Climate Change Vulnerability of Women in Small Island Communities *(A Case Study of Pari Island, Indonesia)*

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Abstract
Purpose: To assess the climate change vulnerability of women on Pari Island, Thousand Islands Archipelago, Indonesia, using the IPCC framework through a gender-specific lens.
Methodology/approach: A gender-sensitive mixed-methods vulnerability assessment was applied, combining a composite indicator framework with qualitative inquiry. The analysis had three stages: (1) Adapting IPCC's dimensions (exposure, sensitivity, and adaptive capacity) to identify indicators from the literature and adjusted to data availability for Pari Island. (2) For each indicator, data were collected from primary and secondary sources and then scored for women on an ordinal 1-5 scale using empirically and context-informed thresholds. Component sub-indices and an overall Gendered Vulnerability Index (GVI) were constructed using equal-weighted averaging. (3) Qualitative information obtained to complement the vulnerability index through purposive sampling of key informants in-depth interviews. Results/findings: Women on Pari Island experience moderate exposure to climate hazards (E = 3.0), moderate climate change sensitivity (S = 2.94), and relatively low adaptive capacity (AC = 3.44). The overall GVI of 3.12 places women in a moderate-to-high vulnerability class, with qualitative findings showing how structural gender inequalities and reliance on climate-sensitive fisheries and tourism shape everyday climate risks, despite strong social cohesion and emerging community initiatives. Limitations: The assessment is limited to a single small-island case study and a finite set of indicators derived from the literature and constrained by data availability. Several indicators could not be scored at the island scale and relied on district-level proxies, while others lacked gender-disaggregated data. The use of a 1-5 ordinal scale treated as quasi-interval data, equal weighting of components, and unquantified uncertainty in the underlying datasets introduces potential statistical imprecision and means that the index should be interpreted as a relative, rather than definitive, measure of women's climate vulnerability in Pari Island. Contribution: This study contributes to the development of methodologies for assessing gender-responsiveness and provides insights into how to develop and implement women-centered adaptation strategies in small islands. Novelty: This study introduces a multi-phased Gendered Vulnerability Index, incorporating qualitative inquiry to capture aspects of gendered adaptation dynamics.

Keywords: *climate change, gender vulnerability, small islands, adaptive capacity, Pari Island*

1. Introduction

Climate change is an unavoidable global challenge that threatens human well-being and the stability of natural systems. Both its effects and impacts are felt across various societies, but they are unevenly distributed across regions, social groups, and ecological contexts, creating heightened risks for communities with limited resources and coping capacities (IPCC, 2014, 2022). Small island communities face particularly severe climate-related threats. These islands are highly exposed to sea-level rise, coastal erosion, storm surges, and saltwater intrusion, while their often-remote locations, limited infrastructure, and constrained economic bases reduce the options available for adaptation and resilience (Nurse et al., 2014; Pathirana et al., 2024).

Gender is one of the main factors that shapes how people experience climate vulnerability. Extensive research shows that women frequently face disproportionate impacts from climate change because of unequal access to resources, differentiated livelihoods and care roles, constrained mobility, and exclusion from formal decision-making spaces (Ravera et al., 2016; Patnaik, 2021). In coastal and island environments, these disadvantages interact with biophysical exposure to intensify women's sensitivity to climate hazards and restrict their adaptive capacity (Brody et al., 2008; UNFCCC 2022). Simultaneously, women are widely recognized as key actors in adaptation and community resilience, drawing on local ecological knowledge, leading resource management initiatives, and sustaining social networks that enable collective action (Mcleod et al., 2018; Alston & Whittenbury, 2014; Brody et al., 2008).

Despite the growing recognition of gendered climate impacts, there are still few empirical studies that measure climate vulnerability systematically and in a gender-sensitive manner, especially in small islands in the Global South (Ravera et al., 2016; Saputro & Kurian, 2023). Many vulnerability assessments in these settings rely on household-level indicators or generic socioeconomic measures and do not disaggregate results by gender or capture the specific experiences and constraints faced by women (Ravera et al., 2016; Saputro & Kurian, 2023). In Indonesia, small islands form a large part of the national territory and support millions of residents; however, detailed place-based studies on women's climate vulnerability remain limited. In particular, there is a shortage of research that uses composite indicator approaches to integrate exposure, sensitivity, and adaptive capacity into a gender-sensitive index for small island communities (Kurian, 2023; Kelman, 2010).

Pari Island, one of the inhabited islands in the Kepulauan Seribu (Thousand Islands) archipelago north of Jakarta, offers a relevant case for examining women's climate vulnerability in a small island context. The island's residents depend heavily on fisheries, tourism, and coastal ecosystems, which makes local livelihoods and well-being highly sensitive to climate-induced hazards, such as tidal flooding, shoreline retreat, and the decline of marine resources (Nurse et al., 2023; Nurse et al., 2014). In recent years, local adaptation efforts, including mangrove restoration and community-based water management, have emerged. However, structural gender inequalities continue to shape who has access to resources, who participates in decision-making, and who receives institutional support for adaptation initiatives, which can leave women more exposed and less able to respond effectively (Mcleod et al., 2018; UNFCCC 2022).

This study aimed to assess the climate change vulnerability of women living on Pari Island using an indicator-based framework that integrates exposure, sensitivity, and adaptive capacity from the IPCC approach (Adger, 2006; IPCC, 2007, 2014, 2022; Smit & Wandel, 2006). Specifically, this study seeks to construct a gender-sensitive composite vulnerability index for women on Pari Island, compare the relative contributions of different vulnerability components, and identify the key drivers shaping women's climate risks and adaptation potentials (Kelman, 2010; Nurse et al., 2014; Saputro & Kurian, 2023). In addition to quantitative scoring and index construction, the analysis draws on qualitative insights to further explore and explain the patterns observed in the index, providing an evidence-based foundation for future adaptation policy and research in Indonesian small island settings (Brody et al., 2008; Mcleod et al., 2018; UNFCCC, 2022).

2. Literature review and hypothesis/es development

2.1 Climate Change Vulnerability

Climate change vulnerability has emerged as a central concept for understanding how human and natural systems respond to climatic risks. The Intergovernmental Panel on Climate Change (IPCC) initially conceptualized vulnerability in its Third and Fourth Assessment Reports (TAR and AR4) as a function of three components: exposure, sensitivity, and adaptive capacity (Feroze, 2018; IPCC, 2007; Adger, 2006). Exposure refers to the nature and degree to which a system is exposed to climatic variability and extremes; sensitivity denotes the degree to which a system is affected by climate stimuli; and adaptive capacity represents the potential or ability of a system to adjust to climate change, moderate potential damage, or cope with consequences (Chapagain et al., 2025; Estoque et al., 2022; Laitonjam, Singh & Feroze, 2018; IPCC, 2007; Barnett, Woodward & Lim, 2004).

This tripartite framework provides a foundation for empirical vulnerability assessments worldwide. However, the IPCC subsequently refined its approach in the Special Report on Extreme Events (SREX) and Fifth Assessment Report (AR5), shifting toward a risk-centered framework where vulnerability became a function of sensitivity and adaptive capacity, while exposure was separated as an independent component of risk (IPCC, 2014; IPCC, 2012). Despite this reconceptualization, empirical studies have predominantly continued to apply the TAR/AR4 framework, with only a small fraction adopting the revised SREX/AR5 approach (Estoque et al. 2022). The Sixth Assessment Report (AR6) further emphasized the contextual and dynamic nature of vulnerability, recognizing that it varies across spatial and temporal scales and is shaped by development pathways and governance structures (IPCC, 2022).

Indicator-based and composite index approaches have become widely adopted methodologies for operationalizing vulnerability assessments, particularly in data-constrained contexts (Choi et al., 2022; Choi et al., 2019; Wiréhn et al., 2015). These approaches aggregate multiple indicators across the exposure-sensitivity-adaptive capacity dimensions into a single vulnerability score, facilitating the comparability and communication of results to policymakers (Choi et al., 2019; IPCC, 2007; Liew et al., 2019). The construction of composite indices typically involves sequential steps: indicator selection, normalization to a common scale, weighting to reflect relative importance, and aggregation into a final index (Heß; Papathoma-Köhle et al., 2019). Equal weighting is commonly employed when a theoretical justification for differential weights is lacking, although alternative approaches include expert judgment, principal component analysis, and analytical hierarchy processes (Wehbe & Baroud, 2024; Hadipour, Vafaie & Kerle, 2020; Heß, 2017).

2.2 Climate Vulnerability for Women and In Small Island Communities

A substantial body of literature documents that climate change impacts are gendered, with women often experiencing disproportionate vulnerability due to structural inequalities embedded in social, economic, and institutional systems (Anjum & Aziz; Dev & Manalo, 2023; Patnaik, 2021). Gender roles shape differential exposure to climate hazards, sensitivity to their impacts, and capacity to adapt (Kurniawan et al., 2016; Patnaik, 2021). In many developing countries, women face constrained access to productive resources, land, credit, information, and decision-making platforms—factors that fundamentally limit adaptive capacity (Anjum & Aziz, 2025; Brooks, Adger & Kelly, 2005). Women's responsibilities for household care, water collection, and food provisioning intensify during climate shocks, increasing workloads and reducing time for education or income generation (Anjum & Aziz, 2025; Pathirana et al., 2024).

Studies have revealed heightened risks of mental health challenges, adverse maternal and newborn outcomes, water insecurity, and caregiving burdens among women in climate-affected regions (Anjum & Aziz, 2025). Small island developing states (SIDS) face acute climate vulnerability owing to their biophysical characteristics and socioeconomic constraints (Pathirana et al., 2024; IPCC, 2014). Low elevation, small land area, and coastal concentration expose island populations to sea level rise, storm surges, coastal erosion, and saltwater intrusion into freshwater resources (Pathirana et al., 2024; UNFCCC, 2022). SIDS also experience intensifying tropical cyclones, coral bleaching, and ecosystem degradation that threaten fisheries and tourism, which are central to island livelihoods (Pathirana et al., 2024; Nurse et al., 2014). Remoteness, narrow resource bases, dependence on imports, limited infrastructure, and constrained fiscal capacity further compound their vulnerability and limit adaptation options (Pathirana et al., 2024; IPCC, 2022). The IPCC recognizes SIDS as especially vulnerable, projecting increased coastal flooding, freshwater stress, and risks to marine ecosystems under future climate scenarios (Nurse et al., 2014; IPCC, 2022).

