

THE IMPACT OF CLIMATE CHANGE ON INDIGENOUS PEOPLES:

A Study on Food System Resilience and the Role of Indigenous Women

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Table of Contents

Table of Contents.....	2
List of Tables.....	4
List of Charts.....	4
List of Figures.....	5
List of Acronyms.....	5
Glossary and Operational Definitions.....	11
Glossary of Local Terms in Indigenous Communities.....	15
Executive Summary.....	17
Chapter 1: Introduction.....	18
1.1 Background.....	18
1.2 Research Questions and Objectives.....	22
1.3 Theoretical Framework of Research.....	22
1.4 Research Methods.....	27
1.5 Research Locations.....	28
Chapter 2: Literature Review.....	30
2.1 Climate Change & The Rise of Climate Disasters.....	30
2.2 Indigenous Peoples, Deforestation, and Climate Change.....	35
2.3 Food and Climate Change.....	38
2.4 Indigenous Women, Natural Resource Management, and Climate Change.....	39
Chapter 3: Research Findings.....	44
3.1 Mentawai Indigenous Community.....	44
3.2 Talang Mamak Indigenous Community.....	56
3.3 Bara and Cindakko Indigenous Communities.....	64
3.4 Baduy and Kasepuhan Indigenous Communities.....	74
Chapter 4: Analysis.....	89
4.1 The Turning Point of Indigenous Society Transformation.....	90
4.2 Capital and State Penetration as the Basis for Excluding Indigenous Women.....	93
4.3 Ecological Degradation and Local Climate Change.....	97
4.4 Living Economy versus Death Economy.....	107
4.5 Resilience Tactics of Indigenous Women: Reconciling the Past and the Future.....	112

Chapter 5: Conclusion and Recommendations.....	124
5.1 Conclusion.....	124
5.2 Recommendations.....	126
5.3 Policy Implications: National & Regional Strategic Directions.....	132
Reference.....	136

List of Tables

Table 1. Rationale for Research Location Selection.....	28
Table 2. Mapping Legal Frameworks and the Implementation Interconnectivity of Human Security, Human Rights, and Disaster-Climate Change Frameworks.....	34
Table 3. Regulations Related to the Prohibition of Land Burning.....	38
Table 4. The Relationship Between Food and Climate Change.....	81
Table 5. The 7 Stages of Farming Rituals (7 Rukun Tani) in the Kasepuhan Indigenous Community...	93
Table 6. Comparison of Capital and State Power Penetration in Indigenous Communities.....	99
Table 7. Analysis of Climate Change Risk Components.....	109
Table 8. Analytical Framework of the Living Economy and Death Economy.....	119
Table 9. Analytical Framework of Indigenous Community Resilience.....	134
Table 10. Programmatic Recommendations Based on Policy-Making Levels.....	156

List of Charts

Chart 1. Number of Natural Disasters and Affected Victims in Indonesia.....	32
Chart 2. Comparison of Disaster Impacts (Geophysical vs. Hydrometeorological) in Indonesia from 1900 to 2020.....	32
Chart 3. Mortality Rates Due to Natural Disasters in the Asia and Pacific Region (1970–2014).....	33
Chart 4. Natural Disaster Patterns in Target Research Locations from 2009 to 2024.....	100
Chart 5. Natural Disaster Occurrences in Mentawai Islands and Tebo Regencies.....	102
Chart 6. Number of Affected Victims of Natural Disasters in Mentawai Islands and Tebo Regencies.....	103
Chart 7. Natural Disaster Occurrences in Maros and Tebo Regencies.....	104
Chart 8. Number of Affected Victims of Natural Disasters in Maros Regency.....	105
Chart 9. Natural Disaster Occurrences in Lebak and Maros Regencies.....	106
Chart 10. Rainfall Intensity in Maros Regency (ml).....	106

List of Figures

Figure 1. IPCC Risk Framework Integrating AR5 and AR6.....	25
Figure 2. Illustration of System Components Determining the Shared Socioeconomic Pathways (SSPs).....	26
Figure 3. Integrative Analysis of Indigenous Women's Resilience Strategies.....	120
Figure 4. Conclusion of the SSP Analysis of Indigenous Communities in Research Locations.....	124

List of Acronyms

Acronym	Expanded Term (English / Formal Translation)
AMAN	Alliance of Indigenous Peoples of the Archipelago (Aliansi Masyarakat Adat Nusantara)
AMDAL	Environmental Impact Assessment (Analisis Dampak Lingkungan)
APBD	Regional Revenue and Expenditure Budget (Anggaran Pendapatan dan Belanja Daerah)
APBN	State Revenue and Expenditure Budget (Anggaran Pendapatan dan Belanja Negara)
AR	Assessment Report
Bansos	Social Assistance (Bantuan Sosial)
Bapanas	National Food Agency (Badan Pangan Nasional)
Bappeda	Regional Development Planning Agency (Badan Perencanaan Pembangunan Daerah)
Bappenas	National Development Planning Agency (Badan Perencanaan Pembangunan Nasional)
BMKG	Meteorology, Climatology, and Geophysics Agency (Badan Meteorologi, Klimatologi, dan Geofisika)

Acronym	Expanded Term (English / Formal Translation)
BNPB	National Disaster Management Agency (Badan Nasional Penanggulangan Bencana)
BPS	Statistics Indonesia (Badan Pusat Statistik)
Bumdes	Village-Owned Enterprise (Badan Usaha Milik Desa)
CBPR	Community-Based Participatory Research
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
Ciptaker	Omnibus Law on Job Creation (Cipta Lapangan Kerja)
C	Celsius
CO ₂	Carbon Dioxide
COP	Conference of the Parties
DPR, DPRD	House of Representatives, Regional House of Representatives
ER	Ethnographic Research
EM-DAT	Emergency Events Database
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FPIC	Free, Prior, and Informed Consent
GHG	Greenhouse Gas

Acronym	Expanded Term (English / Formal Translation)
Ha	Hectare
HHBK / NTFP	Non-Timber Forest Products (Hasil Hutan Bukan Kayu)
ICESCR	International Covenant on Economic, Social, and Cultural Rights
IFC	International Finance Corporation
Inpres	Presidential Instruction (Instruksi Presiden)
IPCC	Intergovernmental Panel on Climate Change
ISPA	Acute Respiratory Infection (Infeksi Saluran Pernapasan Akut)
KABC	Bara & Cindakko Indigenous Community
KABK	Baduy & Kasepuhan Indigenous Community
KAM	Mentawai Indigenous Community
KATM	Talang Mamak Indigenous Community
Karhutla	Forest and Land Fires (Kebakaran Hutan dan Lahan)
KAWAL	Lebak Customary Territory Consolidation & Advocacy (Konsolidasi & Advokasi Wilayah Adat Lebak)
KKI Warsi	Indonesian Conservation Community Warsi
KLHK	Ministry of Environment and Forestry (Note: Separated into the Ministry of Environment and the Ministry of Forestry under the Merah Putih Cabinet)
KPH	Forest Management Unit (Kesatuan Pengelolaan Hutan)

Acronym	Expanded Term (English / Formal Translation)
KTH	Forest Farmers Group (Kelompok Tani Hutan)
KTT	Summit (Konferensi Tingkat Tinggi)
KWT	Women Farmers Group (Kelompok Wanita Tani)
MBG	Free Nutritious Meal Program (Makan Bergizi Gratis)
NGO	Non-Governmental Organisation
NKRI	The Unitary State of the Republic of Indonesia (Negara Kesatuan Republik Indonesia)
OPD	Regional Government Work Unit (Organisasi Perangkat Daerah)
PBB	United Nations (UN)
Perda	Regional Regulation (Peraturan Daerah)
Perhutsos	Social Forestry (Perhutanan Sosial)
Perlinsos	Social Protection Program (Program Perlindungan Sosial)
Perpres	Presidential Regulation (Peraturan Presiden)
TEK	Traditional Ecological Knowledge
PP	Government Regulation (Peraturan Pemerintah)
PLN	State Electricity Company (Perusahaan Listrik Negara)
PLTS	Solar Power Plant (Pembangkit Listrik Tenaga Surya)
Polri	Indonesian National Police (Polda: Provincial Level, Polres: Regency Level, Polsek: Sub-district Level)

