

Climate Crisis and Social Inequality: Resilience of Vulnerable Communities Facing Recurrent Disasters in Indonesia

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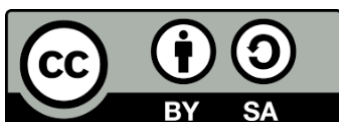
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Abstract

The climate crisis does not produce socially uniform impacts. Intensifying hydrometeorological hazards interact with poverty, asset inequality, housing quality, access to services, gender and age inequalities, employment status, and institutional capacity, causing socially vulnerable groups to experience greater losses and slower recovery. This article examines how recurrent disasters can transform community resilience from a learning process into a process of capacity erosion. The study employs a structured integrative review and secondary-data synthesis focused on Indonesia with global comparative evidence. The core literature comprises 40 sources selected for substantive relevance, traceability, publisher quality, and methodological strength; 20 are peer-reviewed international journal articles published between September 2023 and 2026. Current data are drawn primarily from WMO, BNPB, BPS-Statistics Indonesia, UNDRR, IPCC, and the World Bank. Four principal findings emerge. First, repeated exposure does not automatically strengthen resilience; when the interval between shocks is shorter than the time required for recovery, asset losses, debt, livelihood disruption, and impaired social functioning can accumulate. Second, social inequality acts as a risk multiplier by limiting households' ability to mitigate hazards, access assistance, and convert experience into adaptive investment. Third, social capital is essential but finite; recent longitudinal evidence indicates that cumulative disaster exposure can erode bonding social capital, social support, and social functioning. Fourth, adaptive social protection, inclusive governance, risk financing, and ex-ante investment can interrupt cumulative vulnerability. The article's principal novelty is the Cumulative Vulnerability-Resilience Spiral (CVRS), a framework connecting structural inequality, recurrent exposure, recovery debt, depletion of livelihood and social capital, and greater vulnerability to subsequent shocks. The framework advances a dynamic, distributive, and justice-oriented approach to measuring resilience and designing disaster policy in Indonesia. Keywords: climate crisis; social inequality; community resilience; recurrent disasters; vulnerability; adaptive social protection; climate justice

Keywords: Climate Crisis, Social Inequality, Community Resilience, Recurrent Disasters, Vulnerability



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INTRODUCTION

The climate crisis can no longer be understood only as a problem of rising temperatures or changes in the probability of natural hazards. It is fundamentally sociological because the same physical event produces different consequences when it intersects with class structure, asset distribution, institutional quality, territorial inequality, employment status, social networks, and unequal influence over public decisions. The IPCC (2022, 2023) emphasizes that climate risk emerges from interactions among hazards, exposure, and vulnerability, so unequal development can magnify losses even where physical hazards are comparable. In Indonesia, the World Bank (2023) likewise treats climate resilience as integral to development rather than as a separate sectoral agenda. The World Meteorological Organization reported that 2025 was the second- or third-warmest year in the global observational record, with annual global mean near-surface temperature about $1.43 \pm 0.13^{\circ}\text{C}$ above the 1850-1900 pre-industrial average; 2015-2025 were the eleven warmest years on record (World Meteorological Organization [WMO], 2026a). Across Asia, dangerous heat, destructive rainfall and flooding, drought, glacier loss, and record ocean heat in 2025 demonstrated how climate change is already multiplying pressure on societies and economies (WMO, 2026b). The critical question is therefore not simply whether a population is exposed, but who absorbs the losses, how often recovery must begin again, and which resources are available to prevent the next shock from producing the same or greater harm.

The social vulnerability perspective rejects the assumption that disasters are purely "natural" events whose consequences are determined mainly by hazard magnitude. Cutter et al. (2003) demonstrated that vulnerability is embedded in social and spatial characteristics shaping the ability to anticipate, withstand, and recover. Wisner et al. (2004) located disaster risk in social processes that produce unsafe conditions through unequal access to resources and power. Contemporary evidence strengthens this argument. Using more than 7,000 climate-related disasters, Teber et al. (2026) showed that human development is a powerful determinant of disaster impacts and that inequality in human development amplifies risk in the least-developed settings. Hosseinzadehtalaei et al. (2025) similarly project disproportionate exposure to floods, heatwaves, droughts, and compound hot-dry extremes in low-income countries. Climate shapes hazards, but social structures strongly determine who moves from being physically exposed to becoming severely and persistently affected.

Indonesia is an especially important setting for examining this interaction. The National Disaster Management Agency recorded 5,400 disaster events during 2023, illustrating the high frequency of disruptions across the archipelago (Badan Nasional Penanggulangan Bencana [BNPB], 2024). For 2024, BNPB reported 540 deaths, 63 missing persons, 11,531 injured people, and 8,136,271 people affected and displaced. Reported physical damage included 80,304 houses, 612 education facilities, 415 places of worship, 82 health facilities, 89 office facilities, and 445 bridges (BNPB, 2025). The 2025 national disaster-data volume, published in 2026, again documents the prominence of hydrometeorological events in Indonesia's risk landscape (Rosyida et al., 2026). These data matter not only because of the number of events, but because recurrence can transform a sequence of temporary losses into long-term social decline. A first flood may eliminate savings; a second may force the sale of productive assets; a subsequent event may generate high-cost debt, involuntary mobility, interrupted schooling, or occupational downgrading.

Macroeconomic improvement does not eliminate this vulnerability. In March 2026, Indonesia's national poverty rate fell to 8.07%, representing approximately 22.93 million people, yet rural poverty remained 10.67%, substantially higher than the urban rate of 6.34% (BPS-Statistics Indonesia [BPS], 2026a). The national expenditure Gini ratio was 0.368 (BPS, 2026b). These indicators are important, but disaster vulnerability depends on the distribution of adaptive capacity behind national averages. Households just above the poverty line may

fall back below it after productive assets are destroyed. Informal workers can lose income immediately when transport and markets are disrupted. Renters and residents of inadequate settlements may have little authority to reinforce buildings. Women may absorb additional unpaid care work, while older people and persons with disabilities can face evacuation and service-access barriers. Statistical non-poverty therefore cannot be assumed to mean that a household possesses sufficient economic buffers to withstand repeated shocks.