The intersection of gender and small island vulnerability creates compounded risks for female residents. In the Pacific, Caribbean, and other SIDS contexts, women's roles in subsistence agriculture, fisheries, and natural resource management increase their direct exposure to climate-sensitive livelihoods (Bouroncle et al., 2017; Saputro & Kurian, 2023). Gender inequalities in land tenure, financial access, mobility, and institutional participation constrain women's adaptive strategies (Bouroncle et al., 2017; Wabnitz et al., 2021). During extreme events, women and children face higher mortality and injury rates, while post-disaster periods often witness surges in gender-based violence (GBV) (Wabnitz et al., 2021; Asongu et al., 2021). However, women also hold critical knowledge and agency in adaptation: they are often primary stewards of traditional ecological knowledge, lead community-based ecosystem restoration (such as mangrove rehabilitation and water management), and organize collective responses to climate stress (Mcleod et al., 2018; Wabnitz et al., 2021). Evidence from the Pacific Islands indicates that women's participation in local environmental initiatives and decision-making can enhance community resilience and reduce specific dimensions of vulnerability (Mcleod et al., 2018).

2.3 Gender, Power Relations, and Climate Vulnerability

Gender relations and power play a major role in determining communities' vulnerability to climate risks. The ability of individuals and communities to manage and adapt to climate change is influenced not only by ecological factors but also by access to resources, power, information, technology, and socio-economic opportunities. This unequal access is shaped by social and cultural structures that regulate the positions of women, men, and marginalized groups in society. In everyday life, gender and social inequalities often limit women's participation in decision-making processes while reducing their access to and management of natural resources. Poor women, girls, persons with disabilities, and minority groups often face multiple layers of exclusion that increase their vulnerability to climate risk. When climate change exacerbates environmental degradation, these groups bear an additional burden, especially in the absence of fair and inclusive policy interventions (UNDP 2022). Climate vulnerability is also influenced by intersectional factors such as age, income, education, employment, health, customs and geographical location. These social identity interactions shape each individual's level of risk and adaptive capacity. Poverty is a key factor that limits the ability to recover from climate shocks, thereby deepening existing inequalities.

In line with Ide et al. (2021), vulnerability to climate change is not only the result of ecological pressures but is a social construct shaped by gender norms, the division of labor, and unequal access to resources. Gender is not merely a category of identity but a mechanism of power that determines who is most at risk and who has a more limited adaptive capacity. Gender relations shape access to water, land, education, health care, and decision-making. In many contexts, women face structural barriers in obtaining land, credit, or economic networks. The division of reproductive labor, such as childcare, family care, cooking, and water collection, places an additional burden on women when resources become scarcer due to climate change. This phenomenon reinforces the feminization of survival, where household resilience depends on women's unpaid work. Patriarchal power structures also increase the risk of gender-based violence in the context of climate change, such as increased domestic violence, early marriage, and sexual exploitation in crisis situations. However, masculinity norms that emphasize the role of breadwinners can place men under psychological pressure when climate change disrupts their livelihoods. Thus, climate vulnerability cannot be understood in neutral or technocratic terms. Vulnerability is intertwined with power relations that shape gender inequality. A gender-sensitive approach emphasizes that adaptation and resilience are not merely technical issues but socio-political processes determined by who holds power, who is listened to, and who is excluded from climate policy. Women are not only victims but also actors who respond to climate change through their negotiated social positions within existing power structures.

2.4 Women's Roles in Small Island and Indonesian Coastal Communities

Women in coastal areas and small islands in Indonesia play reproductive, productive, and socioecological roles that make them key actors in addressing climate change. Rauf's (2025) study on Langkai Island shows that when extreme weather prevents fishermen from going to sea, women fill the economic gap by processing seafood into shredded meat, crackers, and octopus products. Through business groups such as Merpati Putih and Cahaya Rembulan, women engage in production and manage marketing and finances, supporting their families' economies amid limited island infrastructure and access to sea transport.

Handayani et al. (2023) conducted research on coastal communities in West Papua, revealing an unequal division of labor, with women bearing 60-77% of domestic work while also being involved in productive activities such as mangrove utilization and food processing. Despite their significant contributions, women's access to capital, equipment, education, and market information is still lower than that of men, thereby increasing their vulnerability to climate change. However, both studies emphasize that women possess local ecological knowledge and social capacity that are important for community resilience, particularly through income diversification, food and water management, and involvement in coastal conservation.

Women's adaptation is greatly influenced by social cohesion and institutional support. Rauf (2025) found that women's groups function as social learning spaces where they exchange information about weather, business techniques, and strategies for dealing with income uncertainty. This cohesion strengthens collective responses to climate risks in the absence of public services. Handayani et al. (2023) highlighted the importance of institutional support, such as empowerment training and conservation programs. However, the low representation of women in planning and decision-making means that many programs do not fully meet their needs. With inclusive support and greater participatory space, women have proven capable of becoming local innovators and drivers of socioecological resilience. Therefore, strengthening women's adaptive capacity must be accompanied by more gender-sensitive institutional reforms to build coastal community resilience comprehensively.

3. Methodology

This study applies a composite indicator-based vulnerability assessment grounded in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report framework, which conceptualizes vulnerability as a function of three interrelated components: exposure, sensitivity, and adaptive capacity (IPCC, 2007; Estoque et al., 2022; Hinkel 2011). Indicators for each component were selected through a two-stage process that combined a systematic literature review with a contextual assessment of data availability for Pari Island, Indonesia (Hinkel, 2011). The final indicator set comprised 16 exposure, 31 sensitivity, and 32 adaptive capacity indicators. The data sources include satellite-derived climate and environmental datasets, government reports, academic publications, and primary data from in-depth interviews and observations conducted in 2025.

Because the indicators are expressed in heterogeneous units, from continuous biophysical variables to categorical demographic and institutional characteristics, all variables were transformed to a common qualitative ordinal scale from 1 to 5 (Nardo et al., 2008). For exposure and sensitivity, 1 represents very low exposure or sensitivity (minimal contribution to vulnerability), and 5 represents very high exposure or sensitivity (maximum contribution). For adaptive capacity, the indicators were reverse-coded so that 1 represented very high capacity (low contribution to vulnerability) and 5 represented very low capacity (high contribution). This ensures consistent directionality, such that higher scores uniformly indicate a higher vulnerability across all components. Quantitative indicators were assigned to the 1-5 categories using empirically based or literature-informed thresholds, whereas qualitative indicators were scored using transparent, rule-based criteria.

Treating the resulting ordinal 1-5 scores as quasi-interval data for arithmetic operations is a pragmatic methodological choice that is widely used in vulnerability and composite index research (Hahn et al., 2009; Suryanto et al., 2019). The 1-5 scale used here offers adequate granularity for distinguishing relative vulnerability levels while remaining feasible for data collection and interpretation in resource-limited small island settings. Similar ordinal scales have been successfully applied to livelihood and social vulnerability indices to capture meaningful variance and support adaptation planning (Hahn et al., 2009; Suryanto et al., 2019).

Vulnerability (Component/C_index)

$$C\_index = \frac{1}{nc}\sum_{j=1}^{nc} C_j$$

Exposure (E):

$$E = \frac{1}{16}\sum_{j=1}^{16} E_j$$

Sensitivity (S)

$$S = \frac{1}{31}\sum_{j=1}^{31} S_j$$

Adaptive Capacity (AC):

$$AC = \frac{1}{32}\sum_{j=1}^{32} AC_j$$

Each vulnerability component is represented by a sub-index, calculated as the arithmetic mean of its constituent indicators. This simple average ensures that each indicator within a component contributes equally to the corresponding sub-index, reflecting the assumption that no single indicator is a priori more important than the others within the same dimension (Hahn et al., 2009). The overall Vulnerability Index (VI) is constructed by aggregating the three component sub-indices using a simple arithmetic mean with equal weights: exposure, sensitivity, and adaptive capacity, each receiving a weight of one-third (Nardo et al., 2008; Hahn et al., 2009). Equal weighting is one of the most common aggregation schemes in composite indicator construction because it is transparent, easy to communicate, and avoids introducing further subjective judgments regarding the relative importance of components (Papathoma-Köhle et al., 2019). In this study, equal weighting was adopted to reflect the conceptual understanding that all three components are necessary and jointly constitutive of climate vulnerability in small islands.

Overall Vulnerability Index (VI):

$$VI = \frac{E+S+AC}{3}$$

Several methodological limitations and assumptions must be considered when interpreting the resulting indices. Indicator selection, although informed by literature and local relevance, remains partly subjective: different researchers may prioritize different indicators or draw component boundaries differently, potentially producing alternative vulnerability patterns, and sensitivity analysis using alternative indicator sets could strengthen robustness but falls outside the scope of this assessment (Hinkel, 2011). The use of a 1-5 ordinal scale and its treatment as quasi-interval data introduces potential statistical imprecision. While this practice is common and defensible in composite index and vulnerability research, it assumes that average scores provide meaningful relative measures of vulnerability and should therefore be interpreted with caution (Nardo et al., 2008; Papathoma-Köhle et al., 2019).

The equal-weighting assumption for the three components, although consistent with much composite indicator practice and justified by transparency and simplicity, does not reflect empirically derived or context-specific relative importance, as the contribution of exposure, sensitivity, and adaptive capacity to overall vulnerability may differ across hazards and socioecological settings. Alternative weighting schemes based on expert judgment or stakeholder preferences could yield more context-sensitive indices but would introduce additional subjectivity and complexity (Papathoma-Köhle et al., 2019). Any composite index inherently aggregates across indicators and components, which may mask critical within-dimension variations. Therefore, a moderate overall vulnerability score may conceal severe deficits in specific indicators that warrant targeted interventions (Nardo et al., 2008). Finally, uncertainty in the underlying data, including measurement error, spatial and temporal mismatches, and reliance on proxy indicators, propagates through the index construction but is not formally quantified in this study, a common limitation in composite vulnerability assessments that should be considered when using the index for decision-making (Papathoma-Köhle et al., 2019). Despite these limitations, this approach offers a structured, replicable, and transparent framework for assessing climate change vulnerability on Pari Island.