Acronym	Expanded Term (English / Formal Translation)
PPL	Field Agricultural Extension Officer (Petugas Penyuluh Lapangan)
PT ABT	Alam Bukit Tigapuluh Private Limited Company
RAN API	National Action Plan for Climate Change Adaptation
RAD API	Regional Action Plan for Climate Change Adaptation
RMI	Indonesian Indonesian Young Foresters (Rimbawan Muda Indonesia)
RPPLH	Environmental Protection and Management Plan
RTRW	Regional Spatial Plan (RT/RW: Neighborhood/Hamlet administrative units)
SCF	Sulawesi Community Foundation
SIKAT	Acculturation Crisis Alert Toolkit (Siaga Krisis Akulturasi Toolkit)
SMA	Senior High School
SMP	Junior High School
SREX	Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
SSP	Shared Socioeconomic Pathways
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women

Acronym	Expanded Term (English / Formal Translation)
UUD 1945	The 1945 Constitution of the Republic of Indonesia
UU	Law / Act
WB	World Bank
WMO	World Meteorological Organization
YCMM	Mentawai Citra Mandiri Foundation (Yayasan Citra Mandiri Mentawai)

Glossary and Operational Definitions

Climate Adaptation

Efforts to adjust to a changing climate to mitigate negative impacts or exploit emerging opportunities. In the context of indigenous peoples, adaptation encompasses strategies rooted in traditional knowledge and local wisdom—such as crop diversification, adjustments to planting schedules, water conservation, and the restoration of agroecological practices—to safeguard food security, livelihoods, and cultural heritage.

AMDAL (Environmental Impact Assessment)

A comprehensive study concerning the significant impacts of a planned business or activity on the environment. This assessment is vital for governments, corporations, and the general public, as every business enterprise is required to possess a rigorous and complete AMDAL document. It serves as a decisive tool for formulating policies that prioritize environmental sustainability around development zones.

CEDAW

An international treaty that specifically governs women's rights, explicitly focusing on the elimination of all forms of discrimination against women.

Ecofeminism

An interdisciplinary approach that highlights the interconnectedness between the exploitation of nature and the oppression of women, both rooted in patriarchal systems that hierarchically subordinate them under male dominance. Ecofeminism also emphasizes how women and nature are frequently personified as Mother Nature (Ibu Pertiwi), a symbol reinforcing the critical role women play in environmental conservation and resource management. Although criticized by some for oversimplifying the intrinsic proximity of women to nature, ecofeminism remains a vital framework for advocating ecological and gender justice, as well as mainstreaming the role of women in sustainable development and climate change responses.

Climate

The long-term average pattern of weather conditions in a specific region—typically spanning a 30-year period according to the WMO—encompassing temperature, precipitation, humidity, and sunshine. Unlike weather, which fluctuates daily, climate reflects long-term trajectories.

Intersectionality

An analytical framework that examines how various social identities—such as gender, ethnicity, and indigenous status—intersect to construct distinct forms of vulnerability or inequality. In climate change contexts, an intersectional approach highlights how indigenous women disproportionately experience climate impacts due to compounding layers of discrimination based on gender and socio-cultural status, paired with restricted access to resources, information, and decision-making platforms.

Climate Justice

A principle recognizing that the impacts of climate change are not distributed equitably. Consequently, it demands a fair distribution of burdens and responsibilities between developed and developing nations,

as well as among different social groups based on their vulnerabilities, capacities, and historical contributions to the climate crisis.

Human Security

While multiple definitions exist across disciplines, the IPCC defines human security within the context of climate change as a condition achieved when the vital core of human lives is protected, and when individuals possess the freedom and capacity to live with dignity. In this assessment, the vital core encompasses universal, culturally specific, material, and non-material elements necessary for people to act on behalf of their own interests. Human security is profoundly influenced by markets and the state; poverty, systemic discrimination, and extreme natural or technological disasters can severely undermine it.

Local Wisdom

The body of knowledge, values, and practices developed by a community over generations. It functions to regulate the relationship between humans, nature, society, and culture in a sustainable manner. This aligns with Law No. 32/2009 on Environmental Protection and Management, Ministry of Education and Culture Regulation No. 81A/2013, and Keraf's (2002) Environmental Ethics, which emphasizes local wisdom as traditional ecological knowledge essential for maintaining human-nature equilibrium.

Climate Vulnerability

The propensity or predisposition of an individual, community, or natural system to be adversely affected by the harmful impacts of climate change. The level of vulnerability varies depending on exposure, sensitivity, and adaptive capacity. Indigenous peoples often exhibit high vulnerability due to their direct dependence on nature, limited resource access, and systemic marginalization from decision-making arenas.

Climate Crisis

A global emergency triggered by the surge in anthropogenic (human-induced) greenhouse gas emissions, resulting in rapid climate shifts with far-reaching consequences for Earth's systems, human life, and biodiversity. These changes are accelerating in frequency and severity—manifesting as extreme temperatures, floods, droughts, and rising sea levels—and threaten both ecological balance and human survival.

Loss and Damage

This concept operates on two distinct tiers: capitalized as Loss and Damage, it refers to the formal international political and financial framework under the UNFCCC designed to address climate impacts; written in lowercase as loss and damage, it denotes the actual, manifest economic and non-economic losses and physical damage experienced by communities and ecosystems due to climate change, such as coastal erosion or catastrophic crop failures.

Indigenous Peoples / Local Communities

In the Indonesian context, this refers to distinct social groups and local communities living by ancestral origins, customary territories, customary laws, and traditional knowledge passed down through generations. According to AMAN, indigenous peoples possess a collective identity, distinct ancestral land/resource tenure, and customary institutions regulating their socio-cultural life. Legally, Article 18B paragraph (2) and Article 28I paragraph (3) of the 1945 Constitution recognize customary law communities. However, the government frequently utilizes the administrative term Isolated Indigenous

Communities (Komunitas Adat Terpencil - KAT) under Presidential Regulation No. 186/2014 and Ministry of Social Affairs Regulation No. 9/2012, operating under the baseline assumption that all native Indonesians are indigenous (pribumi), excluding those of foreign descent like ethnic Chinese.

Climate Mitigation

Deliberate, planned interventions designed to reduce greenhouse gas emissions at the source or enhance carbon sinks through sustainable practices. This includes the local wisdom of indigenous peoples in preserving forests, soils, and biodiversity.

Net Zero

A state wherein the total volume of greenhouse gases released into the atmosphere is fully counterbalanced by atmospheric removal or absorption, yielding a net balance of zero. Transitioning to net zero represents one of the greatest global challenges; it requires governments and citizens to collectively and drastically overhaul energy production, distribution, and consumption models to achieve carbon neutrality.

Traditional Ecological Knowledge (TEK)

A cumulative body of understanding, practices, and beliefs regarding the relationship of living beings with one another and with their physical environment, evolving through adaptive processes and handed down through generations. This definition builds on academic literature, notably Berkes (1999), concerning the science and way of life of indigenous communities regarding how to steward, utilize, and live in harmony with nature.

Climate Change

A long-term shift in global or regional temperature and weather patterns. These changes can be driven by natural mechanisms (such as solar cycle variations, orbital shifts, or volcanic eruptions) or by human activities that alter the composition of the global atmosphere by increasing greenhouse gas concentrations. Since the Industrial Revolution in the 1800s, emissions have surged due to the burning of fossil fuels (coal, oil, and gas). The UNFCCC distinguishes between climate change attributable to human activities altering atmospheric chemistry and climate variability resulting from natural causes. For indigenous peoples, climate change disrupts their reciprocal relationship with nature, threatening traditional livelihoods, local ecological knowledge, and the formal recognition of customary lands.

Resettlement

The process of forced or semi-voluntary relocation of indigenous peoples from their ancestral living spaces due to infrastructure development projects, conservation policies, or the impacts of climate change. Resettlement entails not only physical displacement from dwellings but also the profound loss of land access, livelihoods, cultural identity, and the social networks that sustain local food systems and spiritual practices. This definition aligns with the World Bank Environmental and Social Standards and the IFC Performance Standards, which emphasize that resettlement—encompassing physical displacement (loss of shelter and habitat) and economic displacement (loss of assets, income sources, or resource access)—must ensure that the affected populations' standard of living, livelihoods, and socio-cultural conditions are not degraded, but rather improved or at least restored to pre-displacement levels.

