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Philosophical Risk Transformation: A Systematic Review From Protection to Radical Adaptation in Indonesian Coastal Ontology

Deni Sabriyati[1], Hasnah Faizah AR[2]

[1]Universitas Maritim Raja Ali Haji. Kepulauan Riau Province. Indonesia
[2]Universitas Riau. Riau Province. Indonesia

Corespodence: denisabriyati@umrah.ac.id[1]

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ABSTRACT

Coastal regions in Indonesia are increasingly exposed to compound climate-related hazards sea-level rise, erosion, storm surges, and saltwater intrusion while also facing strong anthropogenic pressures, creating not only a management problem but a deeper philosophical crisis about how risk, nature, and human agency are understood. Against this background, this study aims to systematically examine the philosophical transformation of coastal risk governance from a technocentric Protection, paradigm toward, Radical Adaptation within Indonesian coastal ontology, addressing the gap in philosophical (ontological, epistemological, and ethical) analysis of this transition. Methodologically, the article applies a systematic literature review, synthesizing 94 selected sources (2010–2025, with seminal works for foundations) gathered through database searches (Scopus, Web of Science, ScienceDirect, and Garuda) and supplemented by semantic search, followed by structured extraction and content analysis using a priori thematic coding across ontology, epistemology, and axiology or ethics. The findings indicate a clear shift in scholarship and practice: conventional protection strategies centered on engineering control are increasingly inadequate under accelerating uncertainty, while radical adaptation reframes risk as an intrinsic feature of coastal existence that requires coexistence, relationality, and transformative learning rather than defending the status quo. This transformation is marked by (1) an ontological move from separation/domination to living-with-risk, (2) an epistemological move toward hybrid knowledge that integrates scientific approaches traditional ecological wisdom, (3) an ethical reorientation toward ecological solidarity, intergenerational justice, moral responsibility.

Keyword: Climate Justice, Coastal Ontology, Local Wisdom, Radical Adaptation

INTRODUCTION

Coastal regions are facing a complex dual crisis resulting from the increasing frequency and intensity of natural disasters driven by global climate change, combined with massive anthropogenic pressures (Aung et al., 2022; Basher-Ahammed et al., 2026). Numerous studies indicate that rising sea levels, severe erosion, and saltwater intrusion have fundamentally reshaped the ontological landscape of coastal environments (Gupta et al., 2025). This situation represents not merely an environmental or managerial challenge but also a profound philosophical crisis one that compels society to re-evaluate its understanding of risk, nature, and human agency. The central concern is how coastal communities and policy systems conceptualize, interpret, and respond to accelerating risks under increasingly uncertain ecological conditions.

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Historically, the dominant paradigm informing coastal risk management has been the Protection paradigm. Rooted in the traditions of instrumental rationalism and twentieth-century positivism, this paradigm assumes that natural processes can be fully understood, accurately predicted, and effectively controlled through engineering interventions. Hence, coastal management has centered on constructing seawalls, concrete embankments, and other forms of hard infrastructure intended to physically separate people from perceived threats posed by the sea. The fundamental ambition of this paradigm is to establish a clear division between human space and natural forces, with the expectation that control over nature is both possible and desirable.

This situation represents not merely an environmental or managerial challenge but also a profound philosophical crisis. However, empirical evidence over the past three decades demonstrates that this paradigm is increasingly inadequate. Hard infrastructures have repeatedly failed in the face of climate-induced uncertainties, such as rapid sea-level rise, erratic storm surges, and irreversible shoreline transformations. These failures reveal not only technical weaknesses but also deeper philosophical limitations: namely, the assumption that nature is a stable, predictable entity that can be subdued through human ingenuity. The accelerating unpredictability of coastal processes challenges this assumption and demands a reconsideration of the foundational worldview that underpins coastal management. This shift is encapsulated in the emerging concept of Radical Adaptation, which calls for a fundamental reorientation of the Human–Nature–Risk relationship. Rather than attempting to dominate or eliminate risk, Radical Adaptation encourages communities to coexist with risk—an approach that necessitates cognitive, ethical, and practical transformation.