Although the composite index provides a structured snapshot of relative vulnerability levels, the numerical scores alone cannot fully capture the social processes, power relations, and lived experiences that shape how climate risks are produced and negotiated in everyday life. To avoid treating vulnerability as a purely technical construct, the quantitative results were complemented with qualitative analysis through in-depth interviews with purposive sampling with selected individuals that are deemed to hold important information, including fishermen, local communities, members of women's groups, coastal tourism managers, NGO representatives, health workers, and officials from the Ministry of Marine Affairs and Fisheries as the government agency responsible for coastal management). Data analysis was conducted thematically, starting with transcription, initial coding, theme grouping, and preparation of analytical narratives describing the vulnerability of women on Pari Island. This mixed-methods design allows the index to be interpreted not as an endpoint, but as an entry point for deeper inquiry into the gendered dynamics of vulnerability on Pari Island.

4. Results and discussion

4.1 Climate Change Vulnerability Indicators

Building on the methodological framework described earlier, the final set of indicators for exposure, sensitivity, and adaptive capacity on Pari Island was identified and scored. Drawing on the existing literature and local context, each indicator is expressed on a qualitative 1-5 scale, where higher values reflect higher vulnerability for exposure and sensitivity and lower adaptive capacity. However, for several indicators, data were not available at either the Pari Island or Kepulauan Seribu scales. These indicators are retained in Table 1 for transparency, but their scoring criteria are not included. The resulting indicators and their scoring criteria are presented in **Table 1**.

Table 1. Vulnerability Index Indicators and Scoring Criteria

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
Exposure	Physical Climate Hazards	E1	Cyclones	No Record	Rare	Occasional	Frequent	Direct/Annual	Salman et al. (2025); UK Government (2025); Sarkar, Paul & Garai (2024); Sahoo & Bhaskaran (2017); Trimediannto et al. (2024); Roukounis & Tsihrintzis (2022); Kantamaneni (2019); Ahsan & Warner (2014); Mycoo (2022), Sarkar et al. (2024), Salman et al. (2025)
		E2	Floods	<0.1 m	0.1-0.25 m	0.25-0.5 m	0.5-1 m	1 m	UK Government (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Roukounis & Tsihrintzis (2022); Etongo & Arrisol (2021); Ahsan and Warner (2014); Kantamaneni (2019); El-Saoud & Othman (2022), Maranzoni et al. (2022), Krishnan et al. (2022)
		E3	Droughts	3.000 m, no dry seson	2.500-3.000 mm, 1-2 dry months	2.000-2.500 mm, 2-3 dry months	1.500-2.000 mm, 3-4 dry months	<1,500 mm/year, >4 months	Farhan et al. (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Siqueira & Nery (2021); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Mycoo et al. (2022) Roukounis & Tsihrintzis (2022); Siqueira & Nery (2021)
		E4	Stroms/Surge	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Salman et al. (2025); UK Government (2025); Sahoo & Bhaskaran (2017); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Roukounis & Tsihrintzis (2022); Hoque et al. (2019), Kantamaneni (2019), Mahendra et al. (2011)
		E5	Tidal Range	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Sarkar, Paul & Garai (2024); Sahoo & Bhaskaran (2017); Roukounis & Tsihrintzis (2022); Mutmainah & Putra (2017); Addo (2013); Kantamaneni (2019); Mujabar & Chandrasekar (2011)
		E6	Erosion and Shoreline Change	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Sarkar, Paul & Garai (2024); Roukounis & Tsihrintzis (2022,; Kantamaneni (2019); Hoque et al. (2019); Mutmainah & Putra (2017); Addo (2013); Jana & Bhattacharya (2011); Mahendra et al. (2011)

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
	Temperature Extremes	E7	Temperatur	mean <25°C	mean 25-28°C	mean 28-30°C	mean 30-32°C	mean >32°C	UK Government (2025); Bedo, Mekuriaw & Bantider (2024); Maja et al. (2022); Mycoo et al. (2022), Roukounis & Tsihrintzis (2022); Wang et al. (2022); Etongo & Arrisol (2021); Johnson et al. (2021); Mwangi et al. (2020); Manik & Syaukat (2015); Weitz et al. (2024), Vacellio et al. (2021)
	Percipitation Variability	E8	Rainfall Variability	<100 mm/month max	100-200 mm/month max	200-300 mm/month max	300-400 mm/month max	>400 mm/month max	World Bank (2025); Soltani et al. (2022); Bedo, Mekuriaw & Bantider (2024); Sahoo & Bhaskaran (2017) and Maja et al. (2022) Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Etongo & Arrisol (2021); Johnson et al. (2021); Mwangi et al. (2020); Siqueira & Nery (2021)
	Sea-Level Rise	E9	Rate of rise	<2 mm/year	2-4 mm/year	4-7 mm/year	7-15 mm/year	>15 mm/year	Setiawati (2025), Rienaldi (2022), Bott et al. (2021); CMCC (2021); Mercy Corps Indonesia (2021); Mondal, Roy, and Saha (2022); Mycoo et al. (2022); Sagala, Bhomia, and Murdiayrso (2024); Sahoo & Bhaskaran (2017); Trimediannto et al. (2024); Roukounis and Tsihrintzis (2022); Hoque et al. (2019), Kantamaneni (2019), Mahendra et al. (2011)
		E10	Saltwater instrusion	<1 ppt	1-10 ppt	10-25 ppt	25-32 ppt	≥32 ppt	Trimediannto et al. (2024); Muzillo et al. (2023); Putrannto et al. (2022); Rustadi (2023); Yasuor et al. (2020); California Departement of Water Resources (2016)
	Disaster Exposure	E11	Disaster Frequency	No disasters or < 1 event every 5 years	Occasional (1-2 events per 5 years)	Regular (1-2 events per year)	Frequent (3-5 events per year)	Very frequent (multiple events per year)	Latifah et al. (2025); PPRD East 3 (2024); Fajirin, Hayati & Faqih (2020); UK Government (2025); Sarkar, Paul & Garai (2024); Roukounis & Tsihrintzis (2022); Manik & Syaukat (2015); Ahsan & Warner (2014)
		E12	Disaster Risk	Low risk	-	Moderate Risk	-	High Risk	UK Government (2025); Sarkar, Paul & Garai (2024); Roukounis & Tsihrintzis (2022); Manik & Syaukat (2015); Ahsan & Warner (2014); Worl Bank (2021); BNPB (2021); European Comission (2017)
	Disease Exposure	E13	Malaria/Dengue Risk Zones	No cases	Sporadic/rare cases	Moderate endemic/season al patterns	High endemic	Very high endemic	UK Government (2025); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Mwangi et al. (2020); WHO Indoensia

									(2024); YKAN (2019); Rejeki et al. (2018)

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
		E14	Diarrheal Diseases InciDence	No cases	Sporadic/rare cases	Moderate endemic/seasonal patterns	High endemic	Very high endemic	CDC (2025); Hossain et al. (2025); WHO Indonesia (2024); Rejeki et al. (2018); UK Government (2025); Trimediannto et al. (2024); Wang et al. (2022)
		E15	Other Diseases	No cases	Sporadic/rare cases	Moderate endemic/seasonal patterns	High endemic	Very high endemic	CDC (2025); Hossain et al. (2025); WHO Indonesia (2024); Roukounis & Tsihrintzis (2022); Rejeki et al. (2018)
Sensitivity	Physical/Geographic	S1	Geomorphological	Hard rock/consolidated with minimal erosion (<0.5 m/year)	Coarse sand/gravel with low erosion (0.5-2 m/year)	Fine sand with moderate erosion (2-4 m/year)	Silt/mixed sediment with high erosion (4-7 m/year)	Mud-dominated with very high erosion (>7 m/year)	Sagala, Bhomia, and Murdiayrso (2024); Mondal, Roy, and Saha (2022); Sagala, Bhomia, and Murdiayrso (2024); Sahoo & Bhaskaran (2017); Roukounis & Tsihrintzis (2022); Johnson et al. (2021); Hoque et al. (2019); Addo (2013); Mujabar & Chandrasekar (2011); Browning & Sawyer (2021); Masselink et al. (2020); Vacellio et al. (2021)
		S2	Wind	< 20 km/h average	20-40 km/h	40-60 km/h	60-100 km/h	> 100 km/h	Moise et al. (2024); Philippine Atmospheric, Geophysical and Astronomical Services Administration (2023); Chatterjee & Kundu (2021); Kloetzke (2019); Mondal, Roy, and Saha (2022); Sagala, Bhomia, and Murdiayrso (2024); Roukounis & Tsihrintzis (2022); Hoque et al. (2019); Kantamaneni (2019)
		S3	Humidity	< 50%	50-65%	65-75%	75-85%	> 85%	Mondal et al. (2022), Sagala et al. (2024), Roukounis and Tsihrintzis (2022), and Kantamaneni (2019) Ho et al. (2025); Weitz (2024); WHO (2015)
		S4	Slope	10 m	5-10 m	3-5 m	1-3 m	< 1 m	Salman et al. (2025); Mondal, Roy, and Saha (2022); Sagala, Bhomia, and Murdiayrso (2024); Sahoo & Bhaskaran (2017); Roukounis & Tsihrintzis (2022); Hoque et al. (2019); Kantamaneni (2019); Mutmainah & Putra (2017); Boer et al. (2015); Addo (2013); Mahendra et al. (2011); Fellowes (2024); Kennedy (2024); Koesindriyani (2010)
		S5	Soil Type	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Mondal et al. (2022), Roukounis and Tsihrintzis (2022), Mwangi et al. (2020), Addo (2013), and Mujabar and Chandrasekar (2011)