Community resilience scholarship has made an important contribution by shifting attention from vulnerability alone toward adaptive capacity. Norris et al. (2008) conceptualized community resilience through networks of capacities involving economic development, social capital, information and communication, and community competence. Adger (2000) framed social resilience as the capacity of groups to cope with external stresses, while Aldrich and Meyer (2015) demonstrated the importance of social capital for mobilizing information, assistance, and post-disaster recovery. Yet the success of the resilience concept has created a conceptual difficulty: resilience is frequently discussed as though it accumulates linearly after disaster experience. Narratives celebrating "resilient communities" may unintentionally shift responsibility from institutions and structural inequality toward communities themselves, implying that persistent hardship reflects insufficient local strength rather than repeated exposure and unequal access to recovery resources.

Recent empirical research challenges the assumption that disaster experience necessarily produces positive learning. Li and McNaught (2026) found that cumulative exposure to climate-related disasters can erode bonding social capital, with particularly strong effects among younger cohorts, renters, and socioeconomically disadvantaged areas. Lam and Li (2025) reported reduced social functioning and increased loneliness after climate-related disasters, with some social consequences persisting for several years. Li and Leppold (2025) further demonstrated that multiple climate-disaster exposures are associated with adverse long-term mental-health trajectories. These findings are consequential for policy because local response systems frequently depend on family, neighbors, community organizations, and volunteers as buffers when formal provision is incomplete. If those social reserves can themselves be depleted through repeated mobilization, resilience must be analyzed as a changing stock of material, psychosocial, and relational capacities rather than as a fixed moral quality of a community.

Global flood research provides further evidence that disaster consequences are socially configured. Fox et al. (2024) demonstrate that high-resolution flood-risk mapping becomes substantially more policy-relevant when social vulnerability is integrated into hazard analysis. Sauer et al. (2024) find only limited global progress in reducing vulnerability to flood impacts over the past two decades, indicating that economic growth and technological development do not automatically eliminate risk. Vestby et al. (2024) show that political and socioeconomic conditions shape flood-induced displacement, while Mester et al. (2025) identify socioeconomic predictors of displacement vulnerability. Vesco et al. (2025) find that political development and institutional conditions are associated with reduced human costs of flooding. Together, these studies redirect analysis from hazard intensity toward the interaction among hazards, socioeconomic structures, and state capacity.

The temporal dimension, however, remains insufficiently developed. Many vulnerability and resilience indices provide a snapshot at a single point in time, whereas recurrent disasters operate through cumulative processes. A household that has not replaced productive equipment after the first flood enters the second flood with lower capacity. A village government repeatedly spending limited funds on repairs may postpone development investment. Mutual-aid networks that are mobilized again and again may experience fatigue. A child who repeatedly loses weeks of schooling experiences a different developmental trajectory from a child exposed to a single interruption. A small business that repeatedly loses

inventory may lose access to formal credit. The key variable is therefore not only "how vulnerable was the household before the event?" but also "how complete was recovery before the next event?" Pinho et al. (2025), analyzing compound risks in the Brazilian Amazon, show how escalating floods, droughts, heatwaves, fires, and landslides create disproportionate burdens for Indigenous and traditional communities and narrow the space available for recovery.

A second gap concerns the separation between community-resilience research and social-protection research. In Indonesia, Surtiari et al. (2024) show that informal social protection is highly relevant to climate adaptation, but it cannot substitute for formal protection. Globally, Huber and Murray (2024) argue that national social-protection systems can provide a channel for loss-and-damage finance, while Mackinder et al. (2025) identify both synergies and challenges in linking social-protection and climate-adaptation finance. Aleksandrova et al. (2024) show that climate-finance access for social protection still faces institutional and funding barriers. Fragmentation occurs when disaster management focuses on emergency response, social policy focuses on routine poverty, and climate policy focuses on adaptation projects, even though households experience all three dimensions simultaneously.

A third gap concerns how resilience is judged. Composite resilience indicators can improve while concealing deteriorating outcomes among particular subgroups. Liu et al. (2025) propose a human-centric disaster-resilience perspective that foregrounds social equity and well-being rather than infrastructure restoration alone. Yang et al. (2024), using time-series evidence in rural Cambodia, demonstrate the value of measuring resilience dynamically, while Lerner and Van Praag (2024) highlight the importance of local leadership and social relationships in environmental-disaster resilience. A community therefore cannot be considered fully "recovered" merely because a main road has reopened if the poorest households remain indebted, women's paid work has not resumed, people with disabilities have lost service access, or local support networks have become more fragile.

The research gap addressed in this article is the lack of an integrated explanation connecting four processes: (1) pre-disaster structural inequality; (2) recurrent or compound hazard exposure; (3) incomplete recovery that creates recovery debt; and (4) gradual erosion of assets, mental health, and social capital that increases vulnerability to the next shock. Recent global studies identify individual components of this process, but relatively few syntheses conceptualize recurrent disasters as a mechanism reproducing social inequality at community level, particularly in Indonesia. Existing approaches also tend to analyze social capital separately from formal social protection, even though Indonesian evidence indicates that the two interact, complement one another, and can also be forced into unhealthy substitution (Surtiari et al., 2024).