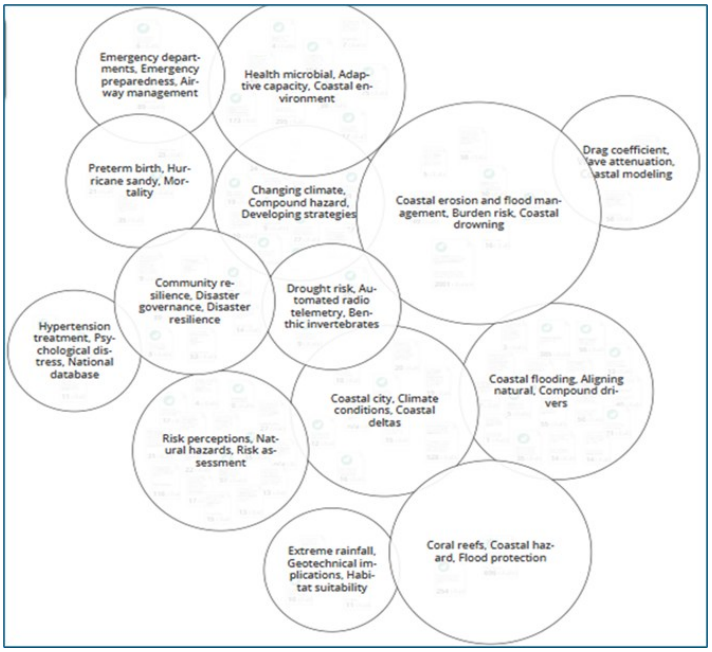

Figure 1. Empirical development of coastal disaster risk complexity from 1995–2025
Source: Open KnowledgeMap, 2025

Insights from the global knowledge map on the "philosophy of coastal risk disaster" published by Open Knowledge Maps (2025) reveal that contemporary debates are increasingly interdisciplinary, integrating ecological science, social theory, and moral philosophy (figure 1). Studies spanning 1995 to 2025 highlight that risk is not merely a biophysical phenomenon but a socio-ecological construct shaped by human values, governance dynamics, cultural practices, and historical relationships with the coastline. Within this academic landscape, the

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philosophy of risk functions as a reflective lens through which scholars analyze how societies interpret uncertainty and how these interpretations shape collective responses. This broader intellectual context positions the present study within the growing body of literature seeking to understand the deeper meaning and ethical implications of coastal risk.

In Indonesia, philosophical inquiries into coastal risk have become increasingly relevant. Coastal regions serve as more than geographical locations; they are lived spaces that shape identities, cultural expressions, and ontological understandings of the sea. For maritime communities, the coast embodies livelihood, spirituality, and intergenerational continuity. Consequently, transformations in coastal landscapes due to climate change carry not only ecological and economic implications but also ontological disruptions that challenge established relationships between humans and their environment (Sunarto, 2011; Marfai, 2019). This contextual uniqueness underscores the importance of examining coastal risk through a philosophical lens in addition to technical and policy-oriented perspectives.

Recent developments in Indonesia reflect a significant epistemological and ontological shift in coastal risk governance. The limitations of conventional protection strategies—such as seawalls, coastal embankments, and mangrove belts—have become increasingly evident. Empirical research from Central Java, Maluku, and the Riau Archipelago shows that while hard infrastructure may offer short-term relief, it often fails to deliver sustainable, long-term resilience (Andhika, 2021; Nugraha & Setiawan, 2022). Moreover, such approaches frequently neglect socio-cultural dimensions, marginalize local knowledge, and disrupt community-nature relationships. These shortcomings serve as catalysts for reimagining risk governance and exploring alternative paradigms that integrate social values, ecological processes, and ethical considerations.

In response, Radical Adaptation has emerged as a transformative concept that reconceptualizes risk not solely as a threat but as a space for learning, innovation, and ecological reconciliation (Idrus & Usi, 2024). This paradigm shift encourages communities to embrace adaptive living strategies, acknowledging that risk is an inherent and unavoidable element of coastal life. The transition toward Radical Adaptation is neither linear nor uniform; rather, it unfolds through cycles of social learning, community negotiation, shifts in collective values, and policy experimentation. It encompasses a wide array of adaptive practices, including elevating houses, modifying livelihoods, developing social networks, strengthening community-based resilience mechanisms, and revitalizing traditional ecological knowledge (Sunarto, 2011; Dalimunthe et al., 2025).

This shift reflects an evolving philosophical recognition that humans and coastal environments exist in a mutually constitutive relationship. The sea is not merely an external force to be controlled; it is a dynamic, living space that shapes and is shaped by human choices. Consequently, Radical Adaptation represents a reorientation of ontological assumptions—moving from a worldview centered on separation and domination toward one grounded in coexistence and relationality. This paradigm invites deeper ethical reflection on how communities might live more harmoniously with changing environmental conditions while preserving cultural integrity and ecological balance.

The growing body of literature underscores the urgency of transitioning from protection-oriented strategies to more transformative and relational forms of adaptation. Such a shift is not only environmental or technical but also philosophical. Transformative options such as managed retreat, community relocation, or shifts in livelihood systems represent profound changes in how communities conceptualize their place within dynamic coastal ecosystems. These transitions require careful negotiation of cultural values, emotional attachments, and ethical considerations, underscoring the complexity of the philosophical dimensions of adaptation. Within this context, the present study positions itself at the intersection of risk philosophy, coastal governance, and socio-ecological transformation. By

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analyzing the ontological, epistemological, and ethical foundations that distinguish the Protection paradigm from Radical Adaptation, this study contributes to ongoing academic debates on the future of coastal resilience in Indonesia. While the technical limitations of the Protection paradigm are well-documented, a systematic philosophical analysis (ontological, epistemological, and ethical) of the required transition to the emerging paradigm of Radical Adaptation in the specific socio-ecological context of Indonesian coastal ontology is lacking.