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
	Land Use/Land Cover	S6	Built-up area density	< 10%	10-30%	30-50%	50-70%	> 70%	Roukounis & Tsihrintzis (2022); Kantamaneni (2019); Jana & Bhattacharya (2011); Mahendra et al. (2011); Boatz, Reimann & T. Vafeidis (2024); MacManus et al. (2021)
		S7	Natural vegetation	> 60%	40-60%	20-40%	10-20%	< 10%	Roukounis & Tsihrintzis (2022); Kantamaneni (2019); Jana & Bhattacharya (2011); Mahendra et al. (2011); Li et al. (2025); Graca et al. (2022); Zhang et al. (2014)
		S8	Wetland	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Trimediannto et al. (2024), Roukounis and Tsihrintzis (2022), Kantamaneni (2019), Jana and Bhattacharya (2011), Mahendra et al. (2011);
		S9	Forest	> 30%	15-30%	5-15%	1-5%	< 1%	Roukounis & Tsihrintzis (2022); Kantamaneni (2019); Jana & Bhattacharya (2011); Mahendra et al. (2011); Li et al. (2025); Kennedy (2024); Kasim, Yusof & Shafri (2019); Kurniawan et al. (2016)
		S10	Agricultural area	< 5%	5-20%	20-40%	40-60%	> 60%	Bedo, Mekuriaw & Bantider (2024), Sarkar, Paul & Garai (2024), Maja et al. (2022), Mycoo et al. (2022), Roukounis & Tsihrintzis (2022), Kantamaneni (2019), Boer et al. (2015), Janaa n d & Bhattacharya (2,11); Mahendra et al. (2011); Fellowes (2024); Kennedy (2024); Browning & Sawyer (2021)
		S11	Mangrove	Extensive/healthy mangroves	Good coverage	Moderate degradation	Severe degradation	Critical degradation	Mondal, Roy, and Saha (2022); Sagala, Bhomia, and Murdiayrso (2024); Trimediannto et al. (2024); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Setiawati (2025); Munana, Pribadi & Suryono (2023); Wilson (2017)
		S12	Sea Grass	Stable or expanding coverage	Minor losses	Moderate losses	Severe losses	Critical loss	Bedale, Kodiran & Wardianto (2025); Roukounis & Tsihrintzis (2022); Johnson et al. (2021); Sustainability Directory (2025); Brodie & N'Yeurt (2018); Waycott et al. (2009)

		S13	Corals	No bleaching healthy coral	Minor bleaching (10% affected)	Moderate bleaching (10-30% affected)	Severe bleaching (30-60% affected)	Catastrophic bleaching (60% affected)	Bedale, Kodiran & Wardianto (2025); Trimediannto et al. (2024); Roukounis & Tsihrintzis (2022); Johnson et al. (2021); Susanti et al. (2025); Doorga et al. (2023); Wilson et al. (2015); Cinner et al. (2013)

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
	Demographic	S14	Female Percentage	< 40%	40-45%	45-55%	55-60%	> 60%	Madhuri (2025); Salman et al. (2025); UK Government (2025); Bedo, Mekuriaw & Bantider (2024); Abele & Bekele (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Mwangi et al. (2020); Ahsan & Warner (2014); UNDP (2025); Abubakar (2024); Imad (2023); Fruttero et al. (2023)
		S15	Population density	< 200/km²	200-500/km²	500-1,000/km²	1,000-2,000/km²	> 2,000/km²	Salman et al. (2025); UK Government (2025); Bedo, Mekuriaw & Bantider (2024); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Mwangi et al. (2020); Boer et al. (2015); Ahsan & Warner (2014); Jana & Bhattacharya (2011); Das et al. (2024); YKAN (2024); Bernard et al. (2021); Balica et al. (2012)
		S16	Population under 5 years	< 15%	15-25%	25-35%	35-45%	> 45%	Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); Abele & Bekele (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Iliscupidez et al. (2025); Li et al. (2025); UNICEF (2021); Save the Children (2021); UNICEF (2010)
		S17	Population under 65 years	< 5%	5-10%	10-15%	15-20%	> 20%	Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); Abele & Bekele (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Gu (2019)
		S18	Female-headed households	< 5%	5-15%	15-25%	25-35%	> 35%	Madhuri (2025); Salman et al. (2025); Maja et al. (2022); Wang et al. (2022); Boer et al. (2015); Arujo (2023); Taylor et al. (2015)
		S19	Household Size	1-2 persons	3-4 persons	5-6 persons	7-8 persons	> 8 persons	Maja et al. (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Mwangi et al. (2020); Boer et al. (2015); Tamanna & Hossain (2024)
		S20	Disability/People with special needs	Absent	< 2%	2-5%	5-10%	> 10%	Jodoin et al. (2025); Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); UNICEF (2021)
	Economic/Livelihood	S21	Small Business and Trade	< 10%	10-20%	20-30%	30-40%	> 40%	Roukounis & Tsihrintzis (2022); Mwangi et al. (2020); Aditiya et al. (2025); Noekent et al. (2025); Jainudin et al. (2024); Londa & Pangemanan (2021);

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
		S22	Homestay	< 10%	10-20%	20-30%	30-40%	> 40%	Roukounis & Tsihrintzis (2022); Borazon et al. (2023); Pathak et al. (2021); Setiawan (2021)
		S23	Fishery	< 20%	20-30%	30-40%	40-50%	> 50%	Sarkar, Paul & Garai (2024); Mycoo et al. (2022); Etongo & Arrisol (2021); Kim et al. (2025); Mulyasari et al. (2020)
		S24	Tourism	< 50,000 visitors/year	50,000-150,000 visitors/year	150,000-300,000 visitors/year	300,000-500,000 visitors/year	> 500,000 visitors/year	Roukounis & Tsihrintzis (2022); World Bank (2023); Climate Council (2018)
		S25	Farmer Group	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Null (N/A)	Bedo, Mekuriaw, & Bantider (2024); Boer et al. (2015);
		S26	Unemployment	< 4%	4-7%	7-10%	10-15%	> 15%	Roukounis & Tsihrintzis (2022); Ahsan & Warner (2014); World Bank (2025); IMR (2023); Isdijoso et al. (2013)
		S27	Inflation Rate	0-2%	2-4%	4-6%	6-10%	> 10%; hyperinflation and economic crisis.	UK Government (2025); Cevik & Jaller (2023); Kotz et al. (2023); World Bank (2025); IMR (2023); Isdijoso et al. (2013)
		S28	Household income level	>$10,000/year	$5,000-10,000/year	$2,500-5,000/year	$1,000-2,500/year	<$1,000/year	Bedo, Mekuriaw, & Bantider (2024); Sarkar, Paul, & Garai (2024); Abele & Bekele (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Etongo & Arrisol (2021); Manik & Syaukat (2015); Ahsan & Warner (2014);
		S29	GDP	>5% growth	2-5% growth	0-2% growth	-2 to 0% growth	<-2% growth	UK Government (2025); Boer et al. (2015);
		S30	Poverty rate	<5%	5-10%	10-15%	15-25%	>25%	Mwangi et al. (2020); Boer et al. (2015); Ahsan & Warner (2014);
	Resource/water/food	S31	Food Security	>80% self-sufficient	60-80% self-sufficient	40-60% self-sufficient	20-40% self-sufficient	<20% self-sufficient	Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Maja et al. (2022); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Ahsan & Warner (2014);
		S32	Water Security	>80% self-sufficient	60-80% self-sufficient	40-60% self-sufficient	20-40% self-sufficient	<20% self-sufficient	Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimedianto et al. (2024); Muzillo et al. (2023); Maja et al. (2022); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Mwangi et al. (2020); Kantamaneni (2019); Boer et al. (2015); Ahsan & Warner (2014);

		S33	Legal/Customary Discrimination	No gender discrimination	Minimal, isolated cases	Moderate systemic discrimination	High discrimination	Extreme discrimination	Madhuri (2025), Bedo et al. (2024), and Bant

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
		S34	Gender-Based Violence	No gender discrimination	Minimal GBV, isolated cases	Moderate GBV	High GBV	Extreme GBV	Madhuri (2025); Mulrean (2025); UK Government (2025); Quinones (2025);
Adaptive Capacity	Human Capital	AC1	Education level	>80% tertiary education	50-80% secondary+	30-50% secondary+	10-30% secondary+	<10% secondary+	Trimediannto et al. (2024); Abele & Bekele (2022); Maja et al. (2022); Mycoo et al. (2022); Wang et al. (2022); Etongo & Arrisol (2021); Manik & Syaukat (2015); Ahsan & Warner (2014).
		AC2	Access to education facilities	Complete facilities (preschool-university)	Preschool-senior high locally	Preschool-junior high locally, senior high accessible	Preschool-junior high only (senior high requires travel/cost barrier)	Elementary or less	Trimediannto et al. (2024); Mycoo et al. (2022); Etongo and Arrisol (2021); Boer et al. (2015); Manik and Syaukat (2015); Ahsan and Warner (2014);
		AC3	Literacy Rate	≥99%	95-98.9%	90-94.9%	80-89.9%	<80%	Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Mwangi et al. (2020); Ahsan & Warner (2014); Brooks et al. 2005; UNFPA 2024; IPCC AR6 2022; Pambudi et al. 2023
		AC4	Average Lenght of Schooling	≥12 years	10-11.9 years	9-9.9 years	7-8.9 years	<7 years	Trimediannto et al. (2024); Abele & Bekele (2022); Maja et al. (2022); Mycoo et al. (2022); Wang et al. (2022); Etongo & Arrisol (2021); Manik & Syaukat (2015); Ahsan & Warner (2014); Randell & Gray 2019; Brooks et al. 2005; UNESCO 2024; Lutz et al. 2018; UNDP-BIMP EAGA 2015
		AC5	School Participation Rate.	Primary ≥99%, Junior ≥95%, Senior ≥90%	Primary ≥95%, Junior ≥90%, Senior ≥80%	Primary ≥90%, Junior ≥85%, Senior ≥70%	Primary ≥85%, Junior ≥80%, Senior ≥60%	Below Score 4 thresholds	Trimediannto et al. (2024); Abele & Bekele (2022); Maja et al. (2022); Mycoo et al. (2022); Wang et al. (2022); Etongo & Arrisol (2021); Manik & Syaukat (2015); Ahsan & Warner (2014); UNESCO-G (20244; Indonesia KREASI 2025; Randell & Gray 2019; BPS Indonesia 2024; IPCC 2022
		AC6	Access to healthcare services	Hospital and full health centers locally	Full health center and referral hospital accessible	Auxiliary health center and referral accessible	Auxiliary center only, referral difficult (distance/cost/storms)	Minimal/no facilities	Indonesia Mininstry of Health (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Maja et al. (2022); Mycoo et al. (2022); Etongo & Arrisol (2021); Boer et al. (2015); Manik & Syaukat (2015)
		AC7	Health workforce	>10 health workers/1,000 population	5-10/1,000population	2.5-5/1,000 population	1-2.5/1,000 population	<1/1,000 population	Indonesia Mininstry of Health (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Maja et al. (2022); Mycoo et al. (2022); Etongo & Arrisol (2021); Boer et al. (2015); Manik & Syaukat (2015)

