

Environmental Ethics in the Qur'an and Modern Mining Practices: A Case Study of PT Freeport Indonesia

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ABSTRACT

This article examines the concept of ecology in the Qur'an with an emphasis on the principles of *khalifah*, *mīzān*, *amanah*, and the prohibition of *fasād* as the basis for environmental management ethics. This study aims to assess the phenomenon of environmental damage occurring in the operational area of PT Freeport Indonesia through the perspective of Islamic ecology. The method used is qualitative research with a thematic interpretation approach, which integrates classical and contemporary interpretation studies as well as theoretical analysis of green economics and stewardship. The results show that the Qur'an not only provides normative guidelines but also an analytical framework for evaluating extractive industry practices. Various forms of environmental degradation, such as tailings management, landscape changes, and water quality deterioration, suggest a discrepancy between mining practices and the ecological ethical principles outlined in the Qur'an. These conditions reflect a disruption of the principle of balance (*mīzān*), the suboptimal implementation of the caliphate mandate, and the emergence of indications of structural *fasād*. This study affirms the relevance of thematic interpretation of the Qur'an as a critical approach in the study of Islamic ecology and sustainable natural resource management.

Keywords: *Caliph, Islamic ecology, mīzān, PT Freeport Indonesia, thematic interpretation*

INTRODUCTION

Globally, natural resource management faces serious challenges due to increased exploitation to meet economic and industrialization needs. The report shows that pressure on Earth's ecosystems continues to rise, as evidenced by biodiversity loss, soil degradation, water pollution, and climate change (Priatna & Monk, 2023; Priatna et al., 2025). The development model oriented toward intensive extraction has created an imbalance between the use of natural resources and the environment's carrying capacity. This condition underscores the need for a governance paradigm that is not only economically oriented but also ensures long-term ecological sustainability.

PT Freeport Indonesia (PTFI) is a strategic case study in examining the dynamics of natural resource management, given its scale of operations and position as one of the world's largest producers of copper and gold. Environmental studies and reports indicate the emergence of various forms of ecological degradation in the company's operational areas, including large-scale sedimentation, deterioration of surface water quality, and changes in the structure and function of the landscape (Tosepu, 2024). These phenomena raise critical questions about the effectiveness of the environmental management instruments implemented by PTFI, as well as the extent to which its operational practices comply with the principles of sustainability mandated by national regulations and international

environmental standards. Thus, PTFI is a relevant empirical case for further examining the tension between economic orientation and environmental conservation demands in the mining sector.

Amid this complexity, the Islamic perspective offers an ethical and theological framework for natural resource management. The Qur'an teaches the principle of *khalifah*, which affirms human responsibility for managing the earth; *mīzān*, the concept of natural balance; *amanah*, a moral obligation; and the prohibition of *fasād*, which prohibits all forms of destruction. These principles place environmental management at the core of sustainability ethics. Thus, Islamic ecology provides a strong normative basis for evaluating extractive industrial practices and assessing their compatibility with religious moral principles.

Several previous studies have examined illegal mining in Mentok District in Bangka Belitung Province (Putri et al., 2023), Dharmasraya Regency in West Sumatra Province (Sari & Mubarak, 2020), Southeast Minahasa Regency in North Sulawesi Province (Tongkotow et al., 2023), PT Timah Tbk (Riyanto et al., 2024), and PT Tambang Madina Madani (Henri et al., 2023). Then there is research that discusses ecology and environmental damage (Hafizah, 2022; Sholehuddin, 2021; Syahadat & Putra, 2022). Research related to the green economy as a solution and the application of Qur'anic interpretation (Fatmawati et al., 2025; Hanif & Azzaki, 2025; Kusuma & Ridwan, 2023). None of these

studies have examined the integration of Qur'anic interpretation and green economy in relation to damage at PTFI directly. This study highlights PTFI as a case study because it has not been studied by previous researchers.

This article attempts to address the issue of how the ecological concepts in the Qur'an, which emphasize *khalifah*, *mizan*, and the prohibition of *fasad*, can be used to assess the phenomenon of environmental damage at PT Freeport Indonesia. Various forms of ecological degradation, such as sedimentation, changes in the landscape, and declining water quality, indicate a gap between normative Sharia principles and mining management practices. Therefore, this study focuses on a critical evaluation of PTFI's environmental practices through the perspective of Islamic ecology to see the extent to which these mining activities are in line with or deviate from the ecological ethics of the Qur'an.

