the future. Furthermore, Article 66 stipulates that any issues arising from the implementation of the Mining Business License (IUP) related to environmental impacts must be resolved in accordance with the applicable regulations (Guess, 2017). Here are the relevant regulations affecting the dynamics of tin mining in Bangka Belitung:

The weakness of legislation concerning tin mining has intensified anthropocentric attitudes in exploiting natural resources. Economic conditions and low levels of education and knowledge are major driving factors, making anthropocentrism dominant in mining activities. This situation worsened during the Reformation Era, which continued the perspective that nature is merely an economic commodity measured by monetary value, while laws became instruments that supported this viewpoint. Consequently, environmental damage has become commonplace (Rosadi, 2012). Community legal awareness involves knowledge, understanding, compliance, and respect for legal provisions. If individuals only know the existence of a law but do not understand it, their level of legal awareness remains low (Soerjono Soekanto, 2002). Legal awareness regarding environmental preservation and management highlights that humans must develop a high level of legal consciousness, which is shaped by the sociological relationship between humans and the environment. However, this awareness is influenced by economic, socio-cultural, and knowledge factors. To foster an environmental legal culture in mining

activities, the following strategies can be implemented with dissemination of eco-friendly mining and environmental regulations through various media tailored to the characteristics of miners. Providing a unified understanding and interpretation of the environment as a subject rather than merely an object, gradually reducing anthropocentric behaviors and fostering ecocentric ethics. Emphasizing the obligation to protect the environment, benefiting individuals, humanity, and other living beings. Simplifying procedures for community mining permits and ensuring follow-up through coaching and monitoring by relevant stakeholders. Implementing specific mechanisms to address violations and errors in community mining processes. Achieving effective environmental legal enforcement through laws that are easy to understand, comply with, and respect. This involves engagement from all levels, including community leaders, religious figures, and educational institutions, to instill environmental awareness from an early age. Jurisdictional-scientific approaches that enforce environmental and mining laws not merely through formal legal norms but by upholding justice and fairness beyond legal demands.

4. Conclusions

This research highlights the negative impacts of tin mining in Bangka Belitung, driven by an anthropocentric paradigm, where humans prioritize their interests without considering environmental sustainability. Mining activities, both legal and illegal, have led to significant environmental degradation, including damage to terrestrial and marine ecosystems, water pollution, loss of biodiversity, and socio-economic impacts. Weak regulations, lack of enforcement, and low public awareness of environmental consequences exacerbate this destruction. To achieve sustainability, the ecocentric paradigm, which places the environment on equal footing with human interests, must be implemented. Key considerations include paradigm Shift: Efforts are needed to shift public perspectives from anthropocentrism to ecocentrism through environmental education and public awareness campaigns. Regulatory Strengthening: The government must strengthen regulations and enforce laws in the mining sector, ensuring compliance with environmental standards for both companies and community mining. Reclamation and Restoration: To reduce environmental degradation, reclamation and restoration must be mandatory on post-mining land. Mining companies must provide an environmental guarantee fund to ensure reclamation implementation. Technological Approaches: The use of GIS and remote sensing technology can be integrated for real-time monitoring of mining impacts, such as land degradation, water pollution, and marine ecosystem changes. These measures aim to reduce environmental damage in Bangka Belitung while fostering a balance between economic interests and environmental preservation. From "tin crust to earth scars", it is time for Bangka Belitung to transition from anthropocentrism to ecological harmony for a sustainable future.

Acknowledgement

The author is grateful to God because of his blessings and grace, the author was abel to complete this research. The author also expressed his gratitude to Dr. herdis Herdiansyah, S.Fil.i., M.Hum. as our lecturer who has helped in providing ideas and materials that must be understood before being able to produce the research. The author realizes that there are still shortcomings in writing this research, for that hoped for constructive criticism and hoped that this research could be useful for all parties ini need.

Author Contribution

Conceptualization, A.K.A; Methodology, A.K.A; Validation, A.K.A; Writing-original draft, A.K.A; Writing-review & editing, A.K.A.

Funding

This research received no external funding.

Ethical Review Board Statement
Not available.

Informed Consent Statement
Not available.

Data Availability Statement
Not available.

Conflicts of Interest
The author declare no conflict of interest.

Open Access

References
Ahmad, R, Ananda Y. S., Anif, F. S, LilI, L, & Abdul, K. (2022). Derita di Balik Tambang: Kontestasi Kepentingan Ekonomi Politik dalam Pertambangan Timah di Bangka Belitung. *Jurnal Pemikiran dan Penelitian Sosiologi, 6*(2), 115-129. https://doi.org/10.24198/jsg.v6i2.36803

Asparita, V., Fournita, A., & Yudi, S. P. (2021). Persepsi Masyarakat dan Dampak Sosial Ekonomi terhadap Lahan Bekas Tambang Timah sebagai Kampoeng Reklamasi Air Jangkang di Desa Riding Panjang Kabupaten Bangka. *Jurnal Pemikiran Masyrakat Ilmiah Berwawasan Agribisnis, 7*(1), 267-268. http://dx.doi.org/10.25157/ma.v7i1.4492