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
		AC8	Life Expectancy	≥80 years	75-79.9 years	70-74.9 years	60-69.9 years	<60 years	Manik & Syaukat (2015); Țarcă et al. (2024); UN SIDS (2024);
		AC9	Human Development Index (IPM)	≥0.800	0.700-0.799	0.550-0.699	0.450-0.549	<0.450 (Very Low)	Manik & Syaukat (2015); UNDP 2018, 2023; World Population Review 2025
		AC10	Skills and training received	Regular training (≥1 per year)	Occasional (every 2-3 years)	Rare (once in 5 years)	Past only (>5 years ago)	No training ever	Madhuri (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Maja et al. (2022); Mycoo et al. (2022); Manik & Syaukat (2015); Warrick et al. 2013; Datta & Behera 2022; Pratiwi et al. 2017; USAID Adapt Asia-Pacific 2019
		AC11	Climate change awareness programs	Regular programs (≥1 per year)	Occasional (every 2-3 years)	Rare (once in 5 years)	Past only (>5 years ago)	No programs ever	Madhuri (2025); Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Maja et al. (2022); Mycoo et al. (2022); Manik & Syaukat (2015); Robinson 2020; UNDP 2016; CARE 2024; Hanh et al. 2020;
	Infrastructure/Housing	AC12	Housing quality and durability	>90% adequate housing (high adaptive capacity)	70-90% (moderate-high)	50-70% (moderate)	30-50% (low, vulnerable)	<30% adequate housing (very low, crisis)	Salman et al. (2025); Bedo, Mekuriaw & Bantider (2024); Trimediannto et al. (2024); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Roukounis & Tsihrintzis (2022); Mwangi et al. (2020); Manik & Syaukat (2015); Ahsan & Warner (2014); Mahendra et al. (2011);
		AC13	social and religious facilities	>10 community facilities/1,000 population	5-10/1,000	2.5-5/1,000	1-2.5/1,000	<1/1,000	Roukounis & Tsihrintzis (2022);
		AC14	Road Infrasrtucture Quality	<10% damaged	10-25%	25-40%	40-60%	>60%	Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Boer et al. (2015); Ahsan & Warner (2014);
		AC15	Transportation Access	>5 transport modes with multiple facilities	2-3 modes with facilities	Boat with air access	Boat-only, multiple facilities	Single facility or frequently inaccessible	Roukounis & Tsihrintzis (2022);
		AC16	Access to electricity	100% with reliable backup	100% with partial backup	90-100% with intermittent	70-90% or 100% with frequent outages	<70% or unreliable	Muzillo et al. (2023); Roukounis & Tsihrintzis (2022); Boer et al. (2015); Manik & Syaukat (2015); Ahsan & Warner (2014).

Framework	Dimension	Indicators		Scoring Criteria 1	2	3	4	5	Sources (Adapted from)
		AC17	Access to water	>90% capacity vs demand with backup	70-90% with partial backup	50-70% or adequate and no backup	30-50% or single critical facility	<30% capacity or frequently failing	Bedo, Mekuriaw & Bantider (2024); Sarkar, Paul & Garai (2024); Trimediannto et al. (2024); Maja et al. (2022); Mycoo et al. (2022); Roukounis & Tsihrintzis (2022); Wang et al. (2022); Mwangi et al. (2020); Boer et al. (2015); Ahsan & Warner (2014);
		AC18	Access to sanitation facility	>95% sewerage/advanced treatment	80-95% improved with treatment	60-80% improved or >80% septic without treatment	40-60% improved or failing systems	<40% or crisis contamination	Bedo, Mekuriaw, & Bantider (2024); Roukounis & Tsihrintzis (2022); Boer et al. (2015); Ahsan & Warner (2014);
		AC19	Access to waste facility	Comprehensive system with complete waste processing treatment	Regular collection with adequate waste processing treatment	Regular collection with export/basic waste processing treatment	Irregular or limited collection	Minimal or failing system	Roukounis & Tsihrintzis (2022); Boer et al. (2015)
		AC20	Communication infrastructure	Multiple networks with backup power amd satellite	Multiple networks with partial backup	Single network, stable but power-dependent	Single network, intermittent	Minimal or no coverage	Bedo, Mekuriaw, & Bantider (2024); Roukounis & Tsihrintzis (2022);
	Social Capital	AC21	Community Organization	Multiple diverse organizations with active membership (>70%)	Multiple orgs with moderate participation (50-70%)	Several orgs with moderate participation (40-50%)	Few orgs or low participation (<40%)	No community organizations	Bedo, Mekuriaw & Bantider (2024), Sarkar, Paul & Garai (2024), Wambura (2024), Maja et al. (2022), Mycoo et al. (2022), Ahsan & Warner (2014), Cheeseman et al. (2025) Narayan 1997; Woolcock & Narayan 2000
		AC22	Community leadership and positions	Inclusive leadership	Some female leaders but gender gaps	Limited female leadership	Minimal female leadership	No women in leadership	Sarkar, Paul & Garai (2024), Wambura (2024), Ahsan & Warner (2014), GIWPS Kpsrl 2020
		AC23	Trust in community institutions	Very strong trust (>80% confidence)	Strong trust (60-80% confidence)	Moderate trust (40-60% confidence)	Weak trust (<40% confidence)	No trust in institutions	Wambura (2024) Ahsan & Warner (2014) UNDP 2017; Malherbe et al. 2020; Cheeseman et al. 2025; World Bank 2023
		AC24	Community cohesion and cooperation	Very strong cohesion (>80% participation)	Strong cohesion (60-80% participation)	Moderate cohesion (40-60% participation)	Weak cohesion (<40% participation)	No cohesion/cooperation	Sarkar, Paul & Garai (2024); Wambura (2024); Mycoo et al. (2022); Ahsan & Warner (2014); PJLSS 2024; Chapagain & Khanal 2025; UNDP 2025; Tokunaga et al. 2021

		AC25	Participation in community activities	Very high participation (>80%) with	High participation (60-80%) with	Moderate participation (40-60%) with significant	Low participation (<40%) or highly gendered	No participation	Sarkar, Paul & Garai (2024); Wambura (2024); Maja et al. (2022); Mycoo et al. (2022); Ahsan & Warner (2014); World Bank 2023

Framework	Dimension	Indicators		Scoring Criteria					Sources (Adapted from)
				1	2	3	4	5	
				gender equity in roles	some gender role divisions	gender role divisions			
	Disaster management systems	AC26	Climate/weather information access	Real-time accessible multi-platform climate info	Regular accessible forecasts/warnings	Available but limited access/frequency	Available but poor dissemination	No climate information access	Salman et al. (2025); Mycoo et al. (2022); Ahsan & Warner (2014); APIK 2017; Faradiba et al. 2023; Chapagain & Khanal 2025
		AC27	Early warning system access	Fully functional EWS	Functional with gaps	Partial system	Minimal/ineffective system	No EWS exists	Salman et al. (2025); Mycoo et al. (2022); Ahsan & Warner (2014); WMO 2024; UNDP 2022; GCA 2024
		AC28	Temporary Evacuation Site (TES)	Multiple adequate TES with <10min access	Adequate TES with 10-15min access	Limited TES capacity or 15-20min access	Inadequate TES or >20min access	No TES exists	Salman et al. (2025); Mycoo et al. (2022); Ahsan & Warner (2014); Ningtyas et al. 2022
		AC29	Final Evacuation Site (TEA)	Multiple adequate TEA with clear protocols	Adequate TEA with some gaps	Limited TEA capacity	Inadequate TEA	No TEA exists	Salman et al. (2025); Mycoo et al. (2022); Ahsan & Warner (2014); GCA SIDS 2024
	Natural Capital	AC30	Land ownership and tenure	Secure formal land title (>80% households)	Mix of formal/customary tenure with security (60-80%)	Customary/informal tenure with moderate security (40-60%)	Insecure informal tenure (<40%)	No land ownership/tenure security	Bedo, Mekuriaw & Bantider (2024), Sarkar, Paul & Garai (2024), Abele & Bekele (2022), IPCC AR6 2022 C,15; IFAD019; UN-Habitat 2019; Chamberlain 2025
	Institutional Capacity	AC31	Climate change Policies	Fully implemented & effective	Implemented with minor gaps	Partially implemented/moderate gaps	Available but weak implementation	No policy exists	UK Government (2025); Jodoin et al. (2025); Mycoo et al. (2022); Trimediannto et al. (2024);
		AC32	Gender Policies	Fully implemented & effective	Implemented with minor gaps	Partially implemented/moderate gaps	Available but not implemented	No policy exists	Madhuri (2025), Jodoin et al. (2025), UK Government (2025), Mycoo et al. (2022), Trimediannto et al. (2024),

Sources: Adapted from various studies

4.2 Women in Pari Island Climate Vulnerability

Building on the indicators and scoring criteria outlined in Table 1, this study applied the framework to the available data for Pari Island to assess women's climate vulnerability across exposure, sensitivity, and adaptive capacity. **Tables 2, 3, and 4** present the resulting indicator values for women on Pari Island, together with their data sources and the corresponding 1-5 vulnerability scores.