This study aims to comprehensively examine the concept of ecology in the Qur'an, particularly the principles of *khalifah*, *mizan*, *amanah*, and the prohibition of *fasad* as the basis for environmental management ethics. This theological foundation is then used to understand and map various forms of environmental damage occurring in the operational area of PT Freeport Indonesia, ranging from changes in the landscape to the degradation of water quality. Furthermore, this study seeks to critically evaluate PTFI's environmental management practices through an Islamic ecological perspective, so that it can be assessed to what extent these mining activities are in line with or deviate from the ecological principles taught in the Qur'an.

This article makes an academic contribution by integrating the study of Qur'anic verses, green economy theory, and preliminary implementation data into a comprehensive analytical framework for understanding the application of the green economy as a solution to the environmental damage caused by PTFI. In addition to its academic contribution, this research can serve as literature to raise public awareness about the ethics of natural resource management in accordance with the principles of the Qur'an.

METHODS

This type of research uses qualitative research with a library research approach because the focus of the research is conceptual analysis of Qur'anic principles and green economy theory, caliphate theory, and stewardship. The data sources used are secondary data such as verses from the Qur'an quoted from the Ministry of Religious Affairs' LPMQ, research data obtained from news articles such as BBC News, Jubi.id, Katadata, and Betahita, as well as the official portal of the company PT Freeport Indonesia. Tafsir books from Ibn Kathir, Al-Misbah from M. Quraish Shihab, Al-Qurthubi.

References from scientific journals were also used to support the research.

The data collection technique used in this study was documentation. Documentation is a research support tool for collecting data or information by reading letters, announcements, meeting summaries, written statements of certain regulations, and other written materials (Gunawan, 2013). The documentation used was obtained from the BBC News, Jubi.id, Katadata, and Betahita news websites, while the YouTube portal was obtained from BBC News Indonesia.

The data analysis technique used was an interactive model, namely data reduction, data display, and conclusion drawing (Miles et al., 2014). Data reduction was carried out by obtaining all data through literature studies covering verses from the Qur'an on natural resource management and official social media discussing the PTFI case study, which was reported to have carried out illegal mining, thereby impacting 2025. The literature used was limited to publications from the last ten years to ensure relevance to contemporary research developments.

Data display involved presenting the reduced data in narrative form, grouped according to the topics of discussion on Qur'anic concepts and PTFI. Conclusions are drawn by critically interpreting and discussing the normative values of the Qur'an with empirical findings from secondary data.

RESULTS AND DISCUSSION

Ecological Concept in the Qur'an

1. The principles of the Qur'an on sustainability and balance as the basis for a green economy

Natural resource management in the modern era faces major challenges due to increasing pressure from exploitation, environmental degradation, climate change, and social injustice. In the context of the mining industry, such as PT Freeport Indonesia, these issues become even more complex because they involve economic, social, environmental, and ethical issues. Therefore, research on NRM must use a theoretical framework that not only assesses technical and economic aspects, but also moral, ecological, and spiritual dimensions. This study develops an integrative theoretical framework that combines Green Economy Theory, Khalifah Theory, and Stewardship Theory.

According to Cato (2009), a green economy is an economy oriented towards ecological balance in order to restore the economy to comply with ecosystem boundaries. Therefore, a green economy is built on the principle that the earth has limits, so that the use of energy, minerals, and natural resources must be in accordance with nature's regenerative capacity. This framework views economic development as not being

in conflict with ecological sustainability. The green economy is operationalized through five main principles, namely low-carbon development, resource efficiency, social inclusion, preservation of natural capital, and the application of a circular economy. Ammar et al. (2024) emphasize that the green economy is a strategic approach to reducing environmental damage, especially in developing countries such as Indonesia, which relies on the extractive sector. In the mining sector, the green economy requires systematic tailings management, the use of environmentally friendly technology, and land reclamation. Aulia et al. (2025) added that energy efficiency and production chain management that reduces pollution are key characteristics of industrial activities that adopt the green economy.