Moreover, by synthesizing key literature and highlighting the unique cultural and ecological characteristics of Indonesian coastal communities, the study aims to illuminate the broader philosophical implications of shifting from controlling risk to living with risk. The primary objective of this article is to systematically review and synthesize the philosophical implications of the transformation from the technocentric Protection paradigm to the transformative Radical Adaptation paradigm within the context of Indonesian coastal ontology.

METHODOLOGY

The article employs a systematic literature review (SLR) to investigate the philosophical transformation of coastal risk paradigms in Indonesia. The review integrates 94 scholarly sources obtained from both international peer-reviewed journals and reputable Indonesian scientific publications, supplemented by semantic search results generated through Elicit (2025). These sources collectively address key themes such as coastal adaptation policy, environmental ethics, local ecological knowledge, disaster ontology, and the shifting discourse on protection versus adaptation in coastal risk governance. The literature search was conducted using major academic databases including Scopus, Web of Science, ScienceDirect, and Garuda, using keyword combinations such as "coastal risk adaptation," "philosophy of risk," "local knowledge," "environmental ontology," and "Indonesian coastal management." The initial screening yielded 241 publications, which were subsequently filtered based on five eligibility criteria:

1. the study focuses on Indonesian coastal regions or offers conceptual relevance to Indonesian coastal contexts;
2. it discusses risk management paradigm changes, including protection and adaptation approaches;
3. it contains identifiable dimensions of adaptation, protection, or philosophical interpretation of risk;
4. it integrates local knowledge, socio-cultural perspectives, or environmental philosophy;
5. it involves community actors, institutions, or governance mechanisms relevant to coastal risk.

Specifically, The review integrated 94 scholarly sources over a publication time span of 2010–2025 (with a few seminal works included earlier for foundational concepts).

1. Types of Studies: The included publications comprised empirical case studies (e.g., vulnerability and Nature-based Solutions), conceptual and theoretical analyses (e.g., disaster ontology and environmental ethics), and policy analyses (e.g., adaptation strategies).
2. Inclusion/Quality Criteria: Publications were filtered based on five criteria, ensuring relevance to the Indonesian context and a focus on paradigm change or philosophical interpretation of risk. The focus was on high-relevance thematic content, with the final 94 sources retained after full-text analysis.
3. Thematic Coding: Data extraction utilized a structured matrix (author, location, method, focus and relevance to the philosophical transformation of coastal risk) followed by a content analysis technique. Thematic categories—Ontology, Epistemology, and Axiology (Ethics) were generated a priori based on the philosophical implications of risk transformation (Busby et al., 2012) and used as the core analytical framework. While not

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strictly adhering to PRISMA, the review follows a structured and systematic protocol for philosophical synthesis.

A content analysis technique was applied to synthesize thematic patterns, identify conceptual trends, and compare the evolution of risk frameworks over time. This analytical process made it possible to trace how Indonesian coastal risk scholarship has shifted from engineering-based protection models toward more adaptive, relational, and ecologically grounded approaches. The research centers on the shift between two philosophical paradigms Protection and Radical Adaptation analyzed across three core philosophical dimensions: Ontology, Epistemology, and Axiology (Ethics).

Table 1. Conceptual Framework

Dimension	Protection Paradigm (Technocentric)	Radical Adaptation Paradigm (Transformational)
Ontology (Nature of Being)	Separation & Domination: Risk is an external, manageable threat; nature is a stable object to be controlled by engineering.	Coexistence & Relationality: Risk is an intrinsic, unavoidable feature of coastal existence; nature is a dynamic, living space.
Epistemology (Nature of Knowledge)	Instrumental Rationalism: Reliance on engineering science, measurable data, and predictive models.	Dual/Hybrid Knowledge: Integration of scientific insights and local/traditional ecological wisdom (e.g., Tunjuk Ajar Melayu Riau).
Axiology/Ethics (Nature of Value)	Anthropocentrism: Value prioritizes human safety and economic continuity through control.	Ecological Solidarity: Value orientation shifts toward intergenerational justice, moral coexistence, and responsibility to the ecosystem.

Source: Author, 2025

Overall, this SLR provides a coherent methodological bridge between empirical coastal-risk evidence and philosophical interpretation, allowing the review to move beyond describing "what policies exist" toward explaining "how and why" Indonesia's coastal risk thinking is changing. By organizing 94 selected studies into the triadic lens of Ontology, Epistemology, Axiology, the analysis systematically captures the deep assumptions embedded in protection-oriented governance (control, predictability, technocentrism) and contrasts them with the emerging logic of radical adaptation (relationality, hybridity of knowledge, and ecological solidarity). This closing synthesis ensures that the study's findings are not treated as fragmented themes, but as an integrated trajectory of paradigm transformation, while also making the framework transferable for future comparative research across Indonesia's diverse coastal regions and policy arenas.