Climate Resilience

The capacity of individuals, communities, and socio-ecological systems to anticipate, prepare for, and effectively respond to the impacts, risks, and vulnerabilities brought about by climate change. It requires maintaining baseline functions and structures, surviving and absorbing shocks, and rapidly recovering from climate-induced disruptions—such as extreme weather events, droughts, or floods—while sustaining long-term survival and livelihoods.

Climate Risk

The potential for adverse consequences for human societies or ecosystems resulting from climate change impacts. Climate risk assessments are based on formal analyses of the consequences, probabilities, and responses to these impacts. The Risk Equation:

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$

demonstrates that climate risk is the product of a physical hazard, exposure to that hazard, and systemic vulnerability, where the interactions among these components dictate the ultimate risk profile.

Local Food System

The holistic manner in which an indigenous community produces, distributes, consumes, and preserves food based on local wisdom and traditional knowledge. It utilizes surrounding natural resources sustainably while safeguarding biodiversity (including indigenous crop varieties), is executed through generational cultural practices, and is organized within customary social structures characterized by equity, justice, and long-term food security.

Glossary of Local Terms in Indigenous Communities

Mentawai Indigenous Community (KAM)

<i>Legeu</i>	: Drought
<i>Eba</i>	: Flood or high tide
<i>Makoat</i>	: Severe weather or sea storms
<i>Malebak</i>	: Calm sea weather
<i>Karai manua</i>	: Weather/climate change
<i>Katipu</i>	: Symptoms of chills, fever, or catching a cold
<i>Keloro</i>	: A severe underwater storm that churns seabed sand and muddies the water, making it exceptionally difficult for fishermen to catch octopus
<i>Marusa / Maolop / Rusa sabeu</i>	: Strong, high-velocity winds
<i>Mallepet / Masepu</i>	: Feeling freezing or intensely cold
<i>Maoloil / Maroket</i>	: Feeling intensely hot or overheated

Talang Mamak Indigenous Community (KATM)

<i>Hari Panas</i>	: Extreme dry season or drought
<i>Aek dalam</i>	: River flooding or high water levels
<i>Tak bisa disambang</i>	: Complete crop failure
<i>Sojuk</i>	: Feeling cold
<i>Hangkal</i>	: Feeling hot
<i>Besolang</i> labor	: Traditional system of mutual cooperation and collective community

Bara & Cindakko Indigenous Community (KABC)

<i>Tomoro</i>	: Extended dry season or drought
<i>Banjiri</i>	: Flood
<i>Maallei</i>	: Crop failure
<i>Anging bangyang</i>	: Strong, destructive winds
<i>Tena tantu cuacanya</i>	: Unstable/unpredictable weather changes
<i>Rammusu</i>	: Feeling cold

Ta'liwa Bambang : Feeling excessively hot or burning heat

Baduy Dalam & Kasepuhan Communities (KABK)

Halodo : Extended dry season or drought

Caah : Flash flood or river flooding

Obah cuaca : Weather/climate change

Angin badag, ngagelebug : Howling, severe winds

Tiris / tiis : Feeling cold

Hareudang : Feeling stifled, hot, or sweaty

Usum panas / usum hujan : Dry season / rainy season

Executive Summary

This study examines the socio-ecological resilience of indigenous communities in Indonesia to the impacts of climate change, with a specific focus on the roles of indigenous women and local food systems, comparing four indigenous community sites supported by the Estungkara Program of Kemitraan-INKLUSI (Mentawai, Talang Mamak, Bara & Cindakko, and Baduy & Kasepuhan). Utilizing an ethnographic and participatory approach, this research aims to understand the vulnerabilities of indigenous women and to identify local adaptation strategies developed to cope with the threats of deforestation, food crises, and pressures from exploitative development policies. An intersectionality approach and an ecofeminism lens are employed to analyze the vulnerabilities of indigenous women, as both frameworks highlight power relations. Intersectionality helps to understand that forms of discrimination do not occur in isolation, but rather create compounded injustices based on the intersection of social identities such as gender, ethnicity, class, and indigenous status. Meanwhile, ecofeminism reveals how discrimination against women is frequently intertwined with the exploitation of nature. By integrating these two perspectives, the structural challenges faced by indigenous women can be comprehensively understood, thereby fostering gender-just, inclusive, and ecologically sustainable empowerment strategies and policies.

The key findings of the study reveal that climate change exacerbates gender inequalities and imposes multilayered burdens on women that threaten traditional practices; however, at the same time, this crisis brings forth the roles and agency of indigenous women as actors of resilience. Through a living economy system, indigenous women build resilience by maintaining agroforestry and communal rice barns, preserving biodiversity, innovating shelf-stable food technologies, conserving seeds, and diversifying livelihoods. This study also identifies a shift among the younger indigenous generation who have adapted to digital technological advancements, although they are confronted with a difficult choice between preserving ancestral traditions characterized by sustainability or adopting an exploitative economy that undermines them.

The study concludes that the resilience of indigenous communities to climate change relies heavily on the living economy practiced by indigenous women—an economic system rooted in nurturing life, social solidarity, and ecological regeneration. To strengthen this resilience, public policies are required that advocate for the recognition and protection of indigenous communities (their territories, traditions, and local knowledge), as well as the active engagement of indigenous women and youth in development planning and climate action implementation to reinforce the leadership and role of indigenous women in local food resilience and sovereignty.

Keywords: *indigenous women; climate resilience; local food systems; agroforestry; ethnography; community-based adaptation*

Chapter 1: Introduction

1.1 Background

Climate change is a global challenge with tangible impacts on Indonesia. Its consequences extend far beyond mere temperature rises, permeating various sectors of life, such as economic losses from increasingly intense natural disasters, crop failures caused by prolonged droughts and high rainfall, and health threats from heatwaves. The World Bank predicts that global economic losses due to this crisis could reach 2.5% to 7% of GDP. The Global Climate Risk Index (2021) report further underscores Indonesia's vulnerability, noting a sharp leap in its ranking to 14th place, down from its previous position of 73rd during the 2000–2019 period. This deteriorating position is closely linked to long-term development policies that heavily rely on natural resource extraction and fossil fuels. These policies not only increase greenhouse gas emissions but also drive environmental degradation, which ultimately compromises the community's quality of life, including indigenous communities who inherently possess a low carbon footprint.

Indigenous communities in Indonesia generally still practice subsistence economic activities, relying on the utilization of resources provided by nature to sustain their livelihoods. This condition renders them highly vulnerable when their surrounding natural resources are disrupted by climate change in the form of extreme weather, as well as an increasing frequency of floods and landslides. These events lead to a decline in both the quantity and quality of food sources, alongside the heightened spread of vector-borne diseases. Furthermore, climate change threatens the agricultural production systems independently managed by indigenous peoples, ultimately endangering their food security.

The trend of natural disasters driven by climate change exhibits significant annual fluctuations. Global weather factors, such as the El Niño and La Niña phenomena, also influence the dominant types of disasters; for instance, El Niño in 2023 triggered an increase in forest and land fires, whereas La Niña in 2024 contributed to more frequent floods and extreme weather. Data from the National Disaster Management Authority (BNPB) reveals that the number of disasters in Indonesia over the past 5 years has reached 14,930 incidents, with 4,004 disasters recorded up to mid-2025, 3,642 incidents in 2024, and 5,400 incidents in 2023. The vast majority of these disasters are classified as hydrometeorological events, such as floods, extreme weather, landslides, tidal waves, and droughts. Additionally, Indonesia frequently experiences forest and land fires during the dry season. The dominance of floods and landslides serves as a stark indication of development policies that neglect environmental sustainability.

Addressing climate change must not only focus on the impacts incurred but must also pay close attention to the protection and fulfillment of human needs, including the need for a sense of security (human security). The UN states that this approach integrates three core freedoms: freedom from fear, freedom from want, and freedom to live in dignity. Freedom from fear refers to protecting individuals from threats directed at their safety and physical integrity, encompassing various dimensions. Freedom from want entails protecting individuals so they can meet their basic needs, covering economic, social, and environmental aspects of their livelihoods. Meanwhile, freedom to live in dignity refers to promoting an enhanced quality of life and improving human well-being, enabling people to make choices and pursue opportunities that empower them.