Table 2 Women in Pari Island Exposure Index

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
Exposure	Physical Climate Hazards	Cyclones	No cyclone tracks were recorded within 500 km of Pari Island, indicating no direct cyclone exposure.	International Best Track Archive for Climate Stewardship Project (Accessed Nov 2025)	1
		Floods	The maximum modelled flood depth was approximately 0.26 m, placing Pari in the moderate shallow inundation category.	WRI Aqueduct Floods Hazard Maps Version (Accessed Nov 2025)	3
		Droughts	Annual rainfall is approximately 2,000 mm with only two dry months, close to the 10-year normal, indicating relatively low recent drought stress.	CHIRPS Daily: Climate Hazards Center InfraRed Precipitation With Station Data (Version 2.0 Final) (Accessed Nov 2025)	2
	Temperature Extremes	Temperatur	Recent temperatures have mostly range between 25-31°C, suggesting moderate heat exposure rather than extreme temperature stress.	Weather Spark (2025)	3
	Percipitation Variability	Rainfall Variability	Proxy data from Pulau Pramuka show strong wet and dry seasons, with monthly rainfall peaks of approximately 300 mm, indicating moderate rainfall variability.	Weather Spark (2025)	3
	Sea-Level Rise	Rate of rise	Proxy measurements indicate that the sea level is rising by approximately 2.55 cm per year, placing Pari in the highest sea-level rise exposure class.	Herianto et al. (2023)	5
		Saltwater instrusion	Water salinity of approximately 32.9-33 ppt indicates very high saltwater intrusion, in the most severe category.	Leonard, Kusnoputranto & Junita (2023)	5
	Disaster Exposure	Disaster Frequency	Official statistics report no disasters, but residents describe frequent tidal flooding, coastal abrasion, and strong winds, indicating a high disaster frequency.	Primary Data (In depth interview) and BPS (2025)	4
		Disaster Risk	Moderate risk of extreme weather	BNPB (2021)	3
			Low risk of extreme waves and coastal erosion	BNPB (2021)	1
			Moderate earthquake risk	BNPB (2021)	3

			High drought risk	BNPB (2021)	5
			Low tsunami risk	BNPB (2021)	1
	Disease Exposure	Malaria/Dengue Risk Zones	Malaria was reported in 1999 but is now absent, indicating no current malaria-dengue transmission.	Primary Data (In depth interview)	1
		Diarrheal Diseases InciDence	Diarrhoeal diseases are present without clear seasonality, suggesting a high and persistent disease	Primary Data (In depth interview)	4

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
			burden rather than rare outbreaks.		
		Other Diseases	Coughs and colds linked to beach sand and unstable weather are common, indicating a high background burden of other diseases.	Primary Data (In depth interview)	4

Sources: Primary Data (2025), Government Publication and Various Studies

Table 3 Women in Pari Island Sensitivity Index

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
Sensitivity	Physical/Geographic	Geomorphological	The seabed around Pari consists of mixed mud, sand, and silt, which erodes much more easily than pure sand, making the coastline highly sensitive to erosion.	Jakarta Local Government (Food Security, Marine Affairs and Agriculture Office) (2020)	4
		Wind	Average wind speeds are only around 15 km/h, a light breeze well below damaging thresholds, so Wind-related sensitivity was low.	Weather Spark (2025)	1
		Humidty	The relative humidity was approximately 80%, which strongly amplified heat stress and heightened sensitivity to high temperatures.	Sadikin, Pujiraharjo & Nurhidayat (2018)	4
		Slope	Pari is almost completely flat at 0-3 m above sea level, making it highly sensitive to flooding and sea-level rise.	Jakarta Local Government (Food Security, Marine Affairs and Agriculture Office) (2020)	4
	Land Use/Land Cover	Built-up area density	Built-up areas cover about 26.6% of the island	Land cover analysis results (2025) using Land Cover Data (2022)	2
		Natural vegetation	Almost half of the island remains natural green space about 47.98% of the island	Land cover analysis results (2025) using Land Cover Data (2022)	2
		Forest	Forest cover is almost absent about 0.04% of the island	Land cover analysis results (2025) using Land Cover Data (2022)	5
		Agricultural area	Agricultural land covers around 16.6% of the island	Land cover analysis results (2025) using Land Cover Data (2022)	2
		Mangrove	Mangroves cover about 4.4 ha with generally good density and health	Primary Data (In Depth Interview, 2025); Greenpeace (2025); Arhatin & Endriani (2024)	1
		Sea Grass	Seagrass beds cover roughly 6.3 ha but are starting to decline and show signs of stress	Primary Data (In Depth Interview, 2025); Greenpeace (2025)	3

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
		Corals	Coral reefs cover about 817.54 Ha but are already bleaching and degrading	Primary Data (In Depth Interview, 2025); Greenpeace (2025)	3
	Demographic	Female Percentage	Women make up about 49% of the population	BPS (2025)	3
		Population density	Population density is very high, around 1,400 people per km²	Analyzed Result from BPS (2025)	4
		Population under 5 years	Children under five form a large share of the population (42%)	Greenpeace (2025)	4
		Population under 65 years	Older residents are a relatively small group 6%	Greenpeace (2025)	2
		Female-headed households	Female-headed households exist but are few in number (13 families)	Primary Data (In Depth Interview, 2025)	1
		Household Size	Most households are small (1-2 families) with assumption each families consist of at least 3 people	Primary Data (In Depth Interview, 2025)	3
		Disability/People with special needs	There are residents with mental health conditions or special needs, but they represent a small share of the population	Primary Data (In Depth Interview, 2025)	2
	Economic/Livelihood	Small Business and Trade	There are around six big shops, 50 small shops/warung, 10 MSMEs, and more than 20 other micro-businesses (such as vegetable carts). This shows a diverse but small-scale local economy	Primary Data (In Depth Interview, 2025)	2
		Homestay	Pari Island has 121 homestay units, with an average of two rooms per homestay, indicating that many households depend partly on tourism	Primary Data (In Depth Interview, 2025)	2
		Fishery	Capture fisheries operate with adequate gear, and there are 16 HDPE floating cage units (44 cages) with a potential production of approximately 5,580 kg of fish per year. However, these activities are frequently disrupted by bad weather, strong waves, spatial conflicts, reclamation, wastewater, and high water temperatures	Primary Data (In Depth Interview, 2025)	3
		Tourism	In 2017, tourist arrivals reached 116,032 visitors. Key attractions such as Pasir Perawan Beach, Tanjung Rengge, Bintang Beach, mangrove tours, and snorkeling sites are in good condition and community-managed	Primary Data (In Depth Interview, 2025); Jakarta Local Government (Food Security, Marine Affairs and Agriculture Office) (2020)	2

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
		Unemployement	Using proxy, the open unemployment rate in the Thousand Islands is about 7.93%	BPS (2025)	2
		Inflation Rate	Using proxy, annual inflation is relatively low at around 1.57%	BPS (2025)	1
		Household income level	Average household expenditure in the Thousand Islands is about Rp 1,415,690.48 per month, while reported incomes range roughly from Rp 2-3 million for fisheries and Rp 2-5 million for tourism	Greenpeace (2025)	5
		GDP	Regional GDP growth in 2024 is -1.11% with oil and gas and -0.67% without oil and gas	BPS (2025)	4
		Poverty rate	Using proxy, around 13.04% of residents in the Thousand Islands live below the poverty line	BPS (2025)	3
	Resource/water/food	Food Security	The islands face a food calorie deficit of about -1,061,187.40 thousand kcal per year, meaning local production is far below needs. Food security is maintained only because supplies flow in from nearby mainland areas	Jakarta Local Government (Food Security, Marine Affairs and Agriculture Office) (2020)	5
		Water Security	There is an estimated freshwater deficit of around -49,302.13 m³ per year, and residents rely on desalinated water from RO systems to meet their needs in these areas.	Jakarta Local Government (Food Security, Marine Affairs and Agriculture Office) (2020)	5
		Legal/Customary Discrimination	No obvious, direct gender discrimination is reported, but women are subtly marginalised in discussion spaces through male-dominated decision-makin	Primary Data (In Depth Interview, 2025)	5
		Gender-Based Violence	In 2016, there was a serious case of incest (father-child) that proceeded to legal action in Brazil. Beyond this, residents and tourists report not experiencing frequent catcalling or other overt forms of gender-based violenc	Primary Data (In Depth Interview, 2025)	3

Sources: Primary Data (2025), Government Publication and Various Studies

Table 4 Women in Pari Island Adaptive Capacity Index

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score

Adaptive Capacity	Human Capital	Education level	About 39% of residents have completed primary school, 36% junior or senior high school, only 3% tertiary education, while 22% have never attended school	Greenpeace (2025)	4

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
		Access to education facilities	Pari Island has a kindergarten, primary school, junior secondary school, and a madrasah on the island, but senior high school is only available on Pramuka Island, so students must travel off-island for upper secondary education	Primary Data (In Depth Interview, 2025)	4
		Literacy Rate	Using proxy, the literacy rate in the Thousand Islands is very high at 99.70%	BPS (2025)	1
		Average Lenght of Schooling	Using proxy, average schooling in the Thousand Islands is 9.26 years	BPS (2025)	3
		School Participation Rate.	Using proxy, school participation in Thousand Islands is almost universal at primary and lower secondary level, with 99.79% of children aged 7-12 and 98.62% aged 13-15 enrolled, but drops to 76.44% among youth aged 16-18	BPS (2025)	3
		Access to healthcare services	Health services on Pari consist of one auxiliary health centre (puskesmas pembantu) and two posyandu	Primary Data (In Depth Interview, 2025)	4
		Health workforce	There are 4 doctors, 6 nurses, and 3 midwives serving the island	Primary Data (In Depth Interview, 2025)	4
		Life Expectancy	Using proxy, life expectancy in the Thousand Islands is 75.99 years	BPS (2025)	2
		Human Development Index (IPM)	Using proxy, The Human Development Index for the Thousand Islands is 76.69	BPS (2025)	2
		Skills and training received	Residents report no regular skills-training programmes	Primary Data (In Depth Interview, 2025)	5
		Climate change awareness programs	There are no dedicated climate change awareness or extension programmes	Primary Data (In Depth Interview, 2025)	5
	Infrastructure/Housing	Housing quality and durability	Pari has 178 permanent, 67 semi-permanent, and 14 non-permanent houses; district data show that 90.82% of households meet the minimum floor area of 7.2 m², 100% have adequate walls and floors, but only 20.26% have adequate roofing, and field observations indicate that many buildings already show cracks, signalling weak structural resilience.	Primary Data (Observation, 2025); BPS (2025)	5
		Sarana sosial dan peribadatan	The island has six open fields, one mosque, and three musholla, providing basic spaces for social interaction and religious activities	Primary Data (In Depth Interview, 2025)	3