RESULTS AND DISCUSSION

Radical Adaptation represents a fundamental reorientation of the Human Nature Risk relationship, demanding a philosophical shift from the technocentric Protection paradigm to one of transformation and coexistence. Unlike incremental adaptation such as building higher seawalls or improving early warning systems which seeks merely to defend the status quo, radical adaptation involves non-linear, profound changes to socio-ecological systems, replacing engineering control with learning-based adaptation. Ontologically, it moves away from perceiving risk as an external threat to be dominated, embracing it instead as an intrinsic feature of coastal existence that requires relationality, ecological reconciliation, and a shift in

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values toward moral coexistence, often necessitating transformative actions like planned relocation or complete livelihood shifts

1. The Paradigm Shift from Protection to Adaptation

A growing body of coastal literature demonstrates a significant paradigm shift from traditional protection-oriented approaches toward more adaptive, reflexive, and ecologically grounded strategies. The consolidated findings of the review are presented in Table 2, which maps the empirical and conceptual distribution of the literature within the broader philosophical framework of coastal risk.

Table 2. Mapping the Literature within the Philosophical Framework of Coastal Risk

No	Author (Year)	Study Location	Method	Research Focus	Relevance to Coastal Risk Philosophy
1	Busby et al. (2012)	England	Case study	Typology of risk transformation	Forms a philosophical foundation of risk transformation from technical to socio-philosophical perspectives
2	Johnston & Cooper (2022)	Cayman Islands	Adaptation policy analysis	Island territory adaptation policy toward climate change	Provides empirical frameworks derived from policy for adaptation thinking
3	Dalminutu et al. (2025)	Bali, Indonesia	Observation and interviews	Community interaction with coastal ecosystems and disaster resilience	Illustrates nature-based solution approaches as ecological adaptation expressions
4	Cahyono & Ngadish (2025)	Indonesia	Case study	Community-based disaster risk reduction	Shows social foundation of disaster mitigation and radical adaptation
5	Ludwig & Charbel (2025)	Global	Transdisciplinary approach	Philosophy of community and adaptation	Provides philosophical foundation for transformative adaptation
6	Collier (2025)	Global	Critical analysis of capitalism	Paradox of resilience in neoliberal systems	Critiques resilience that reproduces structural inequalities
7	Saidinullah & Saputra (2024)	Yogyakarta, Indonesia	Local wisdom study	Marine disaster risk and community wisdom	Shows ontological linkage between knowledge and community-based marine disaster adaptation
8	Dong & Lin (2025)	Global	Comparative resilience analysis	Global coastal resilience policy	Presents cross-country policy analysis for coastal adaptation

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No	Author (Year)	Study Location	Method	Research Focus	Relevance to Coastal Risk Philosophy
9	Nguyen & Luo (2019)	Global	Spatial analysis	Ecological vulnerability of coastal zones	Links ecological and social dimensions in coastal risk studies
10	Himawan (2017)	Indonesia	Heideggerian hermeneutics	Disaster meaning in local wisdom	Offering philosophical interpretation for disaster existence through local knowledge
11	Pratomo (2017)	Central Java, Indonesia	Hermeneutics	Local wisdom & disaster relationship	Builds ontology of local wisdom and its role in disaster risk
12	Jompa & Saputra (2022)	Indonesia	Policy analysis	Rehabilitation & NDC-based adaptation policy	Strengthens philosophical basis of climate adaptation in policy frameworks

Source: Author, 2025

Indonesian coastal experience mirrors global findings that rigid engineering structures such as seawalls, breakwaters, and dikes are increasingly unable to withstand compound hazards such as accelerated sea-level rise, land subsidence, tidal flooding (rob), and shoreline erosion (Sunarto, 2011; Cahyono, 2025). Similar conclusions are reported internationally, where high-cost physical defenses fail to address the complex social–ecological interactions shaping contemporary coastal risks (Fang et al., 2020; Mahendra et al., 2021). The Elicit Report (2025) underscores that the inadequacy of conventional protection has catalyzed a shift toward "radical adaptation," a framework that replaces engineering control with learning-based adaptation. This shift is partly informed by ecological risk research showing that rapid environmental change requires flexible, scale-sensitive responses rather than fixed structural measures (Ai et al., 2022; Ju et al., 2021; Wang et al., 2022).

Radical adaptation also embodies a philosophical repositioning. It challenges the anthropocentric assumption that nature can be controlled indefinitely and instead embraces an ethic of coexistence with dynamic coastal processes (Busby et al., 2012; Ludwig & Charbel, 2025). This reflects a broader global discourse on sustainable marine systems under SDG 14, which emphasizes that resilient oceans and coasts require governance strategies grounded in ecological viability and moral responsibility (Arora et al., 2023). Furthermore, evidence indicates that adaptation effectiveness is spatially differentiated: each coastal area possesses unique geomorphological, hydrological, and sociocultural characteristics that influence its adaptive capacity (Nguyen & Liou, 2019; Zhang et al., 2020).

