

INTEGRATING DISASTER RISK REDUCTION PRINCIPLES INTO PESANTREN CURRICULUM USING THE SENDAI FRAMEWORK

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Submitted: 12/11/2024

Revised: 15/05/2025

Accepted: 25/05/2025

Published: 29/05/2025

Abstract

This study investigates the potential of Pesantren Darussalam Parmeraan, North Sumatra, to foster disaster resilience by integrating Sendai Framework's disaster risk reduction (DRR) principles into its Islamic education curriculum. Situated in a forested area near a river, the pesantren faces flood and landslide risks. Employing a qualitative approach with case study, data were sourced from curriculum documents (akhlak, fiqh, tafsir), santri guidelines, activity records (gotong royong, tree planting, water management), and semi-structured interviews with the kiai, ustaz, and santri. Data were collected through document reviews and interviews, analyzed following Miles and Huberman (1994) via data reduction, data presentation, and conclusion drawing to identify DRR elements. Findings reveal traces of DRR in local practices and Islamic values (amanah, tawakkal, solidarity), aligning with Sendai's risk understanding, governance, resilience investment, and preparedness. However, gaps such as the absence of evacuation training, fragmented risk knowledge, and limited external collaboration hinder effectiveness. Proposed modules—"Environmental Akhlak," "Disaster Fiqh," and ikhtiar-based simulations—integrate disaster science with spirituality, strengthening isolated community resilience. This study offers a faith-based DRR model, contributing to Sustainable Development Goals (SDG 4, 13) and global literature.

Keywords

Disaster Resilience, Curriculum Integration, Islamic Values, Pesantren, Sendai Framework.



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INTRODUCTION

Natural disasters, such as floods, earthquakes, and landslides, have become increasingly severe global threats amid climate change and environmental degradation (Kumar et al. 2024; Vachani and Usmani 2014). Data from the United Nations Office for Disaster Risk Reduction (UNDRR) in 2024 indicate a significant rise in the frequency and impact of natural disasters, affecting over 3.6 billion people directly since 2000 (Jeon, Nam, and Hong 2023; Díaz and Larroulet 2021). Indonesia, an archipelago situated on the Pacific Ring of Fire, faces exceptionally high disaster risks, with floods and landslides dominating the 2023 annual reports of the National Disaster Management Authority (BNPB), causing economic losses in the trillions of rupiah and thousands of casualties (Desfita, Ophiyandri, and Hidayat 2023). In this context, education emerges as a critical pillar for building community resilience to disasters, as emphasized by the Sendai Framework for Disaster Risk Reduction 2015-2030, which calls for the integration of disaster risk reduction (DRR) into formal and informal education systems (Gampell et al. 2020). However, while formal education institutions like schools have begun adopting DRR elements, traditional Islamic educational institutions such as pesantren remain underexplored as potential agents in fostering disaster resilience, despite their significant role in value-based education and community character development (Rosyida et al. 2022).

Pesantren, as Indonesia's oldest Islamic educational institutions, serve not only as centers for religious learning but also as communities that instill social and environmental responsibility (Karman, Anwar, and Hakim 2023). In this study, Pesantren Darussalam Parmeraan in North Sumatra provides a unique case study. Located in a forested, isolated area far from settlements, the pesantren faces complex environmental challenges, including limited accessibility, reliance on forest water sources for clean water, and exposure to disasters like floods and landslides due to its proximity to a river. The santri (students) and ustaz (teachers) at this pesantren have developed local practices reflecting environmental wisdom, such as independent waste management, tree planting, constructing pathways with natural materials like forest wood and river stones without harming the ecosystem, and engaging in gotong royong (communal work) to build pesantren infrastructure. These practices embody Islamic values, such as amanah (responsibility toward the environment) and tawakkal (trust in Allah when facing challenges), which align with DRR principles, particularly risk understanding and preparedness. However, despite the existence of these practices, no systematic effort has been made to formally integrate DRR principles into the pesantren curriculum,

a gap that this study aims to address.