In the context of climate change, human security was defined by the IPCC in AR5 Chapter 12 as a condition where the vital core of human lives—encompassing both material and non-material needs—is protected, and people have the freedom and capacity to live with dignity. This IPCC report also

assesses the risk that climate change poses a serious threat to human security because it jeopardizes livelihoods, cultures, and political stability. This marks a shift from the previous report (AR4), which had already identified risks to vulnerable groups such as indigenous peoples, as well as the link between migration and vulnerability.

Meanwhile, the UNDP, in its annually released human development reports, outlines several forms of human security, which include economic security, food security, health security, environmental security, personal security, community security, and political security. Economic security fundamentally requires an assured income from gainful employment or protection from state-provided social safety nets. Food security is built upon the ability of every individual to access food that is readily available, affordable, and paired with the sovereignty to cultivate, utilize, and distribute it. Health security focuses heavily on guaranteeing access to basic healthcare services, particularly for vulnerable and poor groups who face severe limitations and high risks due to climate change and environmental degradation. Environmental security relates to the threat of natural disasters resulting from deforestation and environmental degradation that impact the quality of human life. Personal security is the guarantee for individuals to remain free from violence and to attain a sense of safety in their lives and livelihoods. Community security is the guarantee and protection of the values, culture, and traditions held by a community to enjoy equal citizenship rights without facing discrimination. Lastly, political security is the guarantee provided by the state to protect human rights and prioritize public welfare.

From a human rights perspective, human security is a tangible manifestation of the realization of human rights. Through a human security approach, the fulfillment of rights to land, food, a healthy environment, culture, and participation can be viewed as integral to protecting human dignity and the sustainability of life. When these rights are violated—such as through the land grabbing of indigenous territories or the silencing of women's voices—it is not only human rights that are violated, but also human security, which constitutes its very essence. Consequently, human security serves as a concrete mechanism to realize and uphold human rights for indigenous women in their daily lives.

In this context, international legal instruments serve as a vital benchmark to ensure that the protection of indigenous women does not stall at a normative level but is translated into concrete policies and actions. One of the primary instruments affirming the global commitment to fulfilling women's rights is the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), adopted by the UN General Assembly in 1979 and ratified by 189 countries, including Indonesia through Law No. 7 of 1984. This convention affirms that women's rights are an inseparable part of human rights. This ratification obligates Indonesia to respect, fulfill, and protect women's rights in accordance with the convention's provisions. Global legal instruments and policies like CEDAW provide an essential foundation for protecting women's rights, including within the context of climate change. Through its general recommendations, particularly Articles 37 and 40¹, CEDAW emphasizes

¹ **General Recommendation No 37 (2018) – “Gender-related dimensions of disaster risk reduction in the context of climate change”**

“Women’s right to participate at all levels of decision-making must be guaranteed in climate change policies and programmes.”

“All stakeholders should ensure that climate change and disaster risk reduction measures are gender-responsive, sensitive to indigenous knowledge systems and respect human rights.”

“Measures must be taken to ensure that quality infrastructure and critical services are available, accessible and culturally acceptable for all women and girls on a basis of equality.”

the importance of integrating a gender perspective across all decision-making processes in the environmental and climate sectors, while simultaneously ensuring that women participate equally and inclusively in both public and domestic affairs. This principle reinforces the view that women, especially those from indigenous communities, are not merely passive victims of the climate crisis, but are active agents of change possessing crucial local knowledge and experience. Within this framework, gender justice must be realized at every stage of climate policy so that the protection of women and indigenous communities becomes an integral component of human security and human rights fulfillment.

Fulfilling the cultural and socio-economic rights of indigenous women—including the right to maintain traditions, safeguard local food and medicinal knowledge, and communally manage natural resources—is an indispensable part of sustainable development. This principle is mirrored in the SDGs, which are grounded in global justice and shared responsibility, with Goal 5 specifically targeting gender equality and the empowerment of women. In this context, the right to food serves as a clear example: access to food that is safe, sustainable, culturally appropriate, and obtained with dignity demonstrates the tight linkage between women's rights, environmental preservation, and socio-ecological justice. Therefore, protecting the rights of indigenous women is not merely a moral demand but a core prerequisite for the resilience and sustainability of the planet.

To this day, indigenous communities in Indonesia continue to struggle to secure various forms of human security, which are foundational aspects of both development and the protection of their rights as human beings. The vulnerability of indigenous peoples in fulfilling these rights is not only threatened by climate change but is further exacerbated by the exploitation of natural resources carried out by the government in the name of economic growth and community welfare improvement. Conducted without regard for the living spaces of indigenous peoples, these activities result not only in the destruction of local food sources but also in the loss of traditional medicinal sources and the erosion of indigenous cultures and traditions. Data from the Indigenous Peoples Alliance of the Archipelago (AMAN) states that up to the year 2023, there were 2,578,073 hectares of indigenous territories seized by the state and corporations for mining projects, plantations, and large-scale infrastructure development. Indigenous peoples who steadfastly defend their customary (*ulayat*) rights or endure within degraded environments face not only livelihood challenges and the fading of rituals and traditions, but also live under the constant shadow of natural disasters compounded by climate change.

Although indigenous communities as a whole are affected by climate change, the impacts felt or received by individual members within these communities are not uniform. In the context of gender relations, for instance, the impacts of climate change experienced by men and women differ significantly. Like women in general, indigenous women biologically undergo menstruation, pregnancy, childbirth, and breastfeeding, which demands a greater need for clean water, sanitation, and

General Recommendation No 40 (2024) – “Equal and inclusive representation of women in decision-making systems”

“Women have the right to equal and inclusive representation in all decision-making systems on equal terms with men. The failure to ensure the equal and inclusive sharing of decision-making power between women and men prevents States and the international community from effectively addressing urgent local, national, regional and global challenges.”

“Ensuring all women and girls’ full, equal and meaningful participation in decision-making processes was necessary to develop climate policies that were inclusive, fair and sustainable.”

a healthy environment. Furthermore, women's roles generally involve a higher share of domestic tasks within the household—such as cooking, childcare, and washing—while still bearing the burden of working in the fields. Environmental destruction has made it increasingly difficult for indigenous women to meet these needs. Climate change also imposes an additional burden on them. For example, prolonged droughts force indigenous women to walk long distances to fetch clean water from remote locations.

The vulnerability of indigenous women is further heightened when they are excluded from strategic decision-making forums, both at the family level and within traditional customary institutions. A study conducted by Fadhilah (2016) on indigenous women identified that patriarchal culture positions indigenous women as a subordinate group. Women are perceived to lack the capacity and legitimacy required in decision-making processes. Agarwal (2001) identified that social norms and perceptions within indigenous communities heavily influence women's participation in forest and natural resource governance. First, there is spatial segregation where men occupy the public sphere and women occupy the domestic sphere. The second social norm is the gender-based division of labor. Women bear an extra burden from both farming and managing the household, while men are reluctant to contribute to domestic duties, making it difficult for women to participate in decision-making forums. The third norm involves gender-based behavioral expectations or the social behaviors of men and women that are accepted within a specific social context, which consequently affects women's level of participation.

Another study conducted by Luithui & Tugendhat (2013) also found that many indigenous women experience physical and psychological violence due to the loss of land and natural resources, as well as poverty. For indigenous peoples, land is both a material and spiritual foundation that provides food security, health, and cultural continuity. In many indigenous communities, women are the primary food producers, knowledge holders, healers, guardians, and carriers of culture. When land and access to resources traditionally utilized are lost, indigenous women risk losing their traditional roles as educators and their capacity to apply and safeguard traditional knowledge. When traditional knowledge regarding the utilization of local resources is weak or weakened, a community's capacity to cope with climate-induced changes in their environment is similarly diminished.

Luithui & Tugendhat further highlight that forest clearing for the benefit of plantation and mining companies disproportionately harms women. Women's expertise in managing natural resources and sustaining their families faces eradication due to the loss of access to traditional crops. Additionally, this process causes women to become economically more dependent on men. Therefore, this process of deprivation can be viewed as a form of violence against indigenous women.