Research in China, India, and Southeast Asia shows that hazard exposure interacts with local land-use change, urbanization dynamics, and socio-economic vulnerabilities, producing risk profiles that cannot be addressed through uniform protective measures (Choudhary et al., 2018; Basheer Ahammed et al., 2026a). Thus, the shift from protection to adaptation is not merely a technical transition but a philosophical reorientation toward embracing uncertainty, relationality, and socio-ecological learning. This reorientation underpins an emerging ontology of "living with risk," wherein hazards are perceived as inherent ecological rhythms rather than external enemies to be defeated.

2. Community- and Ecosystem-Based Adaptation

Community-driven and ecosystem-based adaptation have become prominent themes in Indonesia's coastal risk scholarship. Elicit (2025) documents how coastal residents combine

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physical measures (house raising, geotubes, floating platforms) with socio-economic strategies such as livelihood diversification, seasonal migration, cooperative networks, and local savings groups. These bottom-up responses reflect what scholars describe as radical pragmatism as the ability of communities to transform structural constraints into opportunities for innovation, autonomy, and resilience (Helmi & Satria, 2012; Far-Far & Tuhumury, 2022). Similar patterns are identified across the Western Indian Ocean and the Pacific, where blending scientific and Indigenous knowledge enhances community adaptive capacity (Chambon et al., 2024; Combest-Friedman et al., 2012).

Beyond social strategies, ecosystem-based approaches particularly mangrove rehabilitation have become a central adaptation pathway. Empirical studies show that mangroves reduce storm surges, stabilize coastlines, support fisheries, and enhance carbon sequestration (Jompa & Murdiyarso, 2022; Sagala et al., 2024). However, their benefits are not purely biophysical. Dalimunthe et al. (2025) highlight that community interactions with mangroves in southern Bali also reinforce spiritual values, environmental stewardship, and collective identity.

This aligns with global evidence that ecosystem restoration contributes to landscape ecological risk reduction, offering multifunctional benefits that extend beyond hazard mitigation (Guzmán-Colón et al., 2020; Zhai et al., 2020). In Thailand, Chaiklang et al. (2024) illustrate how long-term changes in mangrove land use shape community vulnerability and adaptive behavior. Similarly, studies in Colombia and Hong Kong emphasize the importance of integrating ecological risk assessment into coastal planning to ensure long-term sustainability (Liang et al., 1999; Yanes et al., 2019). The synthesis of social innovation and ecological restoration embodies a hybrid adaptation model: it not only protects communities from coastal hazards but also revitalizes social-ecological relationships. Such hybridization represents an ontological blending of material, cultural, and ecological dimensions of life in coastal spaces

3. Ontological Shifts: Living with Risk

A deeper philosophical transformation is evident in how coastal communities conceptualize risk. Traditional communities in Java, Maluku, Sumatra, and Eastern Indonesia often perceive coastal hazards as part of the cyclical rhythms of nature a worldview that emphasizes harmony, reciprocity, and spiritual alignment rather than domination (Sunarto, 2011; Alwi et al., 2017). This aligns with an ecocentric ontology wherein human existence is embedded within ecological processes rather than positioned above them. Global research similarly demonstrates that island and coastal societies develop relational ontologies shaped by interdependence with land, sea, and climate (Johnston & Cooper, 2022; Xia et al., 2025). For example, studies in the Philippines show that communal hazard awareness is influenced by cultural memory, collective experiences, and shared environmental narratives (Valenzuela et al., 2020).

Philosophically, this ontological orientation represents a shift from "fighting against nature" to "living with uncertainty." It suggests that risk is not an external object to be managed but an emergent property of human environment interactions. Scientific studies support this relational understanding: ecological risk patterns in coastal areas are shaped by the interplay between land-use change, socio-economic systems, and natural processes (Jin et al., 2019; Shi et al., 2016; Chaiklang et al., 2024). Machine learning based coastal vulnerability assessments such as those in Nigeria and India, reinforce that risk is a dynamic, evolving construct shaped by both environmental drivers and human decisions (Akindejoye et al., 2025; Basheer Ahammed et al., 2026b). Thus, ontological perspectives are increasingly converging with empirical models that conceptualize risk as relational, nonlinear, and multi-scalar. These ontological shifts have profound implications for adaptation policy: they

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advocate for coexistence, humility, and anticipatory learning as core values in navigating uncertain coastal futures.