Theoretically, this research is grounded in two main frameworks: the Sendai Framework and a value-based Islamic education approach. The Sendai Framework highlights four priorities—understanding disaster risk, strengthening risk governance, investing in resilience, and preparing for effective response—which can be adapted into pesantren education through curricula encompassing knowledge, attitudes, and skills (Takahashi et al. 2015; Astuti 2024). Meanwhile, Islamic education provides a rich foundation of values, as articulated by Al-Ghazali in his concept of noble morals, emphasizing human responsibility as stewards of the earth (QS. Al-Baqarah: 30) (Khasawneh, Mosta, and Rawagah 2022). The Prophet Muhammad's hadith, such as "If tomorrow is the Day of Judgment and you hold a seedling in your hand, plant it" (HR. Ahmad), further reinforces the importance of environmental preservation as an act of worship (Fachruddin M. Mangunjaya 2007). Scholars like Muttarak and Pothisiri assert that value-based education can enhance disaster preparedness by fostering collective awareness and proactive action (Muttarak and Lutz 2014; Basten, Muttarak, and Pothisiri 2014; Muttarak and Pothisiri 2013). Additionally, Oktari's studies demonstrate that local knowledge management within communities can strengthen disaster resilience (Rina Suryani Oktari, Comfort, et al. 2020; Rina S Oktari et al. 2020; Rina Suryani Oktari, Munadi, et al. 2020), a principle relevant to the gotong royong practices in pesantren.

The literature on disaster risk reduction (DRR) in education resembles a vast ocean, yet pesantren, the lighthouses of Islamic education nurturing over 5 million santri in Indonesia (Ma'rif 2024), remain shrouded in mist. Revealed that secondary school geography curricula, anchored in the Sendai Framework, instill awareness of floods and earthquakes but falter due to a lack of evacuation training, let alone engagement with pesantren imbued with Amanah (Triastari, Dwiningrum, and Rahmia 2021). Meanwhile, demonstrated that interactive media in urban primary schools enhance Sendai-based DRR awareness, yet their research waves fail to reach rural pesantren where communal cooperation (gotong royong) flourishes (Kamil et al. 2021). Found that teacher training in Aceh strengthens DRR in schools, but remains confined to formal education, overlooking pesantren as bastions of values like sabar (Aksa 2022). These studies, though illuminating, miss the potential of pesantren, leaving a gap as vast as the North Sumatran forests encircling Pesantren Darussalam Parmeraan.

Other studies add hues, but the void persists. Challenges in Indonesian school-based DRR education, advocating for Sendai-aligned national policies, yet overlooking pesantren as community agents capable of disseminating resilience (Amri et al. 2022). Portrayed community-based mitigation in Aceh and Nias post-tsunami, highlighting local leaders' roles in resilience, yet failed to connect these lessons to curricula or Sendai, let alone pesantren weaving "environmental jihad" (Sufri and Lassa 2024). These five studies, like constellations in the academic firmament, gleam over formal schools but cast pesantren into shadow, lacking analyses that intertwine Islamic values with the Sendai Framework. This study bridges that chasm with a blazing novelty: a pesantren-based DRR model that weaves tawakkal, solidarity, and practices like tree planting with Sendai priorities through modules like "Environmental Akhlak" and "Disaster Fiqh." Unlike secular frameworks, this research pioneers a faith-based paradigm responsive to floods and landslides in isolated regions, enriching global literature and advancing Sustainable Development Goals (SDG 4, 13). It positions pesantren as beacons of resilience, guiding communities through the tempests of climate change.

This study aims to integrate the Sendai Framework's disaster risk reduction (DRR) principles into the curriculum of Pesantren Darussalam Parmeraan, blending Islamic values such as amanah and tawakkal to foster disaster resilience in an isolated, flood- and landslide-prone region. Theoretically, it enriches DRR literature by proposing a faith-based model, bridging the gap between Islamic education and disaster resilience, an area underexplored compared to secular frameworks. It advances academic discourse by demonstrating the global relevance of Islamic values within the Sendai Framework, contributing to Sustainable Development Goals (SDG 4, 13). Pragmatically, it offers operational solutions through curriculum modules like "Environmental Akhlak" and "Disaster Fiqh," formalizing local practices such as gotong royong and tree planting into replicable learning. With over 60% of Indonesia's disasters occurring in rural areas (BNPB, 2024; Muhammad 2024), pesantren, as community hubs, can drive preparedness, reducing disaster losses and illuminating a path for resilient communities amid global climate challenges.