Women frequently experience injustice not only because they are women, but also due to other intersecting identities attached to them—such as being part of an indigenous community or practicing local traditional beliefs. Indigenous women often lose their land and living spaces due to state policies driven by development projects, while within their own communities, they are frequently excluded from decision-making, especially when they are not part of the customary institutional elite or civil government apparatus. Similarly, women who practice local indigenous faiths (*penghayat kepercayaan*) still face discrimination because their beliefs are not fully recognized by either the state or the surrounding society. All of this demonstrates that forms of injustice against women do not exist in isolation. This intersectionality approach helps explain how gender, indigeneity, and belief systems—

alongside age, education level, and socio-economic background (marital status, elite status, disability, etc.)—interlink to shape women's experiences of injustice²

1.2 Research Questions and Objectives

Departing from the background presented above, this study seeks to answer the primary question: "How does climate change affect the vulnerability and resilience of indigenous women in securing food and preserving cultural practices, and what local-based adaptation strategies can be supported to ensure an equitable and sustainable response?"

This research aims to:

Understand how indigenous women respond and adapt to the impacts of climate change that affect their lives, food, and culture.

Explore how indigenous women interpret and define the environmental changes occurring around them and their impacts on the community's food provisioning systems and security.

Identify the cultural practices and local knowledge threatened by climate change, as well as the ways in which indigenous women adapt to maintain these values and practices.

Analyze the local adaptation strategies implemented by indigenous women in facing the climate crisis, including both the successes and the barriers encountered.

Examine the extent to which indigenous women have access to, support from, and recognition by external parties—such as the government, NGOs, and the private sector—in safeguarding food security and the community's cultural sustainability.

The limitation of this research lies in its specific focus on the resilience and leadership aspects of indigenous women in facing the climate crisis and strengthening local food security, without engaging in an in-depth discussion on the issue of gender-based sexual violence³. This scope is maintained to keep the study aligned with its primary objective, which is to understand the interconnectedness between climate change, the role of indigenous women, and strategies to strengthen food security based on culture and local knowledge.

1.3 Theoretical Framework

This study utilizes a climate risk assessment framework that refers to the Assessment Report (AR), Working Group (WG) II of the IPCC: Impacts, Adaptation, and Vulnerability. This approach is also commonly known as the "Climate Change Risk Assessment" and "Climate Risk and Vulnerability Assessment" (abbreviated as CCRA and CRVA). The experts convened under the IPCC refine the risk assessment framework approximately every 6–7 years, in line with the publication cycles of the Assessment Reports. In AR4, vulnerability was understood as a standalone element that merely interacted with the environment. However, in AR5, vulnerability was positioned as an integral part of

² Injustice against women cannot be viewed solely from a gender perspective, but rather from the intersection of various overlapping social identities. In the Indonesian context, indigenous women and women adherents of indigenous faiths (*perempuan penghayat kepercayaan*) face multilayered forms of discrimination—both from the state through development policies and limited legal recognition, and from within their own patriarchal communities.

³ For this discussion, see *Hasil Riset: Kekerasan Seksual di Masyarakat Adat dan Etnis Minoritas*, edited by Tracy Yoanna Pasaribu, Widya Anggraini, and Melya Findi Astuti (Kemitraan, 2024).

the climate risk framework, determined by the dynamic interaction between hazard, exposure, and vulnerability.

This shift underscores that climate risk does not depend solely on the presence of a threatening hazard, such as floods or droughts, but also on the extent to which a system is exposed to the social, economic, or environmental conditions that influence its level of vulnerability. Consequently, vulnerability analysis becomes more comprehensive as it links biophysical factors with the socio-economic dimensions of the region or system at risk.

The IPCC further elaborates risk as the result of the interaction between hazard, exposure, and vulnerability (AR5), with the addition of responses to climate risk (AR6). The IPCC defines climate risk as the probability of adverse consequences occurring for human and ecological systems when something of high value is at stake and the outcome is uncertain. Furthermore, there are also risks arising from responses to climate change, namely when policies or actions taken fail to achieve their intended outcomes, or instead create trade-offs with other goals and negative impacts on social agendas such as the SDGs. Examples include uncertainties in the implementation of climate policies, the effectiveness of green investments, or the successful adoption of new technologies. A more detailed explanation of each risk dimension is presented in the section below.

- **Hazard:** The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. Hazards can be climate events (e.g., heavy rainfall events), but they can also be direct physical impacts (e.g., flooding). A hazard is not necessarily an extreme weather event (e.g., a tropical cyclone), but can also be a slow-onset trend (e.g., increasing average temperatures, sea-level rise). In the context of climate risk assessment, it is assumed that a hazard represents an external climate signal, which does not always depend on exposure or vulnerability, and cannot always be explicitly and directly resolved through adaptation actions or other measures. Under these conditions, the risk assessment subsequently falls into the category of "loss and damage."
- **Exposure:** The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected. Exposure refers to the presence of indigenous communities in ecologically vulnerable territories, such as coastal areas, river basins, mountainous regions, and fire-prone forests susceptible to climate disasters. Another example of exposure is resettlement policies that separate indigenous communities from their traditional living spaces and livelihood sources, which ironically introduces new exposure to socio-ecological risks.
- **Vulnerability:** The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Vulnerability consists of two relevant elements: Sensitivity and Capacity. In the context of climate risk assessment, sensitivity is determined by factors that directly affect the consequences of a hazard. Sensitivity can include the physical attributes of a system (e.g., building materials of a house, soil type in agricultural land) as well as social, economic, and cultural attributes (e.g., age, gender, income, position within customary institutions or village government). Meanwhile, capacity refers to the community's ability to prepare for and respond to current and future climate impacts. The vulnerability of indigenous communities refers to conditions that weaken their ability to respond to hazards, including high dependence on local ecosystems, limited access to basic services such as

education and healthcare, legal uncertainty over customary land, low mastery of technology, and minimal access to financial services and political participation. Indigenous women, in particular, experience multi-layered vulnerability due to their marginalized social position within many customary systems as well as the state.

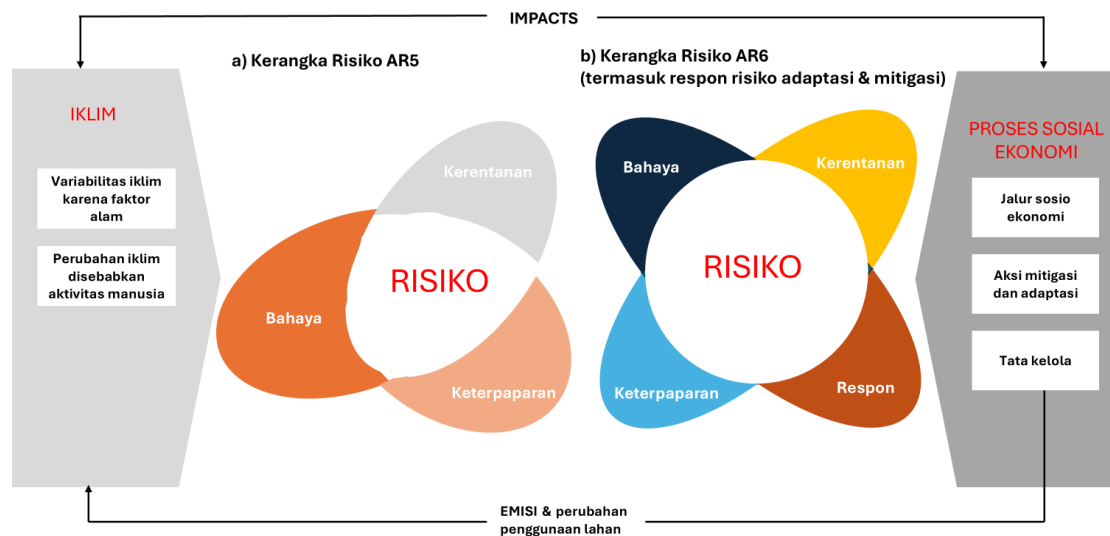
- **Response:** Human actions—encompassing adaptation, mitigation, as well as policies and system transitions—to address climate change, which can reduce risks but also have the potential to create new risks due to failure to achieve goals, side effects, or trade-offs with other development goals. The term response does not stand as an independent entry but is understood in relation to adaptation, mitigation, and other actions. In this regard, hazard, exposure, and vulnerability are dynamic and can change over time and space due to socio-economic changes and human decision responses.
- **Impact:** Effects on natural and human systems. The term impact is used primarily to refer to the effects of extreme weather, natural systems, human systems, climate events, and climate change. Impacts generally refer to the effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure resulting from the interaction of climate change or hazardous climate events occurring within a specific time period and the vulnerability of the exposed society or system. The impacts of climate change on geophysical systems, including floods, droughts, and sea-level rise, are part of the impacts referred to as physical impacts. 'Impact' is the most general term to describe consequences, ranging from the direct physical impacts of a hazard to indirect consequences for society (referred to as social impacts), which ultimately generate risk.