4. Institutional and Policy Transformations

At the institutional level, coastal risk transformation is visible in the evolution of policy frameworks toward adaptive, inclusive, and community-centered governance. Studies by Setiawan & Nugara (2022) and Andhika (2021) show how adaptive governance practices bridge the gap between top-down policies and local realities, enhancing institutional learning and multi-actor collaboration. Adaptive governance emphasizes flexibility, feedback loops, and social capacity-building. It integrates mitigation and adaptation into a coherent framework that acknowledges uncertainty and encourages local experimentation (Dong & Lin, 2025). Internationally, similar shifts are occurring: coastal policies in the Cayman Islands, Puerto Rico, and China increasingly incorporate ecological risk assessment, multi-hazard mapping, and community participation to enhance resilience (Johnston & Cooper, 2022; Guzmán-Colón et al., 2020; Xia et al., 2025).

Risk assessment methodologies are also transforming. Modern approaches integrate remote sensing, GIS, ecological modeling, and machine learning to generate high-resolution vulnerability maps and identify critical areas for intervention (Choudhary et al., 2018; Zhai et al., 2020; Gunawansa et al., 2024). These tools enable policymakers to address the Modifiable Areal Unit Problem (MAUP), optimize spatial scales, and refine coastal zoning regulations (Ai et al., 2022; Ju et al., 2021). Institutional transformation thus reflects not only administrative improvements but also a philosophical realignment: governance becomes a relational practice grounded in ecological ethics, social justice, and intergenerational responsibility.

5. Synthesis Across Ontology, Epistemology, and Axiology

Based on the literature examined, coastal risk in Indonesia emerges as a concrete expression of the interplay between ontological, epistemological, and axiological dimensions. Ontologically, coastal communities understand risk as part of their ecological existence—an inevitable and relational aspect of living with the sea. Epistemologically, adaptation knowledge is generated through collective experience, environmental observation, traditional practices, and scientific insights, forming a hybrid knowledge system. Axiologically, the value orientation shifts from domination over nature toward ecological solidarity, intergenerational justice, and moral coexistence with coastal environments. This philosophical triad underpins the emergence of radical adaptation in Indonesia and beyond. It reframes adaptation not merely as policy reform but as a reawakening of ecological consciousness that situates humans within a dynamic, interconnected, and living cosmos.

CONCLUSION

The transformation of coastal risk governance in Indonesia from a protection paradigm to radical adaptation represents a profound shift in how communities, institutions, and the state conceptualize their relationship with the coastal environment. Radical adaptation is not a form of resignation to hazards; rather, it is a reflective praxis that integrates local knowledge, ecological ethics, scientific insight, and continuous social learning, recognizing that uncertainty is now a defining condition of coastal life. Viewed through the philosophical triad, this transition carries layered implications.

Ontologically, risk is no longer treated as an external threat to be dominated, but as an intrinsic and relational feature of living with the sea. Epistemologically, coastal resilience is strengthened when knowledge is produced through hybrid systems that combine collective experience, environmental observation, traditional ecological wisdom, and scientific evidence. Axiologically, the value orientation shifts from domination toward ecological solidarity,

intergenerational justice, and moral coexistence with coastal ecosystems. Therefore, the future of Indonesia's coastal sustainability depends on a collective shift in awareness and governance practice from controlling hazards to building just, inclusive, and adaptive coexistence with dynamic coastal systems. This conclusion implies that policy and institutional design should prioritize participatory and community-centered adaptation pathways, nurture ongoing learning and experimentation, and embed ethical commitments that protect both ecological integrity and social dignity, especially for vulnerable coastal groups. In this sense, radical adaptation offers not only a governance alternative, but a normative direction for coastal decision-making under accelerating climate risks.

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REFERENCES

Ai, J., Yu, K., Zeng, Z., Yang, L., Liu, Y., & Liu, J. (2022). Assessing the dynamic landscape ecological risk and its driving forces in an island city based on optimal spatial scales: Haitan Island, China. Ecological Indicators, 137. https://doi.org/10.1016/j.ecolind.2022.108771

Akindejoye, A., Viavattene, C., Priest, S., & Windridge, D. (2025). Identifying social vulnerability profiles for coastal flood using supervised and unsupervised machine learning: A case study of Lekki Peninsula, Lagos, Nigeria. International Journal of Disaster Risk Reduction, 127. https://doi.org/10.1016/j.ijdrr.2025.105693

Alwi, I., Mustansyir, R., & Hadi, P. H. (2017). Natural Disasters Management in Indonesia: Perspective of Local Wisdom and Heidegger Hermeneutics. Al-Albab, 6(1), 77. https://doi.org/10.24260/ALALBAB.V6I1.730

Arora, N. K., Mishra, I., & Arora, P. (2023). SDG 14: life below water- viable oceans necessary for a sustainable planet. Environmental Sustainability, 6(4), 433–439. https://doi.org/10.1007/S42398-023-00299-0

Basheer Ahammed, K. K., Pandey, A. C., & Wasim, M. D. (2026). A high-resolution coastal risk assessment framework: Integrating knowledge driven and machine learning models for the Andhra Pradesh coastline. Ocean & Coastal Management, 271, 107947. https://doi.org/10.1016/J.OCECOAMAN.2025.107947

Busby, J. S., Alcock, R. E., & MacGillivray, B. H. (2012). Types of risk transformation: a case study. Journal of Risk Research, 15(1), 67-84.