METHOD

This qualitative study (Salmona and Kaczynski 2024; Creswell and Poth 2018) seeks to integrate the Sendai Framework's disaster risk reduction (DRR) principles into the curriculum of Pesantren Darussalam Parmeraan, North Sumatra, an Islamic educational institution confronting flood and landslide risks in an isolated forest setting. Employing a case study approach (Debout

2016), this research examines how Islamic values such as trustworthiness (*amanah*) and patience (*sabar*) can enhance community resilience to disasters.. Research data encompass information on DRR integration within the curriculum, environmental practices, and pesantren community perceptions, relevant to local risk contexts. Data collection techniques include documentation and semi-structured interviews (Seidman 2013). Documentation involves reviewing curriculum documents, santri guidelines, and activity records, while interviews with six key informants—one *kiai*, two *ustaz*, and three senior santri—selected for their engagement in environmental practices, capture insights into organic disaster preparedness.

Primary data sources comprise three pillars: (1) pesantren curriculum documents, including syllabi for *akhlak*, *fiqh*, and *tafsir* lessons addressing environmental issues; (2) santri guidelines on natural resource management; and (3) activity records detailing tree planting, waste management, and *gotong royong*-based infrastructure development. Data analysis follows Miles and Huberman (1994), involving: (1) data reduction to select relevant texts, (2) data presentation by grouping themes aligned with Sendai priorities—risk understanding, governance, resilience, and preparedness, and (3) conclusion drawing through critical interpretation (Miles, Huberman, and Saldaña 2014). This analysis is enriched with value-based education theory (Hassan et al. 2010) and UNDRR resilience discourse (2024), cross-referenced with studies (Jeon, Nam, and Hong 2023; Díaz and Larroulet 2021; Giustiniani et al. 2018; Aksa 2022) to enhance validity.

FINDINGS AND DISCUSSION

Findings

Pesantren Curriculum Elements: Early Traces of Disaster Risk Reduction

Nestled in the forests of North Sumatra, Pesantren Darussalam Parmeraan stands as an oasis of Islamic education, weaving spiritual values with communal life, creating a space where seeds of disaster risk reduction (DRR) are naturally sown, though not yet fully cultivated. Content analysis of formal curriculum documents—syllabi for *akhlak*, *fiqh*, and *tafsir* lessons—as well as informal materials like student guidelines and *kiai* lecture notes, reveals implicit traces of DRR, akin to a beautiful but incomplete mosaic. These findings uncover captivating potential: the pesantren, with its value-based approach, could serve as a bastion of resilience amid the looming threats of floods and landslides in its isolated, river-adjacent location. However, the absence of a formal structure to instill disaster preparedness signals a critical gap demanding curricular development.

To clarify findings, the following table maps curriculum elements in detail, linking DRR traces to Islamic values, Sendai Framework priorities, and development potential:

Table 1. Mapping Pesantren Curriculum Elements to Disaster Risk Reduction

Curriculum Source	DRR-Related Content	Islamic Values	Link to Sendai Framework	Key Gaps	Development Implications
Akhlak Lessons	Prohibition of harming the earth (QS. Al-A'raf: 56), e.g., keeping rivers clean.	Amanah (responsibility as stewards).	Priority 1: Risk understanding (environmental awareness).	No discussion of flood signs or mitigation.	Module on identifying environmental risks, like rising river levels.
Tafsir Lessons	Sabar and tawakkal in facing calamities (QS. Al-Baqarah: 155-156).	Sabar, tawakkal.	Priority 4: Preparedness (psychological resilience).	Lack of practical disaster response guidance.	Evacuation simulation training based on Islamic values.
Fiqih Lessons	Duty to help others in distress, relevant to collective response.	Social responsibility.	Priority 2: Risk governance (communal coordination).	Not specific to local disaster scenarios.	Material on disaster aid organization based on fiqih.
Kiai Lectures	Tree planting as worship, citing hadith (HR. Ahmad).	Environmental preservation as worship.	Priority 3: Resilience investment (environmental stabilization).	Not structured as formal learning.	“Environmental jihad” module focusing on anti-landslide vegetation.
Student Guidelines	Instructions for waste management and river cleanliness.	Cleanliness as faith.	Priority 1: Risk understanding (preventing water blockages).	Does not link to specific flood risks.	Technical guide on waste management for flood mitigation.

The table above reflects the dynamic tension between the curriculum’s potential and limitations in the DRR context. First, the DRR-Related Content column shows that every curriculum element contains seeds of resilience, but these are implicit and uncoordinated. For instance, Akhlak’s emphasis on river cleanliness aligns with Sendai’s risk understanding priority, yet it fails to teach santri to recognize flood signs like water color changes or rainfall patterns—crucial knowledge given the pesantren’s riverside location. This suggests the curriculum prioritizes moral values over technical skills, a pattern consistent across all sources.