Figure 1 (a) below explains the risk framework that explicitly appears in the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) and AR5, where climate risk is conceptualized as a function of the interaction between hazard, vulnerability, and exposure. The risk of climate change-related impacts results from the interaction of a climate hazard with the vulnerability and exposure of human and natural systems.

Meanwhile, Figure 1 (b) introduces the role of responses to climate change in modulating (altering the direction and magnitude of) the risk determinants, which is a new emphasis in AR6. In addition to the hazard, vulnerability, and exposure petals, the risk determinants in this risk assessment framework have now expanded by one element: response. This means that human actions in responding to climate change—either through mitigation or adaptation—can reinforce or conversely reduce the levels of hazard, vulnerability, and exposure. By incorporating response into this framework, the latest IPCC model becomes more comprehensive because it is capable of illustrating how policies, behaviors, and socio-economic decisions can modulate climate risk, thereby capturing the complexity and interconnectedness between dimensions that occur in the real world.

Within this line of thought, with vulnerability and exposure as essential components in climate risk assessment, there is a growing realization that both elements ultimately contribute to a broader objective: protecting and enhancing human well-being. In recent climate change research utilizing Shared Socioeconomic Pathways (SSPs), there has been a shift toward outcome-based scenarios, which emphasize well-being and resilience as the primary goals of climate adaptation strategies. These scenarios focus on the ultimate outcomes that climate resilience efforts aim to achieve, such as health, economic well-being, and access to critical resources like food, land, water, and energy.

Figure 1. IPCC Risk Framework Combining AR5 and AR6



Source: modified from Ara Begum et al., 2022

This well-being perspective complements traditional vulnerability assessments by framing risk based on its direct impacts on the quality of life of affected communities. Instead of viewing vulnerability merely as a function of exposure and adaptive capacity, the outcome-oriented approach positions vulnerability as a pathway to identify climate hazards that affect social and economic well-being. This includes factors such as food and energy security, health and education, as well as social stability and security. Communities with high adaptive capacity are better equipped to protect well-being achievements—such as health, income, and social stability—even when facing high climate risks. Higher adaptive capacity can lower vulnerability because it enables faster preparation, response, and recovery from adverse and distressing climate events or hazards.

In the context of SSPs, the integration of well-being metrics offers not only a way to project future exposure and vulnerability but also a means to understand how these dynamics affect overall societal resilience. By linking SSP-based vulnerability indicators with well-being outcomes, policymakers can design climate adaptation strategies that are not only effective in reducing physical risks but also enhance community resilience and well-being across various socio-economic scenarios.

This research proposes the integration of Shared Socioeconomic Pathways (SSPs) to create a scenario-based risk assessment that reflects the future trajectories of indigenous communities, making climate indicators more relevant for policy and planning. There are five simplified narratives from the five scenarios based on the global SSPs (O'Neill et al., 2017), scaled down for indigenous communities. These five SSP storylines provide alternative views on whether adaptation challenges are high or low. By modifying the global version of the SSPs, the indigenous community version includes the following:

SSP1 - Sustainability (Indigenous Sustainability): A sustainable and equitable future characterized by inclusive development, social equality, good cooperation, and strong climate policies where emissions are low and adaptation is easy, resulting in a decent and humane standard of living.

SSP2 - Middle of the Road (Indigenous Middle of the Road): A moderate scenario where the future reflects stable trends in economic and population growth, mitigation and adaptation efforts are limited, and climate risks are moderate.

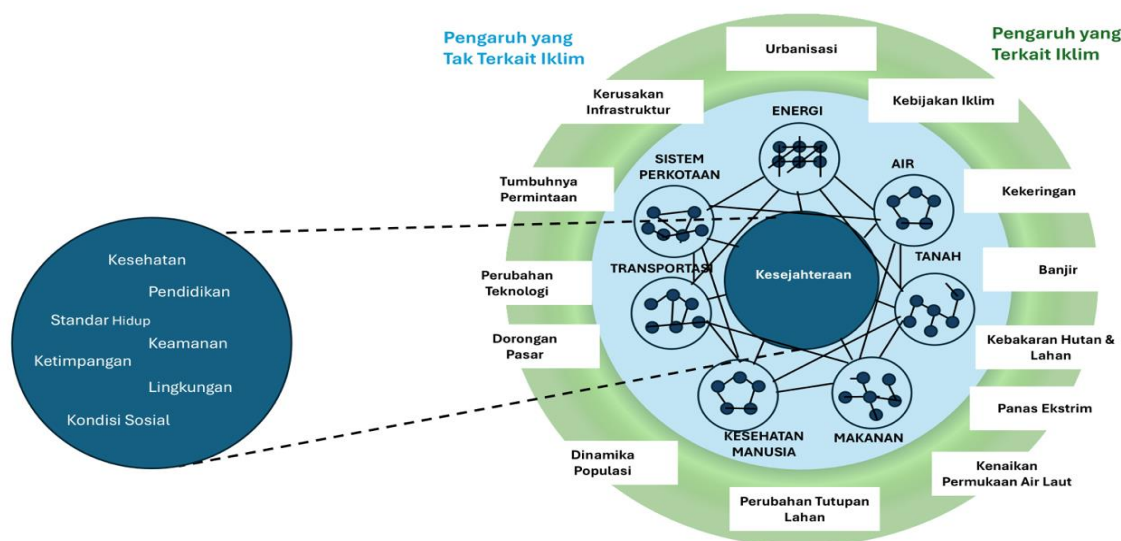
SSP3 - Regional Rivalry (Fragmentation and Rivalry): A future where indigenous communities struggle to maintain decent living standards amidst carbon-intensive development due to fragmentation, protectionism, slow growth, high inequality, and low cooperation, resulting in high emissions and difficult adaptation.

SSP4 - Inequality (Inequality and Exclusion): A future marked by sharp inequalities between the wealthy and the poor; power is concentrated within a handful of elites, yet indigenous communities remain one of the key players. Technology and climate protection are accessible only to the elite, while the majority of the population remains vulnerable, resulting in high climate risks.

SSP5 - Fossil-fueled Development (Fossil-Fueled Development and Socio-Ecological Crisis): A future driven by rapid economic growth through the exploitation of fossil fuel resources and modern technological advancements. In this scenario, indigenous communities tend to be less concerned with environmental sustainability and view high consumption as a symbol of prosperity. Dependence on fossil energy causes emissions to soar sharply, while the capacity to adapt to climate change impacts is possessed only by wealthier segments of society. Consequently, this leads to an increased risk of increasingly extreme climate disasters.

The illustration below depicts the interconnected system components that influence human well-being, encompassing non-climate factors (e.g., urbanization, population, technology, infrastructure, demand growth, market drivers, etc.) as well as climate-related factors (e.g., drought, flooding, sea-level rise, etc.). Each component interacts with critical domains such as energy, water, land, and food, which in turn determine health, education, living standards, and the overall social conditions of society.

Figure 2. Illustration of Various System Components Determining Shared Socioeconomic Pathways (SSPs)



Source: modified from O'Neill et al., 2017 and 2024

1.4 Research Methods

In understanding the impacts of climate change on the lives of indigenous peoples, particularly indigenous women, ethnographic approaches and participatory research serve as two mutually reinforcing methods. The ethnographic method focuses on understanding the meanings, practices, and values embedded within the daily reality of the community through the researcher's direct engagement in the field. This approach allows the researcher to observe how indigenous peoples interpret various ongoing natural, social, and cultural changes, manage natural resources, and preserve local knowledge in the face of climate change uncertainties.