This article addresses three questions. First, through what social mechanisms do recurrent disasters transform resilience into cumulative vulnerability? Second, how do economic and social inequalities shape the speed and completeness of recovery? Third, which interventions can interrupt vulnerability accumulation before the next shock? The article's novel contribution is the Cumulative Vulnerability-Resilience Spiral (CVRS), a conceptual framework treating resilience as a dynamic trajectory. Under the CVRS, recurrent exposure can generate two pathways: a reinforcing resilience pathway when learning is translated into protection, investment, and institutional access; or an erosion pathway when losses occur faster than recovery, generating recovery debt, depleting multiple forms of capital, and magnifying subsequent vulnerability. This reframes disaster sociology from asking only "who is vulnerable?" to asking "how is vulnerability reproduced or interrupted from one disaster to the next?"

RESEARCH METHODS**1. Research design**

This study uses a structured integrative review combined with secondary-data synthesis. The design is appropriate because the research questions require integration across social vulnerability theory, community resilience, social capital, inequality, social protection, and empirical evidence on repeated exposure. Unlike a systematic review designed to estimate a single pooled effect across homogeneous studies, an integrative review can combine longitudinal quantitative research, global comparative studies, qualitative case studies, policy analysis, and institutional reports. Search and reporting procedures were designed to be structured and transparent, but the study does not claim to be a meta-analysis. No primary interviews, focus-group discussions, surveys, or observations were conducted; all empirical claims are traceable to published research and official secondary sources.

2. Search strategy and time boundary

Structured searches covered relevant English- and Indonesian-language publications available up to 10 August 2026. Search terms were combined around "climate disaster," "recurrent disaster," "multiple disaster exposure," "compound hazards," "social inequality," "social vulnerability," "community resilience," "social capital," "poverty," "displacement," and "adaptive social protection," along with Indonesian equivalents. Searches prioritized publisher pages, scholarly records with verifiable DOIs, and official institutional portals. Publications from 2023-2026 were prioritized for current empirical findings, while older studies were retained when foundational to the theoretical framework. This strategy deliberately emphasizes traceability over volume: references were included only when their bibliographic identity and relevance could be verified.

3. Inclusion criteria and evidence quality

Sources were included when they contributed to at least one analytical function: testing inequality as a determinant of disaster risk; examining repeated or compound disaster exposure; measuring changes in social capital, mental health, recovery, or displacement; analyzing community resilience longitudinally; evaluating social protection and adaptation finance; or providing current official data on climate, disasters, poverty, and inequality. Peer-reviewed studies were prioritized when published in traceable international journals, assigned DOIs, transparent about data and methods, and methodologically appropriate to their claims. For national and global statistics, primary institutional sources such as WMO, BNPB, BPS, UNDRR, IPCC, and the World Bank were preferred over secondary media reporting.

4. Core corpus and recent-literature proportion

The final reference list contains 40 core sources. Twenty sources (50%) are peer-reviewed international journal articles published within the three-year period preceding manuscript preparation, from 29 September 2023 through August 2026. They include articles in *Nature Communications*, *Communications Earth & Environment*, *The Lancet Public Health*, *Scientific Reports*, *Risk Analysis*, *Disasters*, *Climate Policy*, *WIREs Climate Change*, *Journal of Rural Studies*, *Journal of Integrative Environmental Sciences*, *Sustainable Development*, *Global Social Policy*, and *International Journal of Disaster Risk Reduction*. The remaining sources consist of foundational scholarship and authoritative institutional reports required for theory, context, and current statistics. This composition intentionally balances recency with conceptual continuity.

5. Synthesis procedure

Evidence was coded across six domains: (1) hazard intensification and exposure; (2) pre-disaster social position; (3) direct loss and disruption; (4) recovery between shocks; (5) changes in economic, human, social, and institutional capital; and (6) interventions that reduce or intensify vulnerability. Each source was reviewed for the direction of relationships, population groups most affected, proposed mechanisms, and policy implications. Statistical effects were not pooled because designs and outcomes were heterogeneous. Instead, pattern matching was used to assess whether findings from different methods and settings converged on common cumulative mechanisms.

6. Operational definitions

"Recurrent disaster" refers here to exposure to two or more disruptive events affecting a household or community before the consequences of previous events have been fully recovered; the events may involve the same hazard or different hazards in sequence. "Resilience" is defined as the capacity to anticipate, absorb, adapt to, and transform conditions without reproducing or deepening injustice. "Recovery debt" is an analytical concept denoting accumulated unresolved recovery needs, including financial debt, unreplaced assets, unrepaired infrastructure, learning loss, impaired health, deferred care obligations, and weakened social relations. It is not an official administrative category; rather, it is a conceptual bridge linking one disaster to vulnerability during the next.

7. Validity, limitations, and ethics

Validity was strengthened through triangulation among global comparative studies, longitudinal research, evidence from lower- and middle-income settings, Indonesia-specific studies, and official statistics. Numerical claims were restricted to verifiable primary institutional or peer-reviewed sources. Nevertheless, the review cannot substitute for longitudinal household research in Indonesia, and it cannot estimate causal differences across provinces, class positions, genders, ages, disability statuses, ethnicities, and hazard types. Because the study uses published materials and aggregate secondary data with no identifiable human participants, human-subject ethics approval was not required. The CVRS should therefore be treated as a conceptual model for empirical testing rather than as a validated predictive instrument.

RESULT AND DISCUSSION**Results****A. Climate and disaster context: frequency is only part of the problem**

Recent evidence indicates that social systems must prepare not only for larger extremes but also for sequences of events that shorten the time available for recovery. WMO (2026a) reported that 2025 global mean near-surface temperature was approximately 1.43°C above the pre-industrial average, while WMO (2026b) documented dangerous heat, destructive flooding, severe drought, glacier retreat, and extensive marine heat in Asia. UNDRR (2025) estimates direct global disaster costs at roughly US\$202 billion annually, while broader costs including cascading and ecosystem consequences may exceed US\$2.3 trillion. These figures highlight two issues. First, visible physical asset loss captures only part of the social cost. Second, disasters have intertemporal consequences through debt, interrupted education, lost income, adverse health, displacement, and damaged networks that may not be recorded as disaster losses.