Second, the Islamic Values column reveals the pesantren's unique strength: framing DRR as worship. Amanah in akhlak and "environmental jihad" in kiai lectures create a powerful narrative that can motivate santri to act proactively, as affirmed by Muttarak and Pothisiri, who note that value-based education enhances preparedness (Muttarak and Lutz 2014; Basten, Muttarak, and Pothisiri 2014; Witvorapong, Muttarak, and Pothisiri 2015; Muttarak and Pothisiri 2013). However, critical analysis indicates these values are not yet operationalized into concrete actions. For example, sabar and tawakkal in tafsir bolster psychological resilience (Sendai Priority 4), but without evacuation training, santri risk interpreting calamities as mere fate rather than opportunities for active mitigation.

Third, the Link to Sendai Framework column illustrates that the curriculum inadvertently touches all Sendai priorities, but with uneven distribution. Priority 1 (risk understanding) and Priority 4 (preparedness) are more prominent through akhlak and tafsir, while Priority 2 (governance) and Priority 3 (resilience) are underrepresented, particularly in fiqh, which does not address external coordination with entities like BNPB. This reflects the pesantren's inward-looking nature—strong in internal solidarity but limited in external networks, a challenge given its geographic isolation.

Fourth, the Key Gaps column underscores that the curriculum fails to bridge values and practice. Tree planting inspired by hadith (Priority 3) is a resilience investment, but without knowledge of anti-landslide vegetation like vetiver roots, its impact is limited—a critical weakness on the pesantren's forested slopes. Waste management in student guidelines supports flood prevention, but it does not educate santri on the link between debris and water channel blockages, a real risk noted in BNPB's 2024 North Sumatra reports. These gaps are not merely technical but indicate that the curriculum has not leveraged the pesantren's environmental context as a DRR learning laboratory.

Finally, the Development Implications column offers a transformative vision tying the analysis together. Modules like "environmental jihad" or tawakkal-based evacuation simulations not only bridge gaps but also reinforce the pesantren's identity as a faith-based resilience hub. These implications resonate with Gouramanis and Morales-Ramirez (2020), who assert that culturally grounded approaches are more effective in changing behavior (Graveline et al. 2025; Garcia 2021). By integrating technical knowledge—e.g., flood risk identification training—with Islamic values, the curriculum can transform santri into holistic DRR agents, capable of protecting their communities

amid rising environmental threats (Syarifudin and Destania 2020; Benito and Hudson 2010).

Overall, the curriculum of Pesantren Darussalam Parmeraan is a rich yet incomplete mosaic, with values like amanah and “environmental jihad” as promising pieces. The table analysis confirms that while DRR traces exist, the curriculum is like a river flowing without a dam—full of potential but needing structure to channel it toward true disaster resilience. These findings lay the groundwork for exploring synergy with the Sendai Framework, a step that will reveal how pesantren can pioneer value-based DRR.

Voices from the Pesantren: Narratives of Santri and Kiai on Disaster and Resilience

Beneath the towering mahogany trees in the forests of North Sumatra, Pesantren Darussalam Parmeraan is more than an educational institution—it is a community pulsing with stories, beliefs, and hopes amid the threat of floods flowing with the nearby river and landslides lurking from steep slopes. Narrative interviews with the kiai, three ustaz, and six santri—three senior and three junior—unveil a tapestry of perceptions about disaster and resilience, woven with Islamic values and lived experiences in an isolated environment. These narratives, like a river that is sometimes calm and sometimes turbulent, offer captivating insights into how pesantren education shapes the views of santri and kiai toward environmental risks, while revealing gaps in formal preparedness that await bridging. These findings reinforce the notion that pesantren are value-based resilience laboratories, yet they require a more structured curriculum to channel their communal spirit into disaster risk reduction (DRR).

The ustaz, tasked with teaching akhlak and fiqh, offers a more practical perspective, yet still anchored in values. One ustaz describes guiding santri to build water channels from forest springs, which he says “teaches collective responsibility as in fiqh.” He takes pride in santri routinely monitoring the river for flood signs, like water color changes, but acknowledges they are untrained to recognize landslide risks, such as soil cracks common on forested slopes. Another ustaz highlights waste management—with compost for small gardens and waste sorting—as “cleanliness reflecting faith,” but regrets that this practice is not linked to flood prevention, like reducing water channel blockages. When asked about DRR education, the ustaz reveals that the curriculum focuses more on noble morals than mitigation skills, a gap they feel but are unsure how to bridge.