Participatory research is fundamentally an approach that conducts research with people, rather than on people. Within this paradigm, individuals or communities are no longer positioned as objects of research, but as subjects or active, equal partners throughout the entire research process. This approach, as embodied in Community-Based Participatory Research (CBPR), is highly crucial in the context of community empowerment, including for indigenous peoples. First, it recognizes and validates knowledge derived from lived experience as a legitimate form of epistemology. Consequently, the research process and its outcomes become contextually more relevant and meaningful for the community. Second, this active involvement is inherently empowering, as it transfers control over the knowledge production process back to the community. This enables them to become the owners of the narrative regarding their own lives, which constitutes a vital step toward decolonizing knowledge—particularly for indigenous peoples who have frequently been treated as mere objects of academic exploration.

In line with this principle, scholars such as Banks & Brydon-Miller (2018) define participatory research as a collaborative effort where community members—whose lives are directly affected by the issue under study—are engaged as full partners in designing, conducting, and disseminating the research. The goal is to bring about equitable and sustainable social change. This process is designed to be democratic, ensuring the voices of all parties are heard; participatory, by involving the community at every stage; empowering, by building community capacity and agency; and educational for both parties, including both the researchers and community members. In the context of indigenous peoples and climate change, this approach ensures that local knowledge is integrated with empirical scientific knowledge, generating solutions that are not only technically effective but also culturally ethical.

Grounded in the principles of CBPR, this study employs a combination of complementary data collection methods to ensure the depth, validity, and sustainability of the research process. The primary instrument applied is in-depth interviews conducted with dozens of key informants from various generations and roles within the indigenous community to explore their local knowledge, perceptions, and personal experiences regarding climate change. To understand collective dynamics and build community consensus, this study also organizes Focus Group Discussions (FGDs) using the SIKAT toolkit (*Siaga Krisis Akulturasi Toolkit* / Acculturation Crisis Preparedness Toolkit), developed by the Estungkara Program in collaboration with Universitas Gadjah Mada. These group discussions involve representatives of customary leaders, women's groups, the youth generation, community cadres, and hamlet/village government officials to identify adaptation strategies, institutional shifts, and prevailing social norms.

As a supporting instrument, participant observation is conducted, with researchers directly immersing themselves in the daily activities of the indigenous community—such as farming, venturing into forests, fields, and rivers, fetching water, washing, cooking, teaching and learning, and observing customary rituals—to understand the context and practices firsthand while building mutual trust. The vast majority of these field interactions and findings are documented through audio recordings, transcriptions, and

field notes, which serve as tools to maintain methodological rigor. To capture temporal dimensions and socio-ecological changes across generations, the oral history and narrative method is utilized by recording the life journeys of village elders, women, and other community figures.

Furthermore, visual participatory approaches such as participatory mapping and community transect are utilized to map ongoing changes, document the impacts of climate change, and reveal the spatial knowledge of the community that often goes unexpressed through verbal interviews. This combination of methods not only guarantees data triangulation but also aligns with the spirit of decolonizing research by positioning the community as the rightful owners of the generated knowledge process and outcomes. The informants involved in this study are diverse, originating both from within and outside the indigenous communities. The categories of informants involved in this research include:

- Indigenous women holding diverse professions such as farmers/shifting cultivators, housewives, health cadres, as well as those active in women farmers' group organizations.
- Customary/village elders, encompassing senior citizens within the indigenous community, including both those holding formal customary leadership positions and non-leaders.
- Community figures, comprising formal leaders (village heads and village apparatus) and informal leaders (customary leaders, religious figures, and community facilitators).
- Indigenous youth, including young male and female figures, as well as youth group organizations operating within the indigenous communities.
- Strategic stakeholders directly and indirectly linked to the lives of the indigenous communities, namely local government agencies (Organisasi Perangkat Daerah) and the business sector.

1.5 Research Locations

This study was conducted in several selected indigenous communities targeted for assistance under the Estungkara Program. The selection of research sites took into account factors such as geographical location, cultural characteristics, strong agrarian or maritime traditions, existing climate change vulnerabilities, and biodiversity values (genetic, species, and ecosystem diversity).

Table 1. Rationale for Research Location Selection

Location	Status	Characteristics
Mentawai Indigenous Community (Malancan Village, North Siberut District and Saureinu Village, South Sipora District, Mentawai Islands Regency)	Primary Research Site	Represents an indigenous community situated in forested and coastal island areas highly vulnerable to climate change. This region falls under the 3T category (<i>terdepan, terluar, dan tertinggal</i> / frontier, outermost, and least developed). Unlike their provincial neighbors, the Minangkabau people who follow a matrilineal lineage, the Mentawai people adhere to a patrilineal kinship system.
Talang Mamak Indigenous Community	Primary Research Site	Represents an indigenous community located within the ecosystem conservation and restoration buffer zone of Bukit Tigapuluh

Location	Status	Characteristics
(Simarantihan Hamlet, Suo Suo Village, Sumay District, Tebo Regency)		National Park, bordering corporate concessions designated for monoculture plantation development.
Bara & Cindakko Indigenous Community (Bonto Somba Village, Tompobulu District, Maros Regency)	Primary Research Site	Represents an indigenous community that still practices customary rituals but has begun adopting new approaches to farming; their living territory is situated within the Bantimurung Bulusaraung National Park area.
Baduy/Kasepuhan Indigenous Community (Kaneke Village & Wangunjaya Village, Lebak Regency, Banten)	Comparative Site	Represents an indigenous community whose customary values, rules, institutions, and managed territories remain relatively well-preserved.

Other considerations for site selection include the characteristics of indigenous peoples who are geographically isolated and highly vulnerable to climate change, located within conservation areas, facing pressure due to natural resource exploitation, or those who have successfully adapted to the environmental shifts occurring in their regions. Additionally, this selection was deliberately made to capture indigenous communities that possess intact social systems and natural resource capitals, serving as a baseline to compare the changes and impacts occurring in the primary research target areas.

The Mentawai Indigenous Community (KAM) in Malancan and Saureinu Villages, the Talang Mamak Indigenous Community (KATM) in Simarintihan Hamlet, and the Bara & Cindakko Indigenous Community (KABC) in Bara and Cindakko Hamlets exhibit the characteristics of indigenous peoples who are geographically isolated from basic service centers, rely on primary livelihoods vulnerable to climate change, are located within or directly border conservation areas and corporate concession zones, face pressures from natural resource exploitation, or have adapted to ongoing changes. Concurrently, the effort to analyze an indigenous community that still maintains a relatively intact social system, customary institutions, and natural resource environment was carried out within the Baduy and Kasepuhan Indigenous Community (KABK).

Chapter 2 Literature Review

2.1 Climate Change and the Escalation of Climate Disasters

Scientists estimate that climate change has actually been underway for quite some time, driven by increased economic activity that has resulted in widespread environmental degradation. Svante Arrhenius, a Swedish Nobel laureate, wrote in 1896 about emissions resulting from the use of coal, which releases carbon dioxide (CO₂) and causes global warming. In 1958, an observatory in Hawaii issued the first scientific warning report regarding high concentrations of carbon dioxide in the atmosphere.

Studies by Toprak (2013) and various other research findings have established a link between global warming and abnormal meteorological events (such as precipitation, temperature, pressure, wind, tornadoes, floods, storms, sea-level changes, glacier and snow thickness, and others). Consequently, the issue at hand is not merely related to warming but is more accurately redefined as "global climate change."

The issue of climate change gained global attention at the UN Conference on Environment and Development held in 1992 in Rio de Janeiro, Brazil. This conference resulted in Agenda 21 and the UNFCCC (United Nations Framework Convention on Climate Change) as foundational international instruments to address the climate crisis at the global level. The UNFCCC entered into force on March 21, 1994, and has now been ratified by 194 countries.

Previously, the UN established the Intergovernmental Panel on Climate Change (IPCC) in 1988 to provide a scientific foundation for global climate policy. Periodic IPCC reports offer the most authoritative scientific depiction of the magnitude, timing, and impacts of climate change. The IPCC Sixth Assessment Report (AR6, 2023) asserts that human activities are the primary cause of the dramatic increase in carbon dioxide and other greenhouse gas emissions, triggering widespread, rapid, and intense global warming within the climate system—unprecedented in thousands of years—referred to as a "code red for humanity."