Indonesia's official statistics show the scale of disruption that can place local recovery systems under repeated pressure. BNPB (2024) recorded 5,400 events in 2023. In 2024, more

than 8.13 million people were affected and displaced, with tens of thousands of houses and hundreds of education, health, religious, office, and bridge facilities damaged (BNPB, 2025). The national 2025 disaster-data publication again shows the central role of hydrometeorological hazards in Indonesia's disaster profile (Rosyida et al., 2026). These statistics do not imply uniform recurrence across the country, but they indicate a substantial probability that some communities will encounter multiple disruptions over relatively short periods. From a resilience perspective, the difference between two communities experiencing the same number of floods depends not only on water depth, but also on whether households restored savings, repaired housing, received assistance, and reduced exposure before the next flood.

Table 1. Current contextual indicators for interpreting cumulative disaster risk in Indonesia

Indicator	Latest value	Analytical significance	Source
Global warming, 2025	~1.43 ± 0.13°C above 1850-1900; 2015-2025 = 11 years	Climate stress is operating on a progressively warmer baseline	WMO, 2026a
Indonesia disasters, 2023	5,400 events	High national frequency raises the probability of recurrent exposure in some locations	BNPB, 2024
Indonesia disaster impacts, 2024	540 deaths; 8,136,271 affected/displaced; 80,304 houses damaged	Social losses exceed physical assets and can generate recovery debt	BNPB, 2025
Poverty, March 2026	8.07%; 22.93 million people; rural 10.67% vs urban 6.34%	Recovery buffers differ strongly by social position and territory	BPS, 2026a
Expenditure inequality, March 2026	Gini ratio 0.368	Economic capacity for mitigation and recovery is unevenly distributed	BPS, 2026b

B. Inequality as an impact multiplier

The synthesis identifies at least five mechanisms through which inequality multiplies disaster impacts. First, asset inequality shapes the ability to invest in pre-disaster measures such as housing reinforcement, relocation of valuables, insurance, savings, or income diversification. Second, service inequality determines access to safe water, health care, transport, communication, education, and evacuation facilities. Third, labor-market inequality determines income continuity during disruption; daily and informal workers lose earnings quickly when mobility and markets stop. Fourth, political inequality influences whose neighborhoods and needs receive protection, relocation, assistance, and reconstruction resources. Fifth, information inequality determines whether warnings can be understood and acted upon. The global evidence of Teber et al. (2026) and the human-centric framework of Liu et al. (2025) both support the conclusion that human development and well-being are not merely background variables but constitutive components of risk.

Risk is also spatially stratified. Fox et al. (2024) show that incorporating social vulnerability into global flood-risk mapping reveals areas where physical hazards overlap with social disadvantage. Hosseinzadehtalaei et al. (2025) project disproportionately high future exposure to several climate extremes in lower-income countries, while Pinho et al. (2025) show how compound risks in the Amazon disproportionately affect Indigenous and traditional communities. Indonesia differs institutionally and geographically, but the sociological logic is similar: the highest risk emerges where hazard, exposure, and constrained capacity coincide. Policies relying only on hazard maps may therefore generate distributional bias. A location with "moderate" physical hazard but extremely high social vulnerability may

require more urgent intervention than a location with high hazard that has strong protective infrastructure and financial resources.

Indonesia's poverty profile provides a relevant social baseline. Approximately 22.93 million people remained below the poverty line in March 2026, and rural poverty at 10.67% remained markedly higher than urban poverty at 6.34% (BPS, 2026a). A national Gini ratio of 0.368 (BPS, 2026b) does not directly measure disaster vulnerability, but it confirms unequal distribution of consumption capacity. Vulnerability also extends beyond officially poor households. Hallegatte et al. (2017) show that disasters can produce welfare losses far greater than measured asset losses because poorer households possess fewer buffers and face higher marginal welfare costs when consumption falls. Winsemius et al. (2018) likewise demonstrate a strong relationship between poverty and exposure to floods and droughts. Near-poor populations should therefore be treated as at risk of disaster-induced impoverishment rather than automatically classified as resilient because they sit above an administrative poverty threshold.

C. From experience to learning or to exhaustion

Classical resilience research often emphasizes learning: communities with prior disaster experience may recognize warning signs, strengthen communication, organize volunteers, and improve preparedness. Yang et al. (2024), using time-series findings in rural Cambodia, demonstrate that resilience changes over time and that longitudinal measurement can capture this evolution. Ross et al. (2024) emphasize knowledge transmission and social learning in disaster-risk reduction. Lerner and Van Praag (2024) show how local leaders and social relations can mediate resilience. These studies support the positive CVRS pathway: experience can become information that, when converted into collective action, investment, and institutional support, reduces losses during subsequent events.

Yet learning requires resources for implementation. Knowing that a house should be elevated is not the same as being able to finance construction. Knowing an evacuation route does not eliminate mobility barriers for older people or persons with disabilities. Knowing that income diversification is desirable does not create alternative employment. Inequality therefore separates "adaptive knowledge" from "adaptive capacity." Although Formetta and Feyen (2019) documented a long-run decline in global vulnerability to several climate-related hazards, that progress was uneven and did not eliminate pockets of social vulnerability. Sauer et al. (2024) find only limited progress in reducing global flood vulnerability over two decades, suggesting that accumulated experience does not automatically produce lower risk. Vesco et al. (2025) demonstrate that political development and institutional capacity are associated with lower flood mortality. Experience becomes resilience when institutions allow information, compliance, resources, and protective investment to work together.