Cahyono, S. A., & Ngadisih. (2025). The Role of Community Resilience in Disaster Risk Reduction. In Examining Disaster Risk Reduction in Indonesia: Building Social Resilience (pp. 113-126). Singapore: Springer Nature Singapore.

Chaiklang, P., Karthe, D., Babel, M., Giessen, L., & Schusser, C. (2024). Reviewing changes in mangrove land use over the decades in Thailand: Current responses and challenges. Trees, Forests and People, 17. https://doi.org/10.1016/j.tfp.2024.100630

Choudhary, K., Boori, M. S., & Kupriyanov, A. (2018). Spatial modelling for natural and environmental vulnerability through remote sensing and GIS in Astrakhan, Russia. Egyptian Journal of Remote Sensing and Space Science, 21(2), 139–147. https://doi.org/10.1016/j.ejrs.2017.05.003

Collier, S. J. (2025). The disaster contradiction of contemporary capitalism: Resilience, vital systems security, and 'post-neoliberalism'. Geoforum, 159, 104204.

Combest-Friedman, C., Christie, P., & Miles, E. (2012). Household perceptions of coastal hazards and climate change in the Central Philippines. Journal of Environmental Management, 112, 137–148. https://doi.org/10.1016/j.jenvman.2012.06.018

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https://ojs.umrah.ac.id/index.php/jmps

Dalimunthe, S. A., Surtiari, G. A. K., Reksa, A. F. A., Jibiki, Y., Prasojo, A. P. S., & Arikawa, T. (2025). Community Interaction with Mangroves as a Nature-based Solution in the Mangrove Forest of Southern Bali. IOP Conference Series: Earth and Environmental Science, 1479(1). https://doi.org/10.1088/1755-1315/1479/1/012047

Dong, W., & Lin, G. (2025). Comparison of Coastal Resilience Policies: A Perspective on Effective Global Governance Strategies. In E3S Web of Conferences (Vol. 617, p. 01019). EDP Sciences.

Far Far, R.A., & Tuhumury, S.F. (2022). Strategi Adaptasi Masyarakat Pesisir Terhadap Dampak Perubahan Iklim di Kepulauan Kei Besar Maluku Tenggara. Jurnal Akuatiklestari, 6(1): 53-61. DOI: https://doi.org/10.31629/akuatiklestari.v6i1.4903

Gunawansa, T. D., Perera, K., Apan, A., & Hettiarachchi, N. K. (2024). Identifying human elephant conflict hotspots through satellite remote sensing and GIS to support conflict mitigation. Remote Sensing Applications: Society and Environment, 35, 101261. https://doi.org/10.1016/J.RSASE.2024.101261

Gupta, K., Manchikanti, P., 2025. Coastal and marine biological diversity conservation in India: challenges in implementation. Biodivers. Conserv. 34, 2977–2998. https://doi.org/10.1007/s10531-025-03106-w

Guzmán-Colón, D. K., Pidgeon, A. M., Martinuzzi, S., & Radeloff, V. C. (2020). Conservation planning for island nations: Using a network analysis model to find novel opportunities for landscape connectivity in Puerto Rico. Global Ecology and Conservation, 23. https://doi.org/10.1016/j.gecco.2020.e01075

Idrus, M. R. H., & Usi, U. A. N. (2024). Realisasi Penanganan Perubahan Iklim di Indonesia melalui Implementasi Sustainable Development Goals (SDGs): Tujuan-13.1. 3. Indonesian Journal of International Relations, 8(1), 77-100.

Jin, X., Jin, Y., & Mao, X. (2019). Ecological risk assessment of cities on the Tibetan Plateau based on land use/land cover changes – Case study of Delingha City. Ecological Indicators, 101, 185–191. https://doi.org/10.1016/j.ecolind.2018.12.050

Johnston, W., & Cooper, A. (2022). Small islands and climate change: analysis of adaptation policy in the Cayman Islands. Regional Environmental Change, 22(2). https://doi.org/10.1007/s10113-022-01887-2

Jompa J., Murdiyarso D. (2022). Rehabilitasi Kawasan Pesisir untuk Adaptasi Perubahan Iklim: Peran kunci mangrove dalam Nationally Determined Contributions. Working Paper 12. Bogor. Indonesia. CIFOR.

