Geographica: Science and Education Journal
GSEJ
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Environmental Crisis in Raja Ampat Conservation Area: A Geospatial Study and Environmental Ethics Perspective

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ARTICLE INFO

ISSN: 2716-4837
Vol. 7, No. 1, June 2025
URL: http://usnsj.id/index.php/geographica

Suggestion for the Citation and Bibliography
Citation in Text: Ginting & Angelia, (2025)
Bibliography:
Ginting, I. S.P., & Angelia, F. (2025). Environmental Crisis in Raja Ampat Consevation Area: A Geospatial Study and Environmental Ethics Perspective*. Geographica: Science & Education Journal*, 7 (1, June), 29-34.

Abstract

The Raja Ampat conservation area in Southwest Papua is facing increasing ecological pressure due to nickel mining activities taking place on small islands such as Gag, Kawei and Manuran. This study aims to analyze the environmental crisis through a literature review approach with a geospatial and environmental ethics perspective. The results show significant changes in land cover between 2015 and 2023, characterized by secondary forest degradation and increased marine sedimentation around the mine site. Spatial data from various sources indicate overlaps between mining business licenses (IUPs) and conservation zones, potentially weakening the ecological function and integrity of conservation areas. In terms of environmental ethics, the practice of resource exploitation in this high ecological value area reflects an anthropocentric approach that ignores the intrinsic value of nature and the rights of local communities to a sustainable living space. This study recommends the need for a moratorium on mining in conservation areas, synchronization of spatial planning policies, strengthening the participation of indigenous peoples, and integrating the principles of ecological justice in environmental decision-making.

Keywords: Raja Ampat, nickel mining, conservation, geospatial, environmental ethics

A. Introduction

Raja Ampat is an archipelagic region in the province of Southwest Papua, Indonesia, renowned for having the highest marine biodiversity in the world. Its natural beauty which includes coral reefs, mangrove forests, and tropical rainforests has established the region as an international conservation hub and one of Indonesia's top priority ecotourism destinations (UNESCO, 2020). Raja Ampat is also designated as part of the National Marine Conservation Area and has been proposed as a UNESCO Global Geopark. However, over the past decade, this region has faced increasing ecological pressure due to the expansion of extractive industries, particularly nickel mining operations on small islands such as Gag, Kawei, and Manyaifun (WALHI Papua

Barat, 2023; JATAM, 2022).

This phenomenon reflects a paradox within national development policies: while the state expresses commitment to environmental conservation, it simultaneously allows natural resource exploitation in pursuit of economic growth. This tension is clearly evident in the spatial overlap between mining permits (IUP) and legally and ecologically protected conservation zones. Land cover change, marine ecosystem degradation, and the diminishing ecological function of conservation areas are among the tangible consequences of this spatial conflict (Mongabay, 2022; Purwanto & Pratama, 2020).

From a geospatial perspective, the ongoing environmental crisis can be examined through satellite imagery interpretation and spatial data, such as land cover change, conservation zoning, and the distribution of mining permits. Several studies have demonstrated a correlation between mining activities and the decline in vegetation quality, as well as increased marine sedimentation (Irawan et al., 2021). However, spatial approaches alone are insufficient to capture the complexity of environmental conflict. A conceptual framework that addresses moral and ethical dimensions especially ecological justice and the protection of local communities' rights to sustainable living spaces is urgently needed.

In this context, environmental ethics becomes essential in evaluating whether current development practices have accounted for the values of ecological justice, moral responsibility toward nature, and the rights of local communities to a livable and sustainable environment (Attfield, 2018; Naess, 1973). Environmental ethics not only questions what is legally permissible, but also what is morally right in the relationship between humans and nature. Accordingly, this paper aims to examine the environmental crisis in Raja Ampat through a geospatial and environmental ethics lens, based on scientific literature and institutional reports.

B. Methodology

1. Research Design

This study adopts a descriptive qualitative approach using the method of library research. It is both exploratory and reflective in nature, aiming to understand the dynamics of the environmental crisis in the Raja Ampat conservation area through a synthesis of prior scientific findings. The study does not utilize primary data, but instead relies on credible and relevant secondary sources, including peer-reviewed journal articles, institutional reports, policy documents, and publicly available spatial data.