D. Cumulative exposure and erosion of social capital

The most direct evidence for the article's core argument comes from research explicitly measuring repeated exposure. Li and McNaught (2026) find that increasing cumulative exposure to climate-related disasters has an erosive effect on bonding social capital. The negative effect is particularly pronounced among younger groups, renters, and socioeconomically disadvantaged areas. This finding challenges the assumption that solidarity will always strengthen after disasters. Initial events may increase mutual aid through temporary shelter, food sharing, information exchange, and volunteerism. However, when needs recur while local resources remain limited, the same networks can experience exhaustion, distributive conflict, perceived unfairness, or withdrawal.

Lam and Li (2025) find that climate-related disaster exposure is associated with reduced social functioning and increased loneliness from the disaster year through the

following two years, with some reductions in social support persisting longer. Li and Leppold (2025) show that multiple disaster exposures are associated with adverse long-term mental-health trajectories. Sociologically, mental health and social capital are mutually reinforcing: persistent stress can reduce the capacity to participate in community life, while weakened support networks increase psychological burden. Recurrent disasters can therefore create a feedback loop in which declining individual well-being reduces collective capacity and declining collective capacity increases vulnerability at the individual level.

E. Displacement, mobility, and reproduction of inequality

Floods and other hazards can trigger temporary or permanent movement, but the ability to move safely is itself stratified. Vestby et al. (2024) show that socioeconomic, political, and security conditions shape flood-induced displacement internationally. Mester et al. (2025) identify socioeconomic predictors of flood-displacement vulnerability. For vulnerable communities, the available choice is often not a free decision between "staying" and "moving" but a trade-off among different risks: remaining in a dangerous location because livelihoods and social networks are anchored there, or relocating while risking job loss, educational disruption, land insecurity, and weaker support networks.

Recurrent disasters can transform mobility from an adaptive strategy into a mechanism reproducing inequality. Asset-rich households may plan relocation, retain old assets, or purchase protection; low-income households are more likely to move after loss and may relocate to low-cost places with new risks. Displacement can also break bonding and bridging social capital. Relocation success should therefore be measured beyond the number of households moved. Relevant outcomes include livelihood stability, transport costs, continuity of education, access to services, perceived security, tenure, and changes in social support after relocation. This process-oriented view follows social-vulnerability approaches that treat risk as socially produced rather than as a property of place alone (Cutter et al., 2003; Wisner et al., 2004).

F. Formal and informal social protection

Indonesia's traditions of mutual assistance, family support, religious organizations, rotating savings groups, neighborhood associations, and other informal mechanisms are essential in crises. Surtiari et al. (2024) show that informal social protection is relevant for strengthening climate adaptation, although effectiveness varies by form and context. The critical implication is that social capital should not justify reduced formal protection. Formal systems should replenish and support informal networks rather than depend on them until exhaustion. When emergency transfers, health care, employment protection, and recovery assistance are delayed, family and neighbors fill institutional gaps; if this repeatedly occurs, "community resilience" can become a mechanism through which institutional responsibility is shifted onto households.

Huber and Murray (2024) argue that social-protection systems can channel loss-and-damage finance because they possess registration and delivery infrastructure close to affected households. Mackinder et al. (2025) identify potential synergies between climate finance and social-protection finance, while Aleksandrova et al. (2024) show continuing barriers to mobilizing climate finance for social protection. Together, these findings support adaptive social protection: programs should respond not only to chronic poverty but also expand coverage, benefit levels, and speed when hazard or impact indicators exceed predefined thresholds. In CVRS terms, such intervention interrupts the spiral by preventing households from selling productive assets, taking high-cost debt, reducing essential consumption, or withdrawing children from school.

G. The Cumulative Vulnerability-Resilience Spiral (CVRS)

The synthesis supports a six-stage CVRS. Stage one is initial inequality, consisting of differences in assets, housing quality, health, education, employment, networks, and institutional access. Stage two is the shock, a climate-related event producing loss and disruption. Stage three is differentiated recovery: households with greater capital repair, replace, or upgrade, whereas resource-constrained households make partial or temporary repairs. Stage four is recovery debt, the residual unmet recovery need that remains when an emergency is officially considered over. Stage five is capital depletion, including savings, productive assets, physical and mental health, care time, educational quality, social trust, and institutional legitimacy. When another hazard occurs, the community enters stage six with lower effective capacity, increasing relative loss. The cycle then repeats.