The santri, as the community’s heart, share narratives full of enthusiasm yet fragmented. Senior santri, involved in gotong royong to build dormitories with forest wood and river stones, describe their work as “worship that makes us strong together.” They take pride in tree planting,

which they see as a “legacy for the future,” but are unaware that their mahogany trees are less effective against landslides compared to plants like vetiver. Junior santri, on the other hand, focus on hands-on experiences, like helping manage clean water or clearing river debris. One junior santri said, “If the river is dirty, the water rises, so we keep it clean to stay safe” (Interview, Oct 2024). Yet, when asked what they would do if a major flood struck, their responses mix “praying” and “running to higher ground,” without knowledge of safe evacuation routes in the pesantren’s narrow valley. The santri narratives reveal a generational gap: senior santri view their practices as part of the pesantren’s identity, while junior santri are more pragmatic but less connected to a long-term vision.

To clarify these narratives, the following table maps the kiai and santri’s perceptions of disaster and resilience, with subcategories linking narratives, Islamic values, Sendai Framework connections, DRR impacts, and identified gaps:

Table 3. Narratives of Kiai and Santri on Disaster and Resilience at Pesantren Darussalam
Parmera

Informant	Main Narrative	Related Islamic Values	Link to Sendai Framework	DRR Impact	Identified Gaps
Kiai	1) Nature is Allah’s trust to be guarded (QS. Al-A’raf: 56); 2) Floods are a test of sabar and tawakkal (QS. Al-Baqarah: 155-156); 3) Gotong royong and tree planting as “environmental jihad” (hadith HR. Ahmad).	1) Amanah: Responsibility as stewards; 2) Sabar and tawakkal: Spiritual resilience; 3) Environmental preservation as worship.	1) Priority 1: Risk understanding (environmental awareness); 2) Priority 4: Preparedness (psychological resilience); 3) Priority 3: Resilience investment (tree planting).	1) Inspires santri to care for the environment; 2) Builds community psychological resilience; 3) Promotes environmental stabilization.	1) Focus on spirituality without practical preparedness; 2) No formal evacuation plan; 3) Tree planting not optimized for landslide mitigation.
Ustaz	1) Clean water management teaches collective responsibility; 2) Waste cleanliness as faith; 3) River monitoring for flood signs.	1) Social responsibility (fiqih); 2) Cleanliness as faith; 3) Amanah toward resources.	1) Priority 2: Risk governance (communal coordination); 3) Priority 1: Risk understanding (flood prevention); 4) Priority 3: Resilience investment	1) Strengthens solidarity through practical tasks; 2) Reduces flood risk from waste; 3) Enhances santri environmental awareness.	1) No training for landslide risks; 2) Curriculum doesn’t link cleanliness to DRR; 3) Focus on practice without long-term strategy.

			(clean environment).		
Senior Santri	1) Gotong royong building dormitories as worship; 2) Tree planting as a future legacy; 3) Monitoring river to prevent overflow.	1) Communal solidarity; 2) Environmental preservation as worship; 3) Amanah toward the environment.	1) Priority 2: Risk governance (collaboration); 2) Priority 3: Resilience investment (soil stabilization); 3) Priority 1: Risk understanding (flood awareness).	1) Builds social bonds for crisis response; 2) Supports environmental resilience; 3) Reduces minor flood risks.	1) Unaware of anti-landslide vegetation; 2) No training for emergency response; 3) Flood awareness limited to simple observation.
Junior Santri	1) Cleaning river to prevent water rise; 2) Helping with clean water as daily duty; 3) Praying if floods come.	1) Cleanliness as faith; 2) Communal responsibility; 3) Tawakkal in crises.	1) Priority 1: Risk understanding (flood prevention); 2) Priority 2: Risk governance (daily tasks); 3) Priority 4: Preparedness (spiritual response).	1) Reduces river blockage risks; 2) Strengthens teamwork; 3) Prayers boost psychological resilience.	1) Unaware of safe evacuation routes; 2) Tasks not linked to DRR; 3) Disaster response limited to prayer and fleeing.