Dwi, Darwance & Saputra, P. P. (2020). Antroposentrisme dan Budaya Hukum Lingkungan (Studi Eksploitasi Timah di Belitung Timur). *Jurnal Hukum, 9*(1), 65-73. https://doi.org/10.33019/progresif.v14i1.1777

Erman, E. (2010). Aktor, Akses, dan Politik Lingkungan di Pertambangan Timah Bangka. *Jurnal Lembaga Ilmu Pengetahuan Indonesia, 17*(2), 71-91. https://jmi.ipsk.lipi.go.id/index.php/jmiipsk/article/view/640

Guess, D. (2017). Melawan Etika Lingkungan Antroposentris Melalui Interpretasi Teologi Penciptaan Sebagai Landasan bagi Pengelolaan-Pelestarian Lingkungan. *Jurnal FIDEI, 2*(1), 184-201. https://doi.org/10.34081/fidei.v2i1.40

Ferianda, A. (2023). Persepsi Masyarakat terhadap Kerusakan Lingkungan Akibat Penambangan Timah di Kecamatan Koba, Kabupaten Bangka Tengah. *Jurnal Ilmu Adminstrasi, 6*(2), 30-41. https://doi.org/10.47995/jian.v1i1.12

Haryadi, D. (2022). Environmental Issue Related to Tin Mining in Bangka Belitung Islands. *International journal of sosial science, 8*(3), 43-55. https://doi.org/10.20319/pijss.2022.83.6785

Holili, H. M., Yunus, Winarto & Agus, S. (2023). Dampak Lingkungan dan Regulasi Pertambangan terhadap Tambang Timah Provinsi Kepulauan Bangka Belitung. *Jurnal Pendidikan Sejarah dan Riset Sosial Humaniora, 3*(1), 113-117. https://ejournal.penerbitjurnal.com/index.php/humaniora/article/view/117

Hynman, D. (2005). Shifting Ecological Imaginaries in the Ok Tedi Mining Crisis in Papua New Guinea. *Journal de la societe des oceanistes, 1*(2), 76-92. https://doi.org/10.4000/jso.396

Ibrahim, I. (2015). Dampak penambangan timah ilegal yang merusak ekosistem di bangka belitung. *Jurnal Hukum Dan Bisnis (Selisik), 1*(1), 77–83. https://journal.univpancasila.ac.id/index.php/selisik/article/view/626

Islami, B., Rahma Sari, F., Azzahra, N., & Oktaviza, S. (2024). Penegakan Hukum Terhadap Tambang Timah Liar Desa Tanjung Labu Pulau Lepar Pongok Bangka Selatan. *JURNAL BEVINDING, 2*(02), 9–14. https://journal.uniba.ac.id/index.php/JB/article/view/1181

Jamil, Asep, K., & Nendi Rohaendi. (2022). Identifikasi Logam Berat di Lahan Pasca Tambang Timah di Kepulauan Bangka Belitung. *Jurnal Geominerba, 7*(2), 164-176. https://doi.org/10.58522/ppsdm22.v7i2.100

Luc, P. T (2022). Cocitation and Bibliographic Analyses. *Jurnal Entrepreneurship Research, 9*(1), 21-59. https://doi.org/10.1080/23311975.2022.2124594

Manik, J. D. N. (2014). Kebijakan pertambangan laut timah yang berdampak pada lingkungan. *PROMINE, 2(*2), 202-215. https://doi.org/10.33019/promine.v2i2.82

Moleong, L, J. (2000). *Metode Penelitian Kualitatif*. Rosdakarya. 330-331.

Mohadab, M. El, Bouikhalene, B., & Safi, S. (2020). Bibliometric Method for Mapping the State of the Art of Scientific Production in Covid-19. *Chaos, Solitons & Fractal, 139*, 110052. https://doi.org/10.1016/j.chaoes.2020.110052

Murty, T & Yuningsih, H. (2022). Upaya Penegakan Hukum Pidana terhadap Tindak Pidana Penambangan Timah Ilegal di Provinsi Bangka Belitung. *Jurnal Hukum, 4*(1), 4349-4372. https://journal.fh.unsri.ac.id/index.php/simburcahaya/article/view/48

Nazir, M. (2015). *Metode Penelitian*. Ghalia Indonesia, 70-77.

Nugraha, A. & Purwanto, S.. (2020). Neo-Ekstraktivisme Tambang Timah di Pulau Bangka Belitung. *Indonesian Journal of Religion and Society, 2*(1), 13-21. https://doi.org/10.36256/ijrs.v2i1.95

Nugraha, R. A., Afra, D. N., Makalew & Syartinilia. (2020). Tourism Development Plans Based on Local Wisdom in Tin Post Mining Area in Merawang District Bangka Regency. *Jurnal Pengelolaan Sumber Daya Alam dan Lingkungan, 10*(3), 374-389. https://doi.org/10.29244/jpsl.10.3.374-389

Nugroho, T., & Yanto A. (2024). Law Enforcement of Illegal Tin Mining in Teluk Kelabat, Bangka Belitung Island. *Jurnal Hukum, 3*(2), 28-42. https://doi.org/10.4108/eai.21-10-2023.2343522.