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
		Road Infrasrtucture Quality	Around 40% of roads, equivalent to about 360 metres, are in a state of moderate damage	Primary Data (In Depth Interview, 2025)	4
		Transportation Access	Pari is served by three piers (a community pier, a transport agency pier, and a small fishers' pier) and two jetties (a main jetty and a fishers' jetty), all reported as maintained	Primary Data (In Depth Interview, 2025)	3
		Access to electricity	Electricity coverage is 100% through PLN, with average consumption of about 2,300 kWh per month per household and 3,200 kWh per month per homestay, and generally stable voltage	Primary Data (In Depth Interview, 2025)	3
		Access to water	The island relies on one reverse-osmosis (RO) unit that serves 100% of residents, with an operational capacity of 4,000 litres per day producing brackish but clear and odourless water; the RO operates only between 09:00-17:00, households must bring or buy their own gallon containers, and fewer than 20% of residents also harvest rainwater	Primary Data (In Depth Interview, 2025)	5
		Access to sanitation facility	There are six public toilets for tourism, and about 99% of households have individual septic tanks with closed, partially clogged pipes, but there is no central wastewater treatment plant, so sanitation remains largely unmanaged beyond on-site facilities	Primary Data (In Depth Interview, 2025)	3
		Access to waste facility	Solid waste services include one garbage boat, two temporary disposal sites (TPS), 41 wheeled bins, and three carts; waste is collected daily, with about 30% managed on the island and 70% transported off-island, although the waste transport motorbike is currently broken	Primary Data (In Depth Interview, 2025)	3
		Communication infrastructure	Pari has a base transceiver station (BTS) providing stable 3G and 4G cellular coverage	Primary Data (In Depth Interview, 2025)	3
	Social Capital	Community Organization	Multiple community groups are active, including Forum Peduli Pulau Pari, a women's group, Wak Misin, a fishers' group, a tourism-awareness group (Pokdarwis), and a community surveillance group (Pokwasnas)	Primary Data (In Depth Interview, 2025)	2
		Community leadership and positions	The women's group is increasingly involved in decision-making and climate awareness, but discussions with male groups are still dominated by a single male	Primary Data (In Depth Interview, 2025)	3

Framework	Dimension	Indicators/Criteria	Result	Data Sources	Score
			figure		
		Trust in community institutions	Trust in community institutions is fairly strong, as shown by emerging division of labour across different fields, participation in training, and the management of shops and gardens through collective deliberation (musyawarah)	Primary Data (In Depth Interview, 2025)	3
		Community cohesion and cooperation	Community cohesion and cooperation are high: residents routinely engage in gotong royong, group meetings for planning, and joint management of shared facilities, with clearly agreed roles that support effective coordination, solidarity, and commitment to sustaining community programs.	Primary Data (In Depth Interview, 2025)	2
		Participation in community activities	Participation in community activities is generally high, but gender dynamics persist: women are actively involved yet still often assigned additional domestic tasks, such as preparing tea and coffee during events	Primary Data (In Depth Interview, 2025)	2
	Disaster management systems	Climate/weather information access	Residents can access BMKG climate and weather information, but this is not yet embedded in a comprehensive local risk communication system	Primary Data (In Depth Interview, 2025)	3
		Early warning system access	There is no formal early warning system	Primary Data (In Depth Interview, 2025)	5
		Temporary Evacuation Site (TES)	Pari Island has no designated temporary evacuation sites or assembly points	Primary Data (In Depth Interview & Observation, 2025)	5
		Final Evacuation Site (TEA)	There are no designated final evacuation sites	Primary Data (In Depth Interview & Observation, 2025)	5
	Natural Capital	Land ownership and tenure	Residents report that no one holds formal land ownership rights	Primary Data (In Depth Interview, 2025)	5
	Institutional Capacity	Climate change Policies	Climate change policies formally exist, but their implementation on the island is not yet optimal	Content Studies on Government Publications (2025)	4
		Gender Policies	Gender-related policies are also in place on paper but are not implemented in practice	Content Studies on Government Publications (2025)	4

Sources: Primary Data (2025), Government Publication and Various Studies

From the scale of 1-5 that are used in this study, women in Pari Island have **climate change exposure with an average score of 3.0**, reflecting the combination of very high sea-level rise and salinity and frequent tidal flooding, but the absence of cyclones and only moderate flood and heat extremes. Climate **change sensitivity, with an average score of 2.97, also** points to moderate sensitivity: high population density, low household income, food and water insecurity, and degrading coastal ecosystems elevate risk, while high literacy, some remaining natural vegetation, and diversified small businesses prevent sensitivity from reaching the highest class. In contrast, **climate change adaptive capacity, with an average score of 3.5**, was the highest among the three dimensions, which, in this scoring scheme, indicates relatively weak adaptive capacity. Limited access to higher education and skills training, a small health workforce, damaged housing and roads, the absence of formal early warning and evacuation sites, insecure land tenure, and poorly implemented climate and gender policies all constrain women's ability to anticipate, absorb, and recover from climate shocks.

Women in the Pari Island Vulnerability Index (VI):

$$VI = \frac{(3.0+2.97+3.5)}{3} = 3.16$$

When combined, these components yield an overall **vulnerability index of 3.16**, placing women on Pari Island in the moderate-to-high vulnerability category. This suggests that women are not primarily exposed to the most extreme hazards, but their everyday lives are shaped by a hazardous coastal environment and socio-economic conditions that are difficult to buffer, given the current level of adaptive capacity. In other words, vulnerability in Pari is driven less by exceptional disasters than by the interaction of chronic environmental stresses with limited institutional support, uneven infrastructure, and constrained opportunities for women to strengthen their livelihoods and participate in decision making.

In the next subsection, these results are interpreted alongside qualitative insights from key informant interviews to explain how gendered roles, access to resources, and support structures shape women's experiences of climate vulnerability on Pari Island.

4.3 Qualitative Insight on Women's Vulnerability

4.3.1 Women in Pari Island Exposure to Climate Change

The vulnerability of women on Pari Island can be understood by first examining their level of exposure to climate change. Women on this island face direct exposure to various climate impacts, including rising temperatures, unpredictable weather changes, rising sea levels, tidal flooding, extreme weather, and increased seasonal diseases. All these forms of exposure affect women's daily activities, especially since they have the primary responsibility for meeting the basic needs of their families, such as clean water, food, and childcare.

One of the most obvious forms of exposure is the change in wind patterns. According to Mrs Aas, '*wind patterns that used to be predictable now often change suddenly when fishermen are already at sea, forcing them to return immediately because the situation is no longer safe*.' [1]This is in line with Saryono's statement as a fisherman that '*now the weather is unpredictable and the wind is also uncertain*'.[2] These changes in wind patterns indicate that weather conditions are becoming increasingly difficult to predict, and women, especially those living in fishing families, have to deal with greater uncertainty regarding the safety of family members and the sustainability of household income.

[1] Interview conducted on November 19, 2025, via Zoom.

[2] Interview results on November 21, 2025.

Rising sea levels and tidal flooding are becoming increasingly frequent. Flooding damages boat mooring areas and limits coastal activities. When tidal flooding occurs, women are usually the first to secure their children and other family members from the flood. However, their response efforts are limited by their lack of access to early warning information, forcing them to rely on the available resources and their local knowledge.

Another exposure that greatly affects women is the clean water deficit in the region. Pari Island has only one Reverse Osmosis (RO) unit as its main source of clean water. When distribution is disrupted, women must adjust their household strategies, extend the time spent fetching water, or reduce usage for certain needs. This condition increases women's workload and narrows their space for adaptation to climate change.

In addition, extreme weather has a direct impact on socio-economic dynamics, especially for those dependent on the tourism sector. When the weather is bad, the number of tourists decreases dramatically. Humid coastal conditions also trigger an increase in seasonal illnesses, particularly respiratory tract infections (coughs and colds). According to local health workers, '*the most common illnesses during extreme weather are coughs and colds*.'[3] Women, as primary caregivers for sick family members, are the first to feel the additional burden during periods of increased illness.

The impact of climate change is also felt by women who depend on tourism-based economies and weather-sensitive activities for their livelihood. Unpredictable weather causes cancellations of homestay guests, as stated by Mrs. Ros: '*My homestay is often cancelled when the weather is unpredictable and tourists are afraid to travel to Pari Island*.[4]' This shows that climate change creates new uncertainties that directly impact the stability of women's incomes. Overall, these various forms of exposure, ranging from changes in wind patterns, tidal flooding, water shortages, and declining tourist visits, show that the women of Pari Island are highly exposed to climate change. This high level of exposure reinforces their sensitivity, which is discussed in the next section.

4.3.2 Women in Pari Island Sensitivity to Climate Change

After the impacts of climate change were identified, the level of sensitivity of women on Pari Island further exacerbated their vulnerability to climate change. Women on this island bear a double burden, namely taking care of domestic work while also carrying out economic activities such as micro, small, and medium enterprises, homestay management, food trading, or other informal work. When extreme weather reduces the number of tourists or disrupts the activities of fishermen, who are the main source of income, household economic pressures increase significantly, and women have to bear the additional burden of maintaining food security and family welfare. Women working in the tourism sector, MSMEs, sanitation, teaching, and fishing are directly impacted by this. Cancellations of homestay guests, a decline in tourists, damage to boat mooring facilities, and an increase in seasonal illnesses, such as respiratory infections, are concrete examples of how women's sensitivity to climate change manifests in their daily lives. As Mrs Ros said, '*When the weather is so unpredictable, tourist numbers are uncertain and income declines*,' showing how much women's businesses depend on stable weather.[5]

Women's sensitivity is also greatly influenced by the social structure and cultural norms of Pari Island. Although women are active in various community activities, their space for participation in decision-making remains limited. Public discussion spaces are dominated by male figures, while women are often placed as providers of consumption and not as key actors in climate adaptation planning or strategy development. A facilitator who accompanied them explained that '*women's discussion spaces are*

[3] Results of the interview with Intan, on November 20, 2025.
[4] Results of the interview on November 20, 2025.
[5] Interview results on November 20, 2025.

often limited to domestic work,' indicating the strength of traditional gender norms that still influence social dynamics, resulting in women's voices being less equally accommodated. In crisis situations such as tidal flooding, inundation, or an increase in seasonal diseases, women are the first to adjust their household activities, ensure the safety of their children, and care for sick family members. This situation reinforces their sensitivity because the burden of caregiving and situational adjustment always falls on women first.