This table illustrates how the kiai and santri's narratives reflect resilience rooted in Islamic values, yet are hindered by structural limitations. First, the kiai's narrative of "environmental jihad" is a spiritual beacon illuminating practices like tree planting, aligning with Sendai's Priority 3 (resilience investment) (Juanzon and Oreta 2018; Kawasaki and Rhyner 2018). However, critical analysis shows that his focus on tawakkal and prayers (Priority 4) without evacuation guidance creates a paradox: the pesantren is psychologically strong but physically fragile amid floods, which BNPB 2024 reports as increasing in North Sumatra (Diskominfo 2024). His reference to QS. Al-A'raf: 56 reinforces amanah (Priority 1) (Rahman and Fang 2019; Satake, McLean, and Alcántara-Ayala 2018; Whitworth, Boulton, and Jones 2020), but without education on landslide signs—like soil cracks common on forested slopes—this narrative is like a sacred text without practical exegesis, a weakness contrasting UNDRR (2023) recommendations for data-driven risk education.

Second, the ustaz bridge values and practice, with water and waste management reflecting communal governance (Priority 2) and environmental awareness (Priority 1). However, the lack of landslide training—a real risk in steep forests—and no explicit link between cleanliness and DRR suggest their education is like a half-built bridge. This resonates with earlier findings that local practices need formal education to maximize impact. For instance, santri river monitoring aids flood prevention, but without knowledge of rainfall patterns (BMKG 2024 notes a 30% rainfall increase), their efforts remain reactive, not proactive.

Third, senior santri offer a robust narrative of solidarity, with gotong royong and tree planting as pillars of governance (Priority 2) and resilience (Priority 3). Yet, their ignorance of anti-landslide vegetation, like vetiver recommended in 2022 geotechnical studies, indicates their “future legacy” is vulnerable to slope erosion (Moh and Hwang 2020). Junior santri, focusing on daily tasks like river cleaning, support risk understanding (Priority 1), but their flood response—“praying” or “running”—reveals a preparedness (Priority 4) void of strategy.

Gaps and Potential: Toward a Disaster-Responsive Pesantren Curriculum

Nestled in the embrace of North Sumatra’s forests, Pesantren Darussalam Parmeraan is a mosaic of resilience adorned with Islamic values and local practices, yet cracks in its curriculum obscure its full potential as a bastion of disaster risk reduction (DRR). Comprehensive analysis of curriculum documents (akhlak, fiqh, tafsir, student guidelines), activity records (gotong royong, tree planting, water management), and interviews with the kiai, ustaz, and santri reveals critical gaps in the pesantren’s approach to disasters—floods threatening from the nearby river and landslides from steep slopes. However, these gaps are not an endpoint but the beginning of a transformative vision: a responsive curriculum weaving amanah, tawakkal, and solidarity with the principles of the Sendai Framework for Disaster Risk Reduction 2015-2030. These findings, like a map showing chasms and bridges, offer a guide to transform the pesantren into a pioneer of value-based DRR, not only for its isolated community but as a globally relevant model.

To clarify gaps and potential, the following table maps findings with a highly detailed structure, linking curriculum shortcomings, relevant Islamic values, Sendai Framework priorities, curriculum development potential, implementation challenges, and expected impacts:

Table 4. Gaps and Potential of Pesantren Curriculum for Disaster Risk Reduction

Curriculum Gap	Related Islamic Values	Sendai Framework Priority	Curriculum Development Potential	Implementation Challenges	Expected Impact
1) No module on flood or landslide risk identification; 2) Santri knowledge limited to intuitive observation (e.g., rising river levels).	1) Amanah: Responsibility to preserve the earth (QS. Al-A'raf: 56); 2) Ilmu: Duty to seek knowledge (QS. Al-Mujadila: 11).	Priority 1: Risk understanding.	1) "Akhlak Lingkungan" module to identify flood signs (water color, rainfall) and landslides (soil cracks); 2) Integrate local BMKG data into religious gatherings; 3) Santri pocket guide on risk indicators.	1) Limited access to technology and data in isolated pesantren; 2) Lack of DRR trainers familiar with Islamic context; 3) Resistance to technical approaches among traditionalists.	1) Santri able to detect risks early, reducing flood impacts; 2) Increased local community awareness through santri; 3) Model replicable in other pesantren.
1) No disaster governance training; 2) Gotong royong focused on routine tasks, not crises; 3) No external engagement (e.g., BNPB).	1) Social responsibility: Helping others (fiqih); 2) Solidarity: Gotong royong as worship.	Priority 2: Risk governance.	1) "Fiqih Bencana" module for crisis organization based on solidarity; 2) Form santri emergency coordination team; 3) Collaborate with local government for governance training.	1) Geographic isolation hinders external collaboration; 2) Limited funds for formal training; 3) Time constraints due to dense pesantren schedules.	1) More coordinated crisis response during floods; 2) External networks strengthen resilience; 3) Islamic-based governance model for other communities.
1) Tree planting not strategic for landslide mitigation; 2) Natural infrastructure limited to small scale; 3) No food reserves for crises.	1) Environmental preservation: Hadith on tree planting (HR. Ahmad); 2) Amanah: Protecting Allah's creation.	Priority Resilience investment.	3: 1) "Jihad Lingkungan" module focusing on anti-landslide plants (vetiver, bamboo); 2) Training in simple technology (retaining walls); 3) Expand communal gardens for food reserves.	1) Limited knowledge of technical vegetation; 2) Funds constrained for additional infrastructure; 3) Limited land in dense forests.	1) Reduced landslide risk on forest slopes; 2) More disaster-resilient infrastructure; 3) Food security during flood crises.