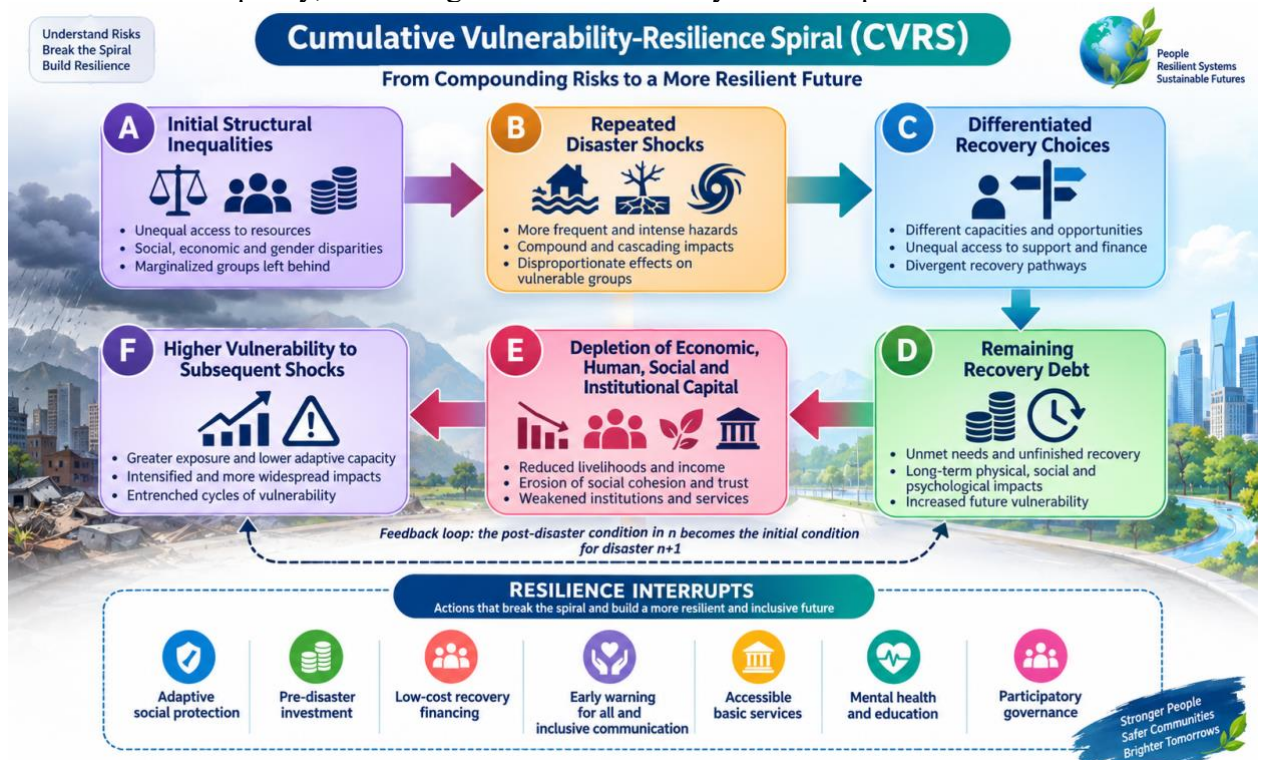


Figure 1. Conceptual model of the Cumulative Vulnerability-Resilience Spiral (CVRS)

The spiral is not deterministic. It can be reversed through "resilience interrupts": adaptive social protection, low-cost recovery finance, insurance or risk-sharing mechanisms, resilient infrastructure, household retrofitting, inclusive early warning, mental-health services, continuity of education, labor protection, and participatory governance. Social learning becomes a resilience interrupt when institutions and households have resources to act on knowledge. CVRS thus integrates social-capital theory (Aldrich & Meyer, 2015), social vulnerability (Cutter et al., 2003), resilience as networked capacity (Norris et al., 2008), and disaster-welfare economics (Hallegatte et al., 2017), while adding a temporal proposition: the post-disaster state after event n becomes the pre-disaster condition for event $n+1$.

The framework generates four testable propositions. P1: the shorter the interval between shocks relative to recovery time, the greater the probability of declining asset stocks and well-being. P2: social inequality magnifies divergence in post-disaster trajectories because resource-rich households are more able to convert learning into adaptive investment. P3: repeated exposure without adequate institutional support reduces the capacity of social capital to function as a protective buffer. P4: interventions delivered before asset sales, school withdrawal, high-cost borrowing, or involuntary migration occur will have larger

distributional benefits than assistance that partially compensates losses after negative coping strategies have already been adopted. These propositions create a concrete research agenda for Indonesian panel surveys and policy evaluation.

Table 2. Testable propositions derived from the CVRS framework

Proposition	Mechanism	Key indicators	Empirical expectation
P1: Inter-shock interval	A new shock arrives before recovery is complete	Days/months between events; asset replacement; income recovery	Shorter interval → larger decline in assets and well-being
P2: Trajectory inequality	Resources determine whether learning becomes adaptation	Income, assets, tenure, insurance, assistance access	Better-resourced groups recover faster; recovery gaps widen
P3: Social-capital erosion	Repeated mobilization depletes network resources	Bonding/bridging/linking capital; support; trust	Cumulative exposure without formal support → weaker buffering
P4: Intervention timing	Preventing negative coping avoids long-run scarring	Asset sales, costly debt, school withdrawal, involuntary migration	Support before negative coping → larger distributional benefits

Discussion

A. Reframing resilience as a trajectory

The article's central implication is the need to shift resilience away from the metaphor of "bouncing back" toward trajectory analysis. Communities do not return to an identical baseline after a disaster. Each shock changes the distribution of assets, relationships, health, experience, and expectations. Some actors may emerge stronger because they receive new investment, information, or assistance; others experience irreversible losses. Resilience is therefore intrinsically distributive. Average village income may recover while the poorest households remain indebted. Infrastructure may be reconstructed while informal workers permanently lose customers. Schools may reopen while some children do not return. Aggregate indicators can create resilience masking, where majority recovery conceals deterioration among groups with the least political and economic power.

The theoretical consequence is that resilience cannot be separated from justice. Adger (2000) situates the capacity to withstand stress within institutions and resource access, while Norris et al. (2008) conceptualize resilience as a network of capacities. CVRS extends these traditions by asking how those capacities change after each event. This is consistent with Liu et al.'s (2025) human-centered approach and Teber et al.'s (2026) evidence on the importance of human development. Just resilience is not only a reduction in total loss; it is also a narrowing of the gap between groups that recover rapidly and those that are repeatedly left behind.

B. Why experience does not automatically become adaptation

The "learning from disaster" narrative often assumes knowledge is the main constraint. The synthesis indicates that resources and authority are often more binding constraints. Households may understand flood risk but lack secure tenure needed to reinforce housing. Fishers may recognize changing seasons but lack finance to diversify livelihoods. Local governments may know risk hotspots yet remain locked into repeated emergency and rehabilitation expenditure. Experience produces adaptation only when at least three conditions

are present: financial capacity, authority to act, and institutional support. Without them, repeated experience can generate anxiety and fatigue rather than transformation.

Li and McNaught's (2026) finding on social-capital erosion clarifies the limits of "community as solution." Mutual aid works when needs can be met using resources circulating through networks. In recurrent disasters, large proportions of a network may be affected simultaneously, reducing internal redistributive capacity. Networks also have costs: time, money, housing space, care work, and emotional labor. When the state repeatedly relies on informal solidarity without replenishing resources, social capital changes from a buffer into a resource being extracted. Resilience policy must therefore treat social capital as social infrastructure requiring maintenance, not as free capacity.