2. Instruments

The data used in this study were obtained from the following sources:

- National and international scientific journals accessed through academic databases such as Scopus, ScienceDirect, Google Scholar, and DOAJ.
- Reports from environmental organizations, including WALHI Papua Barat, JATAM, Greenpeace Indonesia, and UNESCO Global Geoparks.
- Secondary spatial data, including land cover maps, conservation zoning, and the distribution of mining permits (IUP) sourced from the Ministry of Environment and Forestry (KLHK), the Geospatial Information Agency (BIG), and the Indonesian Institute of Sciences (LIPI).
- Verified news sources from environmental media outlets such as Mongabay Indonesia, BBC Earth, and The Conversation, used to provide case updates and impact validation.

3. Technique of Data Analysis

The analysis was conducted using a thematic content analysis approach, which involves organizing and interpreting information into the following key themes:

(1) Geospatial and ecological impacts,
(2) Spatial conflicts and land cover change,
(3) Dimensions of environmental ethics, and
(4) Ecological justice for local communities.

In addition, to support spatial understanding, an interpretative approach was applied to map data and graphical representations from secondary literature. The visualizations are not used for quantitative measurement but rather serve to strengthen the descriptive narrative in explaining the dynamics of spatial transformation and landscape change.

C. Findings and Discussion

1. Findings

A. Land Cover Change

Literature review findings indicate that from 2015 to 2023, the Raja Ampat region

experienced significant changes in its land cover structure, particularly in areas affected by nickel mining activities. Small islands such as Gag, Kawei, Batangpele, and Manuran—previously dominated by secondary forests and coastal vegetation—have begun to show signs of ecological degradation due to land clearing for mining, construction of hauling roads, and the development of supporting mining infrastructure (Irawan et al., 2021).

Satellite imagery data analyzed by WALHI Papua Barat (2023) shows a gradual decline in the Normalized Difference Vegetation Index (NDVI) around mining concession areas, indicating reduced green vegetation density. In several areas, mangrove forests and coastal woodlands have been converted into open land, increasing the risk of coastal erosion and marine sedimentation. This degradation also disrupts the ecological stability of the coastal zone, which serves as a buffer between terrestrial and marine ecosystems.

The distribution of mining permits (IUP) in Raja Ampat also reveals a pattern of overlap with protected areas and national marine conservation zones. Conservation zoning maps—both terrestrial and marine—released by JATAM (2022) identify at least five mining companies that are active or have previously held concessions in the region. These locations are situated within or adjacent to ecotourism zones and core conservation areas, meaning that mining operations pose potential violations of the principles of sustainable ecological spatial planning.