Ju, H., Niu, C., Zhang, S., Jiang, W., Zhang, Z., Zhang, X., Yang, Z., & Cui, Y. (2021). Spatiotemporal patterns and modifiable areal unit problems of the landscape ecological risk in coastal areas: A case study of the Shandong Peninsula, China. Journal of Cleaner Production, 310. https://doi.org/10.1016/j.jclepro.2021.127522

Liang, Y., Wong, M. H., Shutes, R. B. E., & Revitt, D. M. (1999). Ecological risk assessment of polychlorinated biphenyl contamination in the Mai Po Marshes Nature Reserve, Hong Kong. Water Research, 33(6), 1337–1346. https://doi.org/10.1016/S0043-1354(98)00353-4

Ludwig, D., & Charbel, E. H. (2025). Transformative Transdisciplinarity. An Introduction to Community-Based Philosophy.

Mahendra, R. S., Mohanty, P. C., Francis, P. A., Joseph, S., Nair, T. M. B., & Kumar, T. S. (2021). Holistic approach to assess the coastal vulnerability to oceanogenic multi-hazards along the coast of Andhra Pradesh, India. Environmental Earth Sciences, 80(18). https://doi.org/10.1007/S12665-021-09920-Z

Marfai, M. A. (2019). Pengantar etika lingkungan dan Kearifan lokal. Ugm Press.

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VOL 2 NO 3 DECEMBER 2025
https://ojs.umrah.ac.id/index.php/jmps

Nguyen, K. A., & Liou, Y. A. (2019). Mapping global eco-environment vulnerability due to human and nature disturbances. MethodsX, 6, 862–875. https://doi.org/10.1016/j.mex.2019.03.023

Noviana, E., Faizah, H., Mustafa, M. N., Elmustian, Hermandra, Kurniaman, O., Rusandi, M. A., & Situmorang, D. D. B. (2023). Understanding 'Tunjuk Ajar Melayu Riau': Integrating local knowledge into environmental conservation and disaster education. Heliyon, 9(9), e19989. https://doi.org/10.1016/J.HELIYON.2023.E19989

Open Knowledge Maps (2025). Knowledge Map for research on phyloshopy coastal risk disaster. Retrieved from (https://openknowledgemaps.org/map/9ea0914716c1f27e5b4af1a04ad22329)

Perkins, M., Bakker, J. D., & Arkema, K. Exploring the Disaster Risk Reduction and Energy Resilience Benefits of Coastal Ecosystems and Protected Areas in Puerto Rico. Available at SSRN 5211642.

Sagala, P. M., Bhomia, R. K., & Murdiyarso, D. (2024). Assessment of coastal vulnerability to support mangrove restoration in the northern coast of Java, Indonesia. Regional Studies in Marine Science, 70. https://doi.org/10.1016/j.rsma.2024.103383

Setiawan, Y.A., & Nugara, N. (2022). Kebijakan Transformatif Penanganan Risiko Banjir Dan Rob Di Kabupaten Pekalongan. Kajen: Jurnal Penelitian dan Pengembangan Pembangunan.

Shi, Y., Wang, R., Lu, Y., Song, S., Johnson, A. C., Sweetman, A., & Jones, K. (2016). Regional multi-compartment ecological risk assessment: Establishing cadmium pollution risk in the northern Bohai Rim, China. Environment International, 94, 283–291. https://doi.org/10.1016/j.envint.2016.05.024

Sunarto, S. (2011). Pemaknaan Filsafati Kearifan Lokal untuk Adaptasi Masyarakat terhadap Ancaman Bencana Marin dan Fluvial di Lingkungan Kepesisiran. In Forum Geografi (Vol. 25, No. 1, pp. 1-16).

Valenzuela, V. P. B., Esteban, M., Takagi, H., Thao, N. D., & Onuki, M. (2020). Disaster awareness in three low risk coastal communities in Puerto Princesa City, Palawan, Philippines. International Journal of Disaster Risk Reduction, 46. https://doi.org/10.1016/j.ijdrr.2020.101508

Wang, S., Tan, X., & Fan, F. (2022). Landscape Ecological Risk Assessment and Impact Factor Analysis of the Qinghai–Tibetan Plateau. Remote Sensing, 14(19). https://doi.org/10.3390/RS14194726

Xia, Y. D., Li, R. Q., Sun, J. J., Yu, S. L., & Xu, M. (2025). Risk assessment and adaptation technologies for island biodiversity conservation in China under climate change. Advances in Climate Change Research, 16(4), 787–799. https://doi.org/10.1016/j.accre.2025.06.007

Yanes, A., Botero, C. M., Arrizabalaga, M., & Vásquez, J. G. (2019). Methodological proposal for ecological risk assessment of the coastal zone of Antioquia, Colombia. Ecological Engineering, 130, 242–251. https://doi.org/10.1016/J.ECOLENG.2017.12.010

Zhang, W., Chang, W. J., Zhu, Z. C., & Hui, Z. (2020). Landscape ecological risk assessment of Chinese coastal cities based on land use change. Applied Geography, 117. https://doi.org/10.1016/j.apgeog.2020.102174