C. Recovery debt as the linking mechanism

Recovery debt explains why a subsequent disaster can cause severe effects even if its physical intensity is not greater. The debt has financial and nonfinancial components. Financially, households may carry loans, arrears, or depleted savings. Physically, housing may be repaired only temporarily, drainage may remain incomplete, or productive equipment may be replaced with lower-quality substitutes. In human-capital terms, chronic health conditions may worsen, children's learning may lag, and care burdens may increase. Socially, trust and support networks may be strained. Institutionally, development budgets may repeatedly be diverted to rehabilitation. All of these reduce the range of options available during the next event.

UNDRR (2025) describes a global cycle involving disaster, debt, uninsurability, and humanitarian need. CVRS translates this logic to household and community scales. The measurement implication is that governments need inter-disaster indicators rather than only event-time indicators. These could include the proportion of households that have not replaced productive assets, carry disaster-related debt, remain in temporary or substandard housing, experience persistent learning loss, or have not restored pre-event income six and twelve months after an event. When these indicators remain poor while the next hazard season approaches, an area can be understood as facing recovery congestion and prioritized for preventive support.

D. Class, gender, age, disability, and housing status

CVRS should not homogenize the category "vulnerable community." Class affects assets and loss absorption; gender affects the distribution of paid and unpaid labor; age influences mobility and service needs; disability interacts with infrastructure design and communication; housing status affects control over retrofitting and eligibility for assistance; informal employment affects income continuity. Recurrent-disaster research should therefore use disaggregated and intersectional data. Li and McNaught's (2026) finding that renters and disadvantaged areas experience stronger social-capital erosion demonstrates how social position shapes cumulative trajectories.

BPS (2026a) data on the rural-urban poverty gap further show that territory matters. Rural communities may possess dense social networks but face weaker service access, markets, transport, and finance. Poor urban households may live closer to facilities yet face high living costs, density, insecure renting, and eviction pressure. Binary policy categories such as "poor" and "non-poor" are therefore inadequate. Social registries and risk databases should add layers describing hazard location, livelihood dependence, disability, older age, children, rental status, disaster history, and recovery-debt indicators.

The proposed policy logic is consistent with the global shift from post-disaster response toward risk reduction embodied in the *Sendai Framework for Disaster Risk Reduction 2015-2030* (United Nations Office for Disaster Risk Reduction [UNDRR], 2015).

CVRS adds a distributive requirement: risk-reduction success should be judged by whether it prevents the most vulnerable groups from entering an unresolved loss-and-recovery spiral.

E. Adaptive social protection as a spiral interrupt

The social-protection evidence generates direct policy implications. Social programs are typically designed around welfare status in normal times, while disasters can produce abrupt downward mobility. Adaptive systems therefore require vertical expansion of benefits for existing recipients, horizontal expansion to newly affected households, and temporary registration or piggybacking mechanisms enabling rapid inclusion. Surtiari et al. (2024) show why the formal-informal relationship is particularly important in Indonesia. Well-designed programs should strengthen local organizations while ensuring that citizens' entitlements do not depend on social proximity or the generosity of networks.

Huber and Murray (2024) and Mackinder et al. (2025) demonstrate that climate and loss-and-damage finance can be connected to social-protection systems. In CVRS terms, finance should not be limited to transfers after the event; it should prevent recovery debt through temporary rent support, grants for productive tools, housing repair subsidies, replacement of documents, school transport, mental-health services, and flexible support to local governments maintaining essential services. Aleksandrova et al. (2024) nevertheless show that climate-finance architecture is not yet easily accessible for social-protection objectives. Indonesia could develop financing proposals that demonstrate both adaptation benefits and distributional welfare gains.

F. Ex-ante investment and budget justice

Disaster economics often concentrates on the monetary value of post-event damage. Newman and Noy (2023) demonstrate the scale of extreme-weather costs attributable to anthropogenic climate change, while UNDRR (2025) emphasizes the returns to resilience investment. Under CVRS, ex-ante investment has additional value because it prevents cumulative consequences. Drainage, resilient housing, slope stabilization, early warning, or safe infrastructure may prevent not only direct damage but also asset sales, debt, educational disruption, and social erosion that would increase future loss. Cost-benefit analysis should therefore include long-term welfare losses and distributional effects, not merely replacement value of physical assets.

Budget justice requires prioritizing locations where hazard and social vulnerability overlap. Fox et al. (2024) provide a methodological foundation through integration of social vulnerability into high-resolution flood-risk mapping. Indonesian authorities could combine hazard layers from disaster and meteorological agencies with poverty, disability, age, housing quality, service access, employment status, prior disaster frequency, and recovery indicators. Priority would then shift from locations with the highest physical hazard alone toward locations with the highest expected welfare loss and recovery-debt risk. Such an approach can also reduce political bias favoring visible large infrastructure over smaller social interventions that may be decisive for vulnerable households.

G. Governance, trust, and state capacity

Vesco et al. (2025) show that political development is associated with reduced human costs of flooding. In CVRS, state capacity operates at every stage: spatial regulation affects exposure; basic services affect vulnerability; early warning affects immediate loss; assistance affects recovery; transparency affects trust; and public investment affects the next shock. Weak governance accelerates the erosion spiral through delayed assistance, unclear eligibility rules, unequal reconstruction, and insecure rights. Responsive governance can instead use

recovery as a moment for structural correction rather than simple restoration of pre-disaster inequality.

Trust occupies a dual position. It facilitates evacuation compliance and coordination but is also shaped by prior experiences with institutions. Repeated unmet promises of mitigation can weaken confidence and reduce willingness to act on future warnings. Vertical or linking social capital between citizens and institutions is therefore as important as horizontal solidarity. Surtiari et al. (2024) show the relevance of formal-informal interaction in Indonesia; public policy should create channels through which community organizations can access information, small grants, training, and participatory planning without being reduced to low-cost substitutes for state responsibility.