Riyanto, R. K., Istimeisyah, D., Arjuna, M. G. S., & Hasnakusumah, R. T. (2024). Implikasi Eksistensi UU Pertambangan dalam Upaya Penyelesaian Permasalahan Pertambangan Ilegal (Studi Kasus Korupsi Tata Niaga Komoditas Timah di IUP PT Timah Tbk. *Jurnal Ilmiah Penelitian Mahsiswa, 2*(3), 540-550. https://doi.org/10.61722/jipm.v2i3.193

Rusfiana Yudi & Dadang Hermawan (2019). Potensi Bencana Alam Pasca Penambangan Timah Inkonvensional di Kabupaten Bangka Tengah Provinsi Kepualuan Bangka Belitung: Perspektif Ketahanan Wilayah. *Jurnal Konstituen, 1*(1), 59-76. https://ejournal.ipdn.ac.id/konstituen/article/view/57-74

Rifqi, A. (2020). Rencana Pengembangan Kawasan Wisata berbasis Kearifan Lokal pada Area Pasca Tambang Timah. *Jurnal of Natural Resources and Enviornmental Management, 10*(3), 374-389. https://doi.org/10.29244/jpsl.10.3.374-389.

Rosadi, O. (2012). *Pertambangan dan Kehutanan dalam Perspektif Cita Hukum Pancasila Dialektika Hukum dan Keadilan Sosial*. Thafa Media.

Ryzzky, T., Siregar, Y., & Zulkarnain. (2023). Evaluasi Tingkat Keberhasilan Reklamasi lahan Bekas Tambang Timah di PT Timah Tbk. *Journal of Advancing the World of Information and Environment, 6*(1), 50-66. http://www.econews.ejournal.unri.ac.id/index.php/econews

Safitri, T. P., Ahmad Husni, & Ridho Yovanda. (2024). Evaluasi Reklamasi Lahan Bekas Tambang Batubara di Banko Barat PT Bukit Asam Tbk Tanjung Enim Sumatera

Selatan. *Kohesi: Jurnal Sains Dan Teknologi, 4*(4), 91–100. https://doi.org/10.3785/kohesi.v4i4.5429

Secord, P. F., Backman, C. W., & Eachus, H. T. (1964). Effects of imbalance in the self-concept on the perception of persons. *The Journal of Abnormal and Social Psychology, 68*(4), 442–446. https://doi.org/10.1037/h0044914

Setiawan D., & Kusumawardani, A. (2020). Revegetasi untuk rehabilitasi lahan pasca-tambang wilayah operasi PT Pertamina Hulu Rokan, Riau. *BIOEDUSAINS: Jurnal Pendidikan Biologi dan Sains, 8*(2), 207–215. https://doi.org/10.31539/bioedusains.v8i2.14886

Sutoyo. (2010). Paradigma Perlindungan Lingkungan Hidup. *Jurnal Hukum, 4*(1), 193-205. https://doi.org/10.33476/ajl.v4i1.33

Syahrir R., Wall F., & Diallo P. (2020). Socio Economic Impacts and Sustainability of Mining, A Case Study of Historical Tin Mining in Singkep Islan Indonesia. *Extractive Industries and Society Journal, 7*(11), 1525-1533. https://doi.org/10.1016/j.exis.2020.07.023.

Syahrudin., H. (2021). Pelaksanaan Reklamasi Lahan Bekas Tambang di Provinsi Kepulauan Bangka Belitung melalui Pendekatan Whole of Government. *Journal of Public Policy and Applied Administration, 3*(1), 24-43. https://doi.org/10.32834/jplan.v3i1.285

Ulvianti, Ibrahim & Ranto. (2022). Penolakan Penambangan Timah oleh Kelompok Nelayan di Pantai matras Kabupaten Bangka. *Jurnal Ilmiah Mahasiswa, 3*(1), 67-77. https://www.scripta.fisip.ubb.ac.id/index.php/scripta/article/view/123

Widodo A & Syariudin A. (2024). Analisis Kontribusi Daya Saing Timah Nasional di pasar Global terhadap Nilai Ekspor Indonesia. Jurnal Ekonomi Pembangunan, 6(1), 2614-7181. https://doi.org/10.36985/ekuilnomi.v6i1.1110.

Yulianti, Burhanuddin Bani & Albana. (2020). Analisa Pertambangan Timah di Provinsi Kepualuan Bangka Belitung. Jurnal Ekonomi, 1(22), 54-61. https://ejournal.borobudur.ac.id/index.php/1/article/view/629

Biographies of Author

Andifa Khalida Azzara, School of Environmental Science, Universitas Indonesia, Jakarta, 10430, Indonesia.

- Email: andifazzara@gmail.com
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A