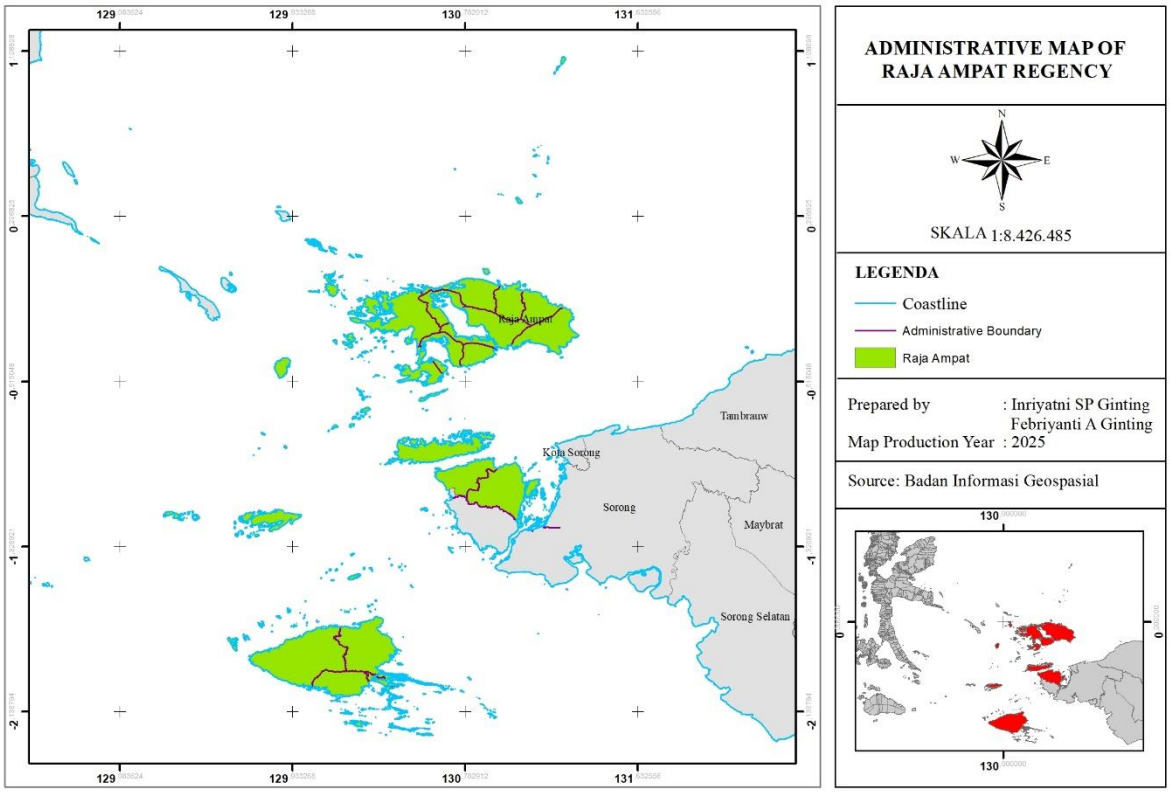

Figure 1. *Administrative Map of Raja Ampat Regency*

Moreover, mining exploration and material transportation activities have also led to increased marine sedimentation. A report by Mongabay (2022) documented high levels of water turbidity around Gag and Kawei Islands during the exploration phase of mining operations. This condition can interfere with coral reef photosynthesis, disrupt marine species reproduction, and accelerate the degradation of underwater ecosystems key ecological components that support Raja Ampat's ecotourism industry.

To strengthen these findings, the following is a list of mining companies that currently hold or have previously held concessions in the Raja Ampat region, based on reports by WALHI and JATAM:

Table 1. *List of Mining Concessions in Raja Ampat (2015-2025)*

No.	Island Name	Company Name	License Type	Concession Area	License Status
1.	Gag	PT Gag Nikel (anak usaha Antam)	Contract of Work	13.136	Active

2.	Kawei	PT Kawei Sejahtera Mining	IUP	±2.100	Revoked
3.	Manuran	PT Anugerah Surya Pratama	IUP	±2.000	Revoked
4.	Manyaifun	PT Mulia Raymond Perkasa	IUP	±2.200	Revoked
5.	Batangpele	PT Mulia Raymond Perkasa	IUP	±2.000	Revoked

Source: WALHI Papua Barat (2023), JATAM (2022), DLHK Papua Barat Daya (2021)

Table 1 indicates that although some companies have had their permits revoked, the ecological impacts from the initial exploration phase persist and may be long-lasting. Furthermore, the presence of these companies on small islands that are ecologically vulnerable highlights the weakness of permit governance that lacks adherence to environmental precautionary principles

B. Spatial Conflict and Threats to Conservation Sustainability

One of the key findings from this literature review is the intensifying spatial conflict between conservation zones and natural resource exploitation areas in Raja Ampat. This conflict arises when spaces that are legally and ecologically designated as conservation areas are simultaneously allocated for mining permits (IUP). The lack of synchronization between spatial planning policies and natural resource licensing is the primary source of this conflict.

Zoning maps released by the West Papua Marine and Fisheries Agency (2020) show that most of Raja Ampat's coastal and marine areas have been divided into several functional zones, such as core conservation zones, ecotourism zones, and sustainable fisheries zones. However, reports by JATAM (2022) and WALHI (2023) reveal that several nickel mining permits are located within or in close proximity to these protected zones. For example, Gag Island, which is part of the Gag–South Waigeo conservation area, holds both high marine biodiversity and unique geological features, yet it was still granted a mining concession to PT Gag Nikel, a subsidiary of PT ANTAM Tbk.

This spatial conflict is exacerbated by the weakness of strategic environmental assessments (KLHS) and the absence of community-based objection mechanisms. In many cases, Indigenous communities residing on these small islands have not been granted adequate access to information regarding mining plans and their ecological consequences (Latifah & Simarmata, 2021). This creates a power imbalance between the state, corporations, and local communities, resulting in the exclusion of the latter from decisions affecting their living spaces.