H. Theoretical contribution and novelty

CVRS makes four theoretical contributions. First, it is temporal: vulnerability is treated as the historical outcome of shocks and recovery rather than as a pre-event condition only. Second, it is distributive: resilience is assessed through variation in trajectories among social groups rather than community averages. Third, it is relational: social capital, formal protection, markets, and institutions are understood as interacting systems; informal solidarity can complement formal systems but may erode when forced to replace them. Fourth, it is policy-oriented: the framework identifies intervention points before negative coping becomes permanent. CVRS therefore connects sociology of inequality to resilience studies and climate-adaptation policy.

The novelty also goes beyond a general "vicious cycle" of disasters and poverty. CVRS gives specific attention to recovery intervals and recovery debt as mediating variables. Two communities with the same initial poverty rate may diverge if one experiences a second disaster before recovery is complete. Likewise, two communities with similar hazard frequency may have different outcomes when one has responsive social protection and accessible recovery finance. By incorporating timing, unresolved recovery, and social-capital change, the framework can be empirically tested with panel data and offers more specific hypotheses than the broad statement that poverty increases vulnerability.

I. An empirical research agenda for Indonesia

Testing CVRS requires longitudinal design. Household surveys should focus on locations with recurrent floods, landslides, drought, or extreme weather and follow the same households across at least three waves. Variables should include assets, savings, debt, consumption, income, food security, lost school days, physical and mental health, care burdens, bonding/bridging/linking social capital, institutional trust, assistance received, and residential mobility. These data can be linked to event timing and intensity from BNPB and meteorological sources. Fixed-effects, event-study, or growth-curve models can test whether cumulative exposure worsens outcomes and whether social protection moderates those effects.

Qualitative research is equally important for mechanisms that surveys may miss. Longitudinal interviews with female-headed households, older people, persons with disabilities, renters, farmers, fishers, informal workers, and microenterprise owners can identify when coping strategies shift from protective to future-damaging. Ethnography of local organizations can assess whether mutual aid strengthens or becomes exhausted after recurrent events. Local-budget analysis can measure fiscal recovery debt, such as the proportion of development spending repeatedly diverted to rehabilitation. Such mixed evidence would allow CVRS to be evaluated as both a statistical relationship and a lived social process.

J. Limitations

This review has four primary limitations. First, definitions of recurrent disaster, resilience, social capital, and vulnerability differ across studies, limiting direct comparability. Second, strong longitudinal evidence on multiple exposures remains concentrated in a limited number of higher-income settings, so transferability to Indonesia must be assessed cautiously. Third, aggregate BNPB and BPS statistics are crucial for context but do not directly link household exposure histories to welfare trajectories. Fourth, CVRS has not yet been tested with Indonesian panel data. The article therefore offers a conceptual model and evidence synthesis rather than a causal estimate of recurrent-disaster effects in Indonesia.

These limitations strengthen rather than reduce the importance of further research. Indonesia combines high disaster frequency, expanding social-protection systems, diverse local institutions, and substantial socio-spatial variation. It therefore offers a strong setting for comparative tests that can contribute to global resilience theory. Future research should move beyond static indices toward resilience trajectories and ensure that vulnerable groups remain visible as analytical units rather than disappearing inside composite community scores.

CONCLUSIONS

The climate crisis is increasing disaster risk, but social inequality determines how that risk is distributed and carried from one event to the next. Current global evidence documents persistent warming and intensifying climate extremes, while Indonesian data show that millions can be affected in a single year and that hydrometeorological hazards remain central to national disaster risk (BNPB, 2025; Rosyida et al., 2026; WMO, 2026a, 2026b). At the same time, more than 22 million Indonesians remain below the national poverty line and economic capacity is unevenly distributed (BPS, 2026a, 2026b). Recurrent disasters should therefore be analyzed as social processes capable of deepening inequality, not merely as repeated physical events.

The evidence synthesis demonstrates that resilience has limits. Experience can produce learning, but learning requires assets, authority, finance, and institutions before it becomes adaptation. When intervals between disasters are shorter than recovery time, households and communities can enter an erosion spiral: losses remain unreplaced, debt rises, livelihoods weaken, mental health deteriorates, and social capital is depleted. Recent evidence that cumulative exposure can erode bonding social capital provides especially important empirical support for this reframing (Li & McNaught, 2026). Community solidarity remains vital, but it cannot be treated as an unlimited resource or as a substitute for institutional responsibility.

CVRS connects initial inequality, shocks, differentiated recovery, recovery debt, capital depletion, and vulnerability to the next event within a single temporal framework. Its policy value lies in identifying interrupt points: adaptive social protection, ex-ante investment, resilient basic services, recovery finance that does not deepen debt, mental-health protection, educational continuity, housing reinforcement, and participatory governance. Resilience assessment should ask not simply whether a community has "recovered," but who recovered, how quickly, at what cost, and whether capacity for the next event has improved or deteriorated.

For disaster sociology, the central implication is a move from static vulnerability toward the study of vulnerability reproduction. Indonesia's most urgent research agenda is to build panel data linking disaster exposure, welfare, social capital, and social protection at household and community levels. Such an approach would transform resilience from a normative slogan into a measurable social trajectory that can be contested and altered through equitable policy.

Ethics, Data, and Interest Statements

Ethics approval: Not required because the study uses published sources and aggregate secondary data with no identifiable human participants. Data availability: All data cited are accessible through the official sources or publications listed in the references. Conflict of interest: The author(s) declare no conflict of interest. Funding: This manuscript does not claim a specific external funding source; funding information should be updated before submission where applicable. Research-integrity note: The article does not claim primary interviews, focus groups, or surveys. The CVRS is a conceptual synthesis requiring future empirical validation.

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