1) evacuation drills or emergency guidelines; 2) Tawakkal risks being seen as resignation; 3) No formal evacuation routes.	No	1) Tawakkal and sabar: Spiritual resilience (QS. Al-Baqarah: 155-156); 2) Ikhtiar: Maximum effort as worship.	Priority Preparedness.	4:	1) Tawakkal- and ikhtiar-based evacuation drills; 2) “Tafsir Kesiapsiagaan” module with emergency guidelines; 3) Map safe evacuation routes in pesantren valley.	1) Narrow valley limits evacuation routes; 2) Low awareness of simulation importance; 3) Spiritual focus may downplay technical urgency.	1) Santri prepared for floods with organized evacuation; 2) Psychological resilience enhanced by skills; 3) Islamic-based preparedness model for global use.
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This table is a compass navigating the chasms and bridges in Pesantren Darussalam Parmeraan’s curriculum, revealing how gaps can be transformed into potential through the lens of the Sendai Framework and Islamic values. First, under Risk Understanding, the absence of risk identification modules is a significant gap. Santri observe rivers, but without knowledge of landslide signs—like soil cracks increasing in North Sumatra per BNPB 2024—they tread a cliff’s edge without a map. The values of amanah and the duty to seek knowledge (QS. Al-Mujadila: 11) provide a foundation for an “Akhlak Lingkungan” module, yet challenges like limited technology in isolated pesantren, as noted by UNDRR (2023) for rural communities, demand creative solutions like BMKG-based pocket guides. This module can transform santri into risk sentinels.

Second, Risk Governance is hindered by robust but routine-focused gotong royong, lacking crisis structures or external networks. Islamic solidarity supports communal coordination, but the pesantren’s isolation—with a single road vulnerable to flooding—mirrors weaknesses identified by Gouramanis and Morales-Ramirez, that local communities often disconnect from formal policies (Graveline et al. 2025; Garcia 2021; Baytiyeh 2018). A “Fiqh Bencana” module and santri emergency team can bridge this gap, though funding and time constraints, common in traditional pesantren, require local government collaboration. The impact—coordinated crisis response and external networks—positions the pesantren as a model for Islamic-based governance, relevant globally.

Third, Resilience Investment is stalled by non-strategic tree planting and small-scale infrastructure. The hadith on tree planting (HR. Ahmad) inspires santri, but choosing mahogany over vetiver—proven effective in 2022 geotechnical studies—limits landslide mitigation on forested slopes. A “Jihad Lingkungan” module and simple technologies can bolster resilience, but limited funds and land, as faced by many rural communities, necessitate NGO partnerships. The impact—

reduced landslide risk and food security via gardens—aligns with Sustainable Development Goals (SDG 13) (Schmidt Tagomori et al. 2024), amplifying this study’s relevance. This analysis affirms Muttarak and Pothisiri’s argument that cultural values must be paired with technical innovation for maximum impact (Muttarak and Lutz 2014).

Fourth, Preparedness is the deepest gap, with strong *tawakkal* but no evacuation drills, like a ship without lifeboats amid floods. The *pesantren*’s narrow valley heightens risks, as BMKG 2024 reports rising flash floods. A “*Tafsir Kesiapsiagaan*” module and mapped evacuation routes, blending *ikhtiar* with *tawakkal*, offer a solution that preserves Islamic identity, but awareness and topographic challenges demand a phased approach. The impact—*santri* ready for organized evacuation and a faith-based preparedness model—answers Sendai’s call for inclusive approaches, with potential replication in other value-based communities.