Women's social vulnerability is also evident in cases of gender-based violence, such as the incident of severe sexual violence in 2016. Although official reports are rare, this case shows that the risk of violence remains, mainly because protection mechanisms, complaint services, and psychosocial support are not functioning optimally. According to Banker, former head of RT 04, '*at that time, I couldn't believe that there was a case of sexual abuse between a biological father and his biological children, until one of the children dared to speak up*.' [6]This statement shows that power imbalances within families and communities can lead to some cases going unreported, meaning that women's vulnerability does not always appear in formal data and occurs covertly.

Furthermore, the pressure on the women of Pari Island also stems from a broader socio-ecological structure, such as conflicts over living space with companies that claim most of the island. Ms Aas, Chairwoman of the Pari Island Women's Community, said that women on the island face multiple layers of pressure, ranging from the strong coastal patriarchal culture that still considers women to be merely housewives to conflicts with resort companies that claim almost the entire land area. According to her, these land claims have forced women to take over the management of gardens and coastal areas so that these areas are not considered vacant and subsequently taken over by companies.[7] However, the women who have taken on these roles previously had no knowledge of farming, so they had to learn independently in the midst of an intimidating situation, including threats that residents should not join women's groups because they were considered dangerous to the interests of the companies. These conditions show that the vulnerability of Pari Island women stems not only from economic pressures and climate exposure, but also from patriarchy, corporate encroachment on their living space, the absence of state protection for citizens, and ecological pressures that threaten their economic sustainability and household welfare.

4.3.3 Women in Pari Island Adaptive Capacity to Climate Change

The adaptive capacity of women on Pari Island is relatively low due to limited structural support, lack of access to information, and unequal opportunities to strengthen climate adaptation knowledge. Observations in the field show that women's vulnerability is exacerbated by the absence of government support; neither the village head nor the regent has ever provided protection or assistance related to the threat of climate change, so that women's communities rely solely on the support of NGOs and academics to develop knowledge and social protection networks. This lack of state intervention places women in a weak position when facing disasters such as tidal flooding, clean water shortages, or income fluctuations due to extreme weather conditions.

In addition to the absence of government support, unequal access to information and training related to climate change reinforces women's limited adaptive capacity. The lack of climate adaptation education and training means that women who deal with daily needs for water, food, and household management do not acquire the knowledge that could help them respond more effectively to climate change threats. According to Ms Atik and several members of the Pari women's group, '*there is no education or training from the local government on climate change*,' so women do not have access to formal knowledge on how to adapt to extreme weather, risk management, or economic diversification strategies.

[6] Results of the interview conducted on November 20, 2025.

[7] Results of the interview on November 19, 2025.

[8]This situation widens the capacity gap between men and women in facing environmental change and disaster risks, as men are often involved in meetings or public discussions that occasionally discuss weather and environmental conditions, while women do not have such opportunities.

Nevertheless, the women on Pari Island have strong social capital, which is the foundation of community-based adaptation capacity. They are active in women's groups, tourism awareness groups, and community activities, and have a high level of solidarity, as reflected in mutual assistance practices and informal information sharing among residents. Field observations show that women carry out various initiatives, such as farming, joint business activities, and pioneering the formation of cooperatives, to strengthen household economic resilience. This social capital functions as a form of adaptive capacity that emerges from the bottom up, although it is not yet balanced by structural support from the government.

Overall, women's adaptive capacity on Pari Island is formed from a mixture of structural limitations and community strength. The lack of government intervention, limited access to climate information, and absence of adaptation training have resulted in low adaptive capacity. However, community solidarity and women's own initiatives have been supporting factors that have prevented their vulnerability from becoming more severe. Nevertheless, the strength of the community is insufficient to replace the need for formal and systematic support, so women's adaptive capacity remains vulnerable.

4.3.4 Women in Pari Island Vulnerability to Climate Change in General

Combining high exposure levels, socioeconomic sensitivity, and limited adaptive capacity, women on Pari Island are highly vulnerable to the impacts of climate change. They are directly exposed to extreme weather events, rising sea levels, clean water shortages, and increased seasonal diseases. Simultaneously, they bear both domestic and economic burdens, especially in sectors that are highly sensitive to climate change, such as fisheries, tourism, MSMEs, and homestay management. Limited access to climate information, limited adaptation training, and the absence of institutional support weaken women's ability to respond to environmental crises. The combination of climate exposure, domestic economic pressures, and limited participation makes women increasingly vulnerable to climate change threats. Figure 1 shows women's group activities in farming as a form of community-based adaptive capacity, but this potential is not yet strong enough without gender-responsive policy support.

[8] Results of the interview conducted on November 20, 2025.

Figure 1. Community Gardening Activities by Women of Pari
Source: Personal Documentation

If women's collective strength is facilitated through inclusive government policies and support for climate adaptation training, they can become key actors in building community resilience. However, current conditions show that the lack of institutional intervention and the absence of an inclusive disaster management system mean that women remain the most vulnerable group. The lack of government support at the village and district levels creates an institutional void that forces women to rely solely on NGOs and academics for legal assistance, environmental guidance, and capacity building.

The vulnerability of women on Pari Island can be better understood through the Feminist Political Ecology (FPE) framework, which emphasizes that experiences of vulnerability are not only influenced by ecological factors, but also by gendered power relations. In line with Elmhirst (2011), Political Ecology needs to examine the struggle for knowledge, power, and practices that produce environmental injustice, including inequality in households and communities. Rocheleau et al. (1996) also emphasize that gender is a critical variable in determining access to and control over resources, so that gender inequality has a direct impact on a group's ability to adapt.

The findings of this study show that the situation on Pari Island reflects the concepts described by Feminist Political Ecology. Although women are active in various community activities, the space for discussion and decision-making is still dominated by men, so women's voices have not been able to effectively shape local policy directions or climate adaptation strategies. Women are often present in community activities as supporters, such as preparing food, rather than as key decision makers. This situation illustrates an arena of shared interests that is not truly equal, as Rocheleau argues that spaces such as households and communities are always colored by unequal power relations.

The findings of Ms. Aas further emphasize this vulnerability. Her explains that women on Pari Island live under multiple pressures, ranging from a strong coastal patriarchal culture that relegates women to the role of housewives to structural conflicts with resort companies that claim almost all of the island's land. These land claims create conditions of dispossession that force women who previously worked as fishermen or informal workers to manage gardens and beaches so that their areas are not considered vacant and subsequently taken over by companies. They must learn to farm independently without experience, often in situations of intimidation, including threats not to join women's groups that are considered dangerous to the company's interests.

The vulnerability experienced by women is exacerbated by the lack of basic infrastructure. They still depend on well water, there are no secondary schools on the island, and health services consist only of a community health center without hospital facilities. Changing ecological conditions, such as extreme weather and wind patterns that can no longer be read by fishermen, also increase economic and safety risks for women and their families.

Overall, the vulnerability of Pari Island women is the result of the intersection of ecological exposure, coastal patriarchy, corporate encroachment on living space, infrastructure inequality, and the absence of the state in their lives. Analysis through the Feminist Political Ecology framework shows that this vulnerability is not natural but is produced through social, economic, and political structures that regulate women's access to resources, living space, and opportunities for adaptation.

5. Conclusion

5.1 Conclusion

Quantitatively, the composite index indicates that women in Pari Island face moderate exposure (E = 3.0) and sensitivity (S = 2.94), low adaptive capacity (AC = 3.44), and moderate-to-high overall vulnerability

(GVI = 3.12). Drawing on in-depth interviews, field observations, and a feminist political ecology lens, these scores reflect structural, gendered, and multi-layered vulnerabilities. Women make essential contributions to household income and community life through fisheries, tourism, small businesses, and care work; however, they remain marginal in formal decision-making spaces that shape adaptation. Discussions and local planning processes are still dominated by men, limiting women's influence on collective strategies, while they simultaneously shoulder the double burden of reproductive and productive labor. When climate variability disrupts fisheries and tourism, women are expected to buffer household economies through savings, income diversification, and managing basic needs, which intensifies their workloads and stress.

Limited access to climate information, training, and adaptation support further heightens women's physical and social vulnerabilities. The absence of local advisory services, early warning systems, and safe spaces means that women are less prepared for storms, water shortages, and other extreme events, even though they are primarily responsible for water, food, and child safety. Although social capital is strong through women's groups, youth and tourism organizations, and everyday mutual aid, this potential is underused because institutional backing is weak, women's representation in formal bodies is low, and gender-specific risks, such as gender-based violence and lack of protection mechanisms, often remain invisible.

Overall, the analysis indicates that women's vulnerability on Pari Island arises not only from living in a hazard-prone coastal environment, but also from unequal power relations, gender norms, uneven access to resources, and constrained adaptive management. Therefore, effective climate adaptation requires gender-sensitive approaches that recognize women's roles, strengthen their adaptive capacity, expand their opportunities, and ensure inclusive and accountable institutions.

5.2 Limitation

This study has several limitations. It focuses on a single small island, so the findings cannot be generalized to other contexts, and limited gender-disaggregated and local disaster data mean that some indicators rely on proxies, purposive key-informant interviews, and a short fieldwork period that may miss seasonal dynamics. The composite index also has methodological constraints typical of indicator-based assessments: indicator selection and component grouping, although informed by literature and local relevance, remain partly subjective; ordinal 1-5 scores are treated as quasi-interval data and averaged using equal weights; aggregation can hide severe deficits in specific indicators; and uncertainty in the underlying data is not formally quantified. Therefore, the index should be interpreted as a relative, rather than definitive, representation of women's climate vulnerability and always read together with disaggregated indicators and qualitative findings.

5.3 Suggestion

This study highlights the need to improve the availability and quality of gender-specific data at the local level so that climate vulnerability assessments can be more accurate and actionable. Local governments and relevant agencies should provide comprehensive climate adaptation training and ensure that women are meaningfully included in planning and decision-making processes. Strengthening institutional support, including early warning systems and gender-responsive socioeconomic programs, is essential for enhancing women's adaptive capacity in small island settings. Future research should cover a wider range of islands and employ long-term designs to capture the temporal and spatial dynamics of climate risk, as well as intersectional differences among women.

Acknowledgment

We gratefully acknowledge the women's group of Pari Island, especially Mrs. Aas and all its members, the residents of Pari Island who shared their time and experiences, and the local leaders and practitioners who supported this research.

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