The Qur'an contains a set of normative principles that affirm that nature was created in balance (*mīzān*) and that humans have an obligation to maintain that harmony, making this foundation relevant to the development of a green economy oriented towards sustainability (Saifuddin et al., 2025). The principles of *khalīfah* and *amanah* also position humans as responsible stewards of the earth, providing a strong moral framework for ethical and long-term resource management. In addition, the prohibition of *isrāf* and *fasād* in the Qur'an demands efficiency, moderation, and prevention of all forms of environmental damage, which is in line with the agenda of conservation and reduction of ecological impacts. Thus, these Qur'anic values provide a conceptual and ethical foundation that can be integrated into the modern green economy and sustainable environmental management paradigms. The following are verses from the Qur'an about *mīzān* and the prohibition of *isrāf*, namely QS. ar-Rahman [55]:7-9 and QS. al-Anam [6]:141.

In QS. ar-Rahman [55]:7-9, Qurthubi's (2008a) interpretation defines *mīzan* (justice) as Allah having established scales and commanded that the scales not be tampered with in the form of cheating on measurements. Meanwhile, the commentary by Shihab (2005) interprets *mīzan* (justice/balance) as a guideline for humans in upholding justice both for themselves and others. *Mīzan* interprets that everything that humans spend, whether in the form of income or other things, must be balanced with the income they receive. According to this verse, ecological balance and damage are caused by an imbalance in the ecosystem between natural resources (SDA) and their management (Rosia et al., 2021).

The verses of the Qur'an that discuss excessiveness (*al-israf*) are QS. al-Anam [6]:141 and QS. al-A'raf [7]:31. Qurthubi's interpretation of *al-israf* is extravagance and excessiveness, and something that cannot return a person to goodness. The context of excessiveness in this verse refers to bad things that are

excessive and prohibited by Allah, while good things such as fairness are very much allowed. The account of Ibn Jarir from Ibn Juraij in the tafsir of Ibn Kathir prohibits excessiveness in all things. From a green economy perspective, wasteful and excessive behavior encourages the unsustainable exploitation of natural resources and accelerates environmental degradation and social inequality (UNEP, 2011). Conversely, fairness and proportionality in the use of resources are in line with the principles of efficiency, balance, and sustainability that form the foundation of the green economy (World Bank, 2012). Therefore, the prohibition of *al-isrāf* in Islam can be understood as an ethical basis for responsible and equitable management of natural resources (Chapra, 2001).

2. *Khalīfah as the foundation of theology and ecological ethic in Islam*

The concept of *khalīfah* in Islam is rooted in QS. al-Baqarah [2]:30; QS. al-An'ām [6]:165; QS. Yunus [10]:14; QS. al-Fatir [35]:39, and QS. Šād [38]:26 in the interpretation of Katsir (2000) which confirms the appointment of humans as caliphs on earth. This verse contains a theological dimension that humans are given a mandate from Allah to manage nature and preserve the universe, not to exploit it arbitrarily. From an Islamic theological perspective, this mandate is normative and binding, as humans will be held accountable before Allah (El-Habsa et al., 2025). Theoretically, the concept of *khalīfah* is closely related to the theory of *amanah* (*trusteeship*) in Islam, which emphasizes that humans are not the absolute owners of nature, but rather guardians who have been entrusted with it.

From a contemporary perspective, Nasr (1996) views the caliphate as a spiritual mandate that requires humans to maintain cosmic harmony and balance in God's creation. The modern environmental crisis, according to him, is a consequence of a spiritual crisis resulting from the severing of humanity's relationship with revelatory values. This view is reinforced by Izzie Dien (2000), who places the *khalīfah* within the framework of Islamic environmental jurisprudence, emphasizing the principles of trust (*amanah*), justice, balance (*mīzān*), and the prohibition of corruption (*fasād*) as the basis of Islamic ecological ethics.

Furthermore, Chapra (2001) links the caliphate with *maqāṣid al-syarī'ah* and sustainable development, placing humans as *trustees* responsible for managing natural resources efficiently, fairly, and oriented toward long-term welfare. In the practical realm, Khalid (2002) emphasizes that *khalīfah* must be realized through conservation actions and social engagement in environmental protection, while Sardar (2010) affirms the need for a transformation of the development and scientific paradigms to be in line

with ecological justice and Islamic spiritual values.

The ethics of the caliphate are reflected in various principles of the Qur'an, including the command to be just (QS. Sād [38]:26), to carry out the trust (QS. al-Aḥzāb [33]:72), the prohibition of causing corruption (*fasād*) on earth (QS. al-A'rāf [7]:56 and QS. ar-Rum [40]:41), maintaining balance QS. ar-Raḥmān [55]:7–9, awareness of responsibility for managing the earth QS. al-An'ām [6]:165, and the obligation to prosper the earth QS. Hūd [11]:61. These principles show that Islam rejects excessive exploitation and encourages moderate, ethical, and sustainability-oriented management of nature. Thus, the concept of *khalīfah* forms a theological and ecological ethical framework for Islam that is relevant to contemporary environmental challenges. This framework positions humans as responsible, just, and sustainability-oriented stewards of nature, thereby aligning with the principles of sustainable development and the green economy in the global context.

3. Stewardship as an ethical framework for environmental management in line with Qur'anic values

The concept of stewardship in Islam stems from the theological view that humans are not the absolute owners of nature, but rather *trustees* who have been mandated by Allah SWT to protect and preserve the earth. This view is rooted in the principle of *amanah*, which is the trust given by Allah to humans to manage natural resources responsibly, fairly, and sustainably. Within this framework, environmental management is not understood as a purely economic activity, but as a moral and spiritual obligation that will be accounted for before Allah (Basri et al., 2024).

Stewardship is closely related to the concept of *islāh*, which is the effort to improve and maintain the environment so that it continues to function in a balanced manner and does not suffer damage. Islam in QS. explicitly prohibits *fasād* (destruction), so stewardship requires humans to actively protect, restore, and repair damaged ecosystems. In addition, stewardship is also in line with the concept of *ʿimārah al-ard*, which is the obligation to prosper the earth through the productive but sustainable use of natural resources. One study in Islamic eco-theology shows that the concept of stewardship integrates spiritual and ecological dimensions, so that human is not only given authority, but also moral and ethical obligations to prevent environmental damage and maintain ecological balance (Alim & Hidayat, 2024).

Within the framework of stewardship, the concept of *islāh* becomes a key principle that emphasizes efforts to improve and preserve the environment. Islam prohibits all forms of *fasād* (damage), so stewardship not only means avoiding destruction of nature, but

also encourages active measures to maintain ecosystem balance and restore damage that has occurred. *Islāh* thus functions as an ethical orientation that guides humans to maintain harmony between economic activities and environmental sustainability. In addition, stewardship is also in line with the concept of *ʿimārah al-ard*, which is the obligation to prosper the earth through productive, fair, and sustainable management of natural resources. This concept emphasizes that development and utilization of nature are permissible in Islam as long as they do not exceed limits and maintain ecological balance. Thus, stewardship in the Qur'anic perspective is an ethical framework that integrates *amanah*, *islāh*, and *ʿimārah al-ard* as the basis for equitable, sustainable, and mutually beneficial environmental management.

Contemporary studies on Islamic environmental ethics show that stewardship in Islam is built on the integration of the values of trust (*amanah*), justice (*ʿadl*), and balance (*mīzān*), all of which serve as the moral foundation for sustainable environmental management. Chapra (2001), emphasizes that the role of humans as *khalīfah* carries moral, social, and ecological responsibilities, so that natural resource management must be carried out fairly, moderately, and oriented towards long-term benefits. According to Chapra, economic development that ignores ethical values will lead to inequality and environmental damage, so the concept of stewardship must be the basis for sustainable development and economic policies.

Nasr (1996) views the modern environmental crisis as a reflection of humanity's spiritual crisis. He emphasizes that nature in Islam has a sacred dimension, so stewardship is not merely a technical responsibility, but a spiritual obligation to maintain the balance of Allah's creation. In Nasr's view, the concepts of *amanah*, *mīzān*, and *islāh* form the foundation of ecological awareness that encourages humans to live in harmony with nature. Meanwhile, Foltz et al. (2003) contribute through academic studies on Islamic environmental ethics, elaborating on Qur'anic concepts such as *khalīfah*, *amanah*, *islāh*, and the prohibition of *fasād* as a normative framework for environmental management. Foltz shows that Islamic teachings have strong potential to build a holistic environmental ethic that is relevant to global sustainability issues. Khalid (2002) develops the concept of stewardship in practice through a sustainability approach and environmental advocacy. He emphasizes that *ʿimārah al-ard* must be realized through the collective responsibility of Muslims in preserving nature, so that Qur'anic values can be implemented in modern environmental management.

Environmental Damage at PT Freeport Indonesia

The Grasberg Mine is located in the Sudirman Mountains, Mimika Regency, Papua Province. PTFI discovered the Grasberg reserves in 1988 and has been operating since 1991. The Grasberg Mine will have been in operation for 34 years in 2025. Grasberg, managed by PT Freeport Indonesia, became one of the second largest mines in the world in 2017. The gold and copper reserves at the Grasberg Mine have a total mineral wealth of 3.8 billion tons. The Grasberg Mine is located in the Sudirman Mountains, Mimika Regency, Papua Province (PT Freeport Indonesia, n.d.).

PTFI conducts mining at Grasberg through the stages of drilling, blasting, sorting, transporting, and grinding ore rock. The gold and mineral reserves at the Grasberg Mine are large and extensive for underground mining using a special method called *block caving*. The *block caving* method involves digging tunnels to the mineral ore reserves underground, blasting the ore body until it is crushed in the ground, and then gradually removing it through the tunnels that have been created (PT Freeport Indonesia, 2017).

In 2018, the Supreme Audit Agency (BPK) published a report on violations committed by PT Freeport Indonesia (PTFI) for causing environmental damage and illegally exploiting protected forests (Munthe, 2018). The area of protected forest illegally used by PTFI covers 4,535.93 hectares (Indonesia Corruption Watch, 2018). The illegal use of protected forests reflects the corporation's weak compliance with environmental ethics, while also indicating the government's ineffective oversight in ensuring that natural resource exploitation is carried out in accordance with the principles of sustainability. This situation also reveals an imbalance between economic interests and ecological protection, creating strong pressure for the implementation of a more transparent, accountable, and environmentally ethical natural resource management model.

In addition, PTFI has also been proven to have started underground mining in Grasberg without a permit, causing \$13.3 billion in damage due to **tailings** from the mine. PTFI's underground mining in Grasberg has had a negative long-term impact. In September 2025, a workplace accident occurred at PTFI's Grasberg Block Cave (GBC) underground mine, partly due to illegal mining in 2015 (Utama, 2025). This impact shows that neglecting technical and environmental ethics standards can have direct consequences on worker safety, environmental quality, and the sustainability of mine operations (Sucahyo, 2023).

The tragedy that befell seven workers at PTFI in September 2025 at the Grasberg underground mine was caused by a large amount of wet material, namely 800,000 metric tons, sliding down from one of the production sites in the Grasberg Block Cave (GBC) area.

The wet material that fell blocked access and limited the evacuation routes for workers who were measuring the walls of the production tunnel and conducting development activities (Syaharani, 2025). According to the BBC News Indonesia YouTube channel, they interviewed a former PTFI worker and mining practitioner named Bangun Samosir. Bangun Samosir stated that one of the causes of the accident in the Grasberg underground mine area was the excessive extraction of material, leading to water pools forming above the mining area. The limit for material extraction is 160,000 tons per day using the block caving method (PT Freeport Indonesia, 2017), while the amount of material extracted at the time of the incident was 800,000 metric tons, equivalent to 881,849 tons. Bangun Samosir said that the higher production demand caused workers to lose control and extract material beyond the daily capacity. This caused water to accumulate and collapse from above the mining site (BBC News Indonesia, 2025).