From a conservation standpoint, mining activities in Raja Ampat pose multidimensional threats. First, mining operations lead to habitat fragmentation that disrupts ecosystem connectivity on both land and sea. Second, exploration and infrastructure development contribute to soil, water, and air pollution, with potential contamination of ecosystem core zones. Third, environmental degradation reduces the attractiveness of nature-based tourism, which forms the backbone of sustainable livelihoods for local communities and is a key argument for Raja Ampat's application as a UNESCO Global Geopark (UNESCO, 2020).

Furthermore, unresolved spatial conflicts could undermine the international legitimacy of conservation areas. According to a UNESCO report (2021), sites overlapping with extractive activities risk losing their status as geoparks or World Heritage Sites due to noncompliance with the principles of ecological integrity and sustainable governance. This situation presents a concrete threat to Raja Ampat's standing as a nationally and globally strategic conservation area. Thus, spatial conflict in Raja Ampat is not merely a technical issue of land-use planning; it reflects structural problems in the governance of natural resources. The absence of coordination mechanisms between institutions (such as the Ministry of Environment and Forestry, Ministry of Energy and Mineral Resources, and local governments), weak oversight of IUP issuance, and insufficient enforcement of environmental laws all constitute serious challenges to the ecological sustainability of Raja Ampat.

2. Discussion

1) Value Crisis in Extractive Development

From the perspective of environmental ethics, the conflict between conservation and mining in Raja Ampat represents a value crisis. A development approach that views nature solely

as an economic resource neglects the intrinsic value of the environment. Within the framework of deep ecology developed by Naess (1973), every ecological entity has the right to exist, regardless of its utility to humans. Therefore, the destruction of coastal ecosystems for economic gain is fundamentally incompatible with the principles of ecological justice (Schlosberg, 2007).

Mining activities within conservation areas not only trigger ecological degradation but also reflect the state's weak moral responsibility in protecting nature. The decision to issue mining permits (IUP) in ecologically sensitive regions reveals the dominance of short-term interests and macroeconomic priorities over sustainability considerations. From an environmental ethics standpoint, this reflects a form of extractive anthropocentrism that contradicts the principles of sustainable development.

2) Power Imbalance and the Marginalization of Indigenous Communities

Human geography views space not merely as a physical entity but as a socio-political arena. In the case of Raja Ampat, the living space of Indigenous communities is often excluded from decision-making processes related to mining. The study by Latifah & Simarmata (2021) reveals that Indigenous Papuans experience dual marginalization: they are not involved in the licensing process and simultaneously bear the direct ecological consequences. When spaces they consider sacred and rely on for their livelihoods are damaged by mining, what is lost is not only ecosystems, but also cultural identity.

This power imbalance in spatial governance reinforces the argument that the environmental crisis in Raja Ampat cannot be separated from issues of social injustice. A just environmental ethic must consider the rights of local communities to a sustainable and uncontaminated living space. This aligns with the principles of environmental justice, which demand a fair distribution of environmental risks and benefits (Attfield, 2018; Schlosberg, 2007).

3) Governance Failure and the Conservation Paradox

The fact that an internationally recognized conservation area such as Raja Ampat can still be designated for mining activities illustrates a failure in environmental governance. The duality of policies between protection and exploitation lies at the root of recurring spatial conflicts. In reality, a geospatial approach combined with the principles of environmental ethics could serve as a foundation for evidence-based and value driven decision-making. Unfortunately, this approach has yet to become the dominant practice in spatial planning and regional development policies in Eastern Indonesia.

D. Conclusion

This study demonstrates that the environmental crisis in the Raja Ampat conservation area is a direct result of spatial conflict between conservation zones and mining exploitation areas. The significant land cover changes from 2015 to 2023 particularly on Gag, Kawei, and Manuran Islands serve as concrete evidence of the geospatial impacts of mining activities on coastal and marine ecosystem degradation. Literature-based spatial analysis reveals that nickel mining permits (IUP) not only overlap with protected areas, but also threaten the sustainability of ecosystem values that underpin Raja Ampat's global conservation significance.

From an environmental ethics perspective, development practices that sacrifice ecologically valuable areas for economic interests reflect a value crisis in natural resource governance. An anthropocentric, short-term resource extraction approach is misaligned with the principles of ecological justice, intergenerational sustainability, and the rights of local communities to a clean and sustainable living space. Ultimately, this spatial conflict indicates a failure of integrated, participatory, and ethical environmental governance.

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