The UNFCCC defines climate change as a change in climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods. The composition of the global atmosphere referred to is the composition of the Earth's atmospheric materials in the form of Greenhouse Gases (GHGs), which include carbon dioxide, methane, nitrogen, and others.

The 2015 Paris Agreement became a milestone in global efforts to curb the pace of global warming. The Paris Agreement became a globally binding international legal framework for addressing climate change (United Nations Framework Convention on Climate Change, 2015). The Paris Agreement sets a target to ensure that the increase in the global average temperature does not exceed 2°C above pre-industrial levels, while striving to ensure that the temperature increase remains well below the more ambitious threshold of 1.5°C. In addition to setting targets, the agreement also establishes a comprehensive framework to facilitate the mobilization of finance, technology transfer, and capacity building for developing countries.

Although various countries have acknowledged the impacts of climate change, measures to mitigate the increase in the Earth's temperature have yet to yield meaningful impacts. Recent reports by the IPCC and Copernicus indicate that global temperatures have now risen by more than 1.5°C, affecting the

natural balance and human life. Scientists also warn that efforts to limit the temperature increase below 2°C are nearly impossible to achieve. Even if global warming can be constrained to 1.5°C, sea-level rise is projected to continue through 2100. This rise in global temperatures has triggered more natural disasters such as droughts, heatwaves, wildfires, storms, and floods.

According to research by the University of the Sunshine Coast and Australian Red Cross Lifeblood (2025), climate change also exacerbates the spread of infectious diseases, particularly those transmitted by mosquitoes. In Indonesia, a UNICEF review (2023–2024) found that the impacts of climate change on nutritional security are complex—ranging from reduced local food production and fish catches, damaged infrastructure, and lost livelihoods, to diminished dietary diversity and disrupted health services. All of these illustrate how climate change directly threatens public health and food security.

Over the past forty-five years, the Asia and Pacific region has accounted for approximately 40% of all global natural disasters, with three-quarters of them being hydrometeorological disasters. Since 2000, China, India, Indonesia, the Philippines, and the United States have been the top five most frequently affected countries. The upward trend of hydrological and meteorological disasters in this region is far more prominent compared to geophysical and climatological disasters. Countries in Asia and the Pacific are among the most vulnerable to climate change, with coastal populations at risk of flooding projected to rise from 300 million in 2010 to 410 million people by 2025.

For Indonesia, this vulnerability is even greater due to its location flanked by the Indian and Pacific Oceans, as well as its position within the Ring of Fire, surrounded by volcanoes and situated at the convergence of three major world tectonic plates: the Indo-Australian, Eurasian, and Pacific plates. Such a geographical location makes Indonesia susceptible to prolonged El Niño–Southern Oscillation (ENSO) events, earthquakes, and tsunamis. Meanwhile, its characteristic as an archipelagic nation renders Indonesia vulnerable to sea-level rise. Furthermore, deforestation and land clearing for agriculture, plantations, and mining have also contributed to making Indonesia one of the largest greenhouse gas emitters in the world.

A BNPB report (2024) indicates that more than 75% of disasters in Indonesia are hydrometeorological disasters, such as floods, droughts, and forest fires triggered by the El Niño phenomenon. El Niño exacerbates droughts, land fires, and the spread of crop pests and diseases. In 2016, economic losses from floods and forest fires reached 2.5 billion US dollars, while infrastructure repair costs reached 275 million US dollars. Between 2020 and 2024, a total of 20,342 disaster events were recorded, affecting more than 31 million people. Data from BNPB and modeling from the Emergency Event Database (EM-DAT) demonstrate a recurring pattern with massive impacts: between 1900 and 2000, hydrometeorological disasters claimed 243,740 lives, affected 32.1 million people, and caused losses of up to 33.7 billion US dollars (approximately Rp567 trillion), reaffirming that climate risks and extreme weather are primary threats to Indonesia.

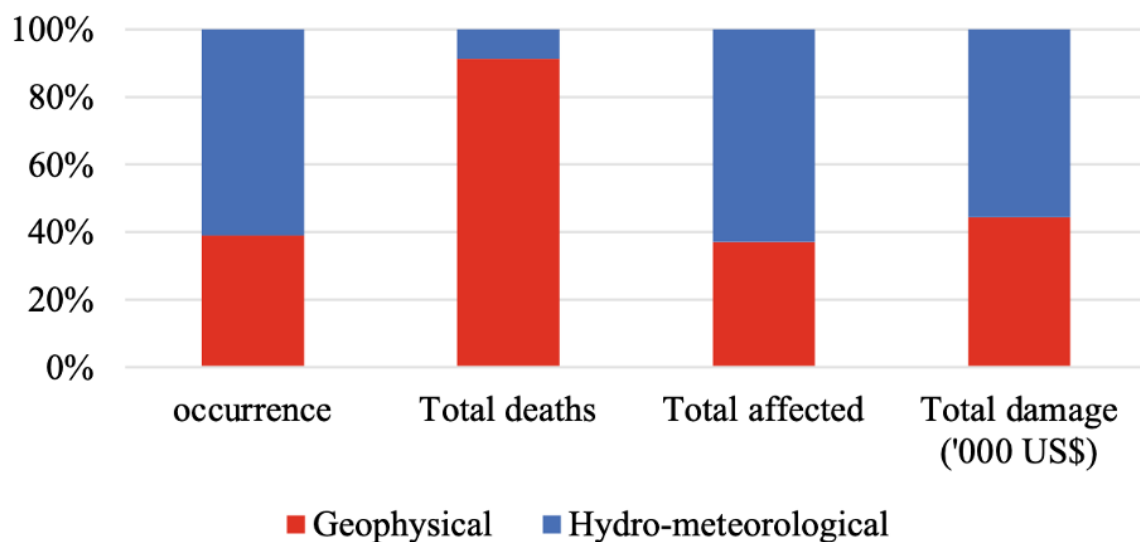
Chart 1. Number of Natural Disasters and Disaster-Affected Victims in Indonesia



Source: National Disaster Management Agency (BNPB)

Note: The above natural disaster data only covers Floods, Landslides, Abrasion, Extreme Weather, Droughts, and Forest and Land Fires.

Chart 2. Comparison of Disaster Impacts (Geophysical vs. Hydrometeorological) in Indonesia from 1900 to 2020



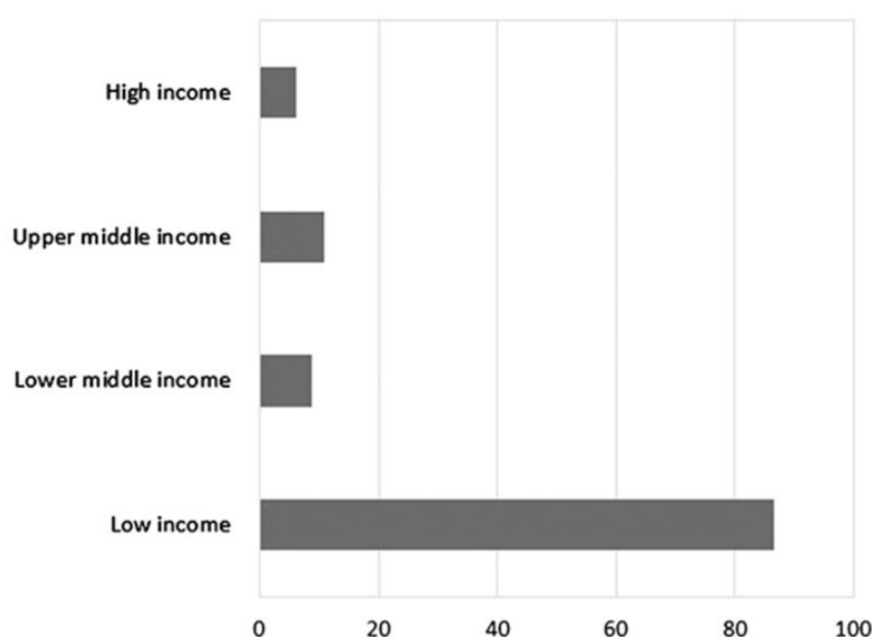
Source Data: Emergency Events Database (EM-DAT)

Note: Geophysical disasters are disasters caused by physical processes within and on the Earth's surface. Examples include earthquakes, tsunamis, volcanic