Critical Evaluation of PTFI's Environmental Damage through the Perspective of Islamic Ecology

The Qur'an affirms that Allah "raised the heavens and established the *mīzān*" and commanded humans not to exceed the limits in upholding that balance QS. ar-Rahmān [55]:7–9. In Qurthubi's (2008a) interpretation, *mīzān* is not only understood as a scale in *muamalah*, but also as a principle of justice and order that governs human life and the universe. Violating *mīzān* means destroying the order established by Allah. Shihab (2005), in his tafsir al-Miṣbāḥ, expands the meaning of *mīzān* to include balance in all aspects of life, including human relations with the environment. This balance requires proportionality between the utilization and preservation of nature. In this context, green economics theory can be understood as an effort by modern humans to translate the value of *mīzān* into economic policy and practice, particularly through the principles of resource efficiency and limiting exploitation. If these principles are not implemented, the exploitation of natural resources will exceed the carrying capacity of the ecosystem (Aulia et al., 2025). In the context of PTFI mining, large-scale production and massive tailings indicate an imbalance between economic profit and environmental sustainability (PT Freeport Indonesia, 2017). This condition reflects a violation of *mīzān*, not only ecologically, but also ethically, as warned by the Qur'an.

The Qur'an states that destruction on land and sea occurs because of human actions, so that they may realize the consequences of their own actions (QS. ar-Rūm [30]:41). In the interpretation of al-Qurṭubī (2008a), *fasād* is understood as any form of action that destroys order and benefit, both in social and natural

aspects. The prohibition against causing *fasād* on earth (QS. al-A'raf [7]:56) indicates that preserving nature is part of religious duty. The al-Miṣbāḥ (2005) commentary emphasizes that this verse is reflective, because environmental destruction is a mirror of human error in managing life. In this framework, green economics theory helps explain how modern patterns of production and consumption can be a source of ecological *fasād* if not controlled by the principle of balance. The environmental impacts occurring in PTFI's operational areas, such as river sedimentation and water quality degradation, can be indicated as a form of systemic *fasād* (Sucahyo, 2023). This damage is not merely a technical consequence, but rather a consequence of an economic perspective that treats nature as an object of exploitation, without regard for its limits and balance.

The concept of caliphate in the Qur'an emphasizes that humans are given the mandate to manage the earth, not to rule it arbitrarily (QS. al-Baqarah [2]:30). Al-Qurṭubī (2008b), emphasizes that caliphate carries moral and legal responsibilities, because humans will be held accountable for how they manage this mandate. QS. al-An'am [6]:165 reinforces this idea by referring to humans as temporary rulers who are tested in their management of Allah's blessings. In the tafsir al-Miṣbāḥ (2005), the mandate in QS. al-Aḥzāb [33]:72 is understood as a heavy burden of responsibility, including responsibility for nature. This mandate requires caution and awareness of the long-term impacts of every human action. The stewardship theory serves as a conceptual framework that explains how this mandate should be carried out in the management of natural resources by institutions and corporations. When PTFI's mining activities cause widespread and sustainable ecological impacts, this shows that the mandate of stewardship is not being fulfilled. The imbalance between economic benefits and ecological burdens reflects a failure to maintain justice and balance, which are at the core of the mandate of stewardship.

The Qur'an commands humans to prosper the earth (*ʿimārah al-ard*) and make improvements (*islāḥ*), not destruction (QS. Hūd [11]:61). Al-Qurṭubī (2008a), emphasizes that the development of the earth must be done in a way that does not cause destruction, because benefit cannot be achieved through harm. Tafsir al-Miṣbāḥ (2005), emphasizes that true development is sustainable development that brings long-term benefits. In this context, green economics and stewardship theories provide practical measures for assessing whether an economic activity has brought prosperity without causing damage. The difficult-to-recover environmental impact indicates that the principle of *islāḥ* is not the main orientation in mining management.

CONCLUSION

This study shows that the Qur'an contains a systematic ecological ethical framework through the concepts of *mīzān* (balance), *khalifah*, *amanah*, and the prohibition of *fasād*. Based on classical and contemporary exegesis, these principles not only serve as normative guidelines but also have the analytical capacity to evaluate natural resource management practices in the context of modern industry. The analysis of PT Freeport Indonesia's mining practices shows a discrepancy between environmental management and the ecological ethical principles of the Qur'an, particularly in terms of tailings management, exploitation intensity, and long-term ecological impacts. This condition reflects the disruption of the principle of balance (*mīzān*), the suboptimal implementation of the caliphate mandate, and the emergence of indications of structural *fasād*. The theoretical implications of this study confirm the relevance of the thematic interpretation approach in the development of Islamic ecological studies. Practically, these findings indicate the need to integrate Qur'anic values into mining policies and governance so that natural resource management can be carried out in a more responsible and sustainable manner.

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