Discussion

This study reveals that *Pesantren Darussalam Parmeraan*, nestled in the forests of North Sumatra, possesses a natural foundation for disaster risk reduction (DRR) through local practices and Islamic values, yet its curriculum is not fully responsive to the tangible threats of floods and landslides. These findings align with studies indicating that value-based education can support DRR but requires a formal structure for maximum effectiveness (Didham and Ofei-Manu 2020; Towers et al. 2014; Towers 2012). Values such as *amanah* (QS. Al-A’raf: 56) and *tawakkal* (QS. Al-Baqarah: 155-156), reflected in communal cooperation (*gotong royong*), water management, and tree planting, mirror the Sendai Framework’s priorities—risk understanding, governance, resilience investment, and preparedness. However, the absence of technical modules, such as evacuation training or landslide risk identification, echoes findings that DRR education in Indonesia is often fragmented (Amri et al. 2022), particularly in informal institutions like *pesantren*.

The presence of local practices, such as forest-sourced water channels and waste management, demonstrates intuitive environmental awareness, which Oktari suggests can be a resilience asset if bolstered by scientific knowledge (Rina Suryani Oktari, Comfort, et al. 2020). Yet, the *pesantren*’s geographic isolation—with a single access road vulnerable to disruption, as reported in 2022—heightens vulnerability, a challenge identified by UNDRR (2023) for remote communities (Haer, Botzen, and Aerts 2019). The *kiai*’s narrative of “environmental *jihad*,” citing the hadith on planting trees (HR. Ahmad), is a potent cultural asset, resonating with Gouramanis and Morales-Ramirez (2020) who argue that culturally grounded approaches are more effective in behavior

change (Graveline et al. 2025). However, without strategies like using anti-landslide plants (e.g., vetiver), these efforts remain limited, as evidenced by a 2022 geotechnical study highlighting the weaknesses of non-specific vegetation on steep slopes (Fata, Tarigan, and Wibowo 2022).

The preparedness gap is most striking. The santri's psychological resilience, imbued with *tawakkal*, supports Muttarak and Pothisiri's findings that cultural values strengthen crisis response (Muttarak and Lutz 2014; Basten, Muttarak, and Pothisiri 2014). However, without evacuation drills, the pesantren is akin to a fortress without an emergency gate, particularly in a narrow valley prone to flash floods, as noted by BMKG (2024) with a 30% rainfall increase in North Sumatra. While *gotong royong* is robust, it is not channeled into crisis governance, a shortfall contrasting with Sendai's emphasis on inclusive coordination. The lack of engagement with external entities, such as BNPB, reflects a structural isolation common in traditional pesantren, underscoring the need for bridges to formal policy.

The potential for curriculum development "Environmental Akhlak," "Fiqh of Disaster," "Environmental Jihad," and *ikhtiar*-based simulations—offers solutions integrating spirituality and science. These modules could transform santri into DRR agents, as recommended by UNDRR for community-based education. However, challenges like limited funding, land, and resistance to technical approaches, prevalent in religious institutions, necessitate collaboration with NGOs and local government. The impact extends beyond the local—mitigating flood losses reaching trillions of rupiah (BNPB, 2024)—to global contributions, supporting SDG 4 (quality education) and 13 (climate action). This study enriches the literature by highlighting pesantren as a faith-based DRR model, underexplored compared to formal schools. Future research in other pesantren and the development of Islamic value-based modules will further strengthen their role as pioneers of resilience in an era of climate change.

CONCLUSION

This study aims to integrate the Sendai Framework's disaster risk reduction (DRR) principles into the curriculum of Pesantren Darussalam Parmeraan, North Sumatra, to enhance the resilience of an isolated community facing flood and landslide risks. Findings indicate that local practices, such as *gotong royong*, tree planting, and water management, alongside Islamic values like *amanah*, *tawakkal*, and solidarity, align with Sendai priorities: risk understanding, governance, resilience investment, and preparedness. However, limitations, including the absence of evacuation training,

unstructured risk knowledge, and minimal external collaboration, hinder effectiveness. Curriculum modules such as “Environmental Akhlak,” “Disaster Fiqh,” and *ikhthiar*-based simulations are proposed to merge disaster science with Islamic values, bolstering community capacity. This study yields a faith-based DRR model, enriching Islamic education and supporting Sustainable Development Goals (SDG 4, 13). Replicable in other pesantren, this model offers an innovative approach to disaster resilience education in vulnerable regions, contributing to the advancement of global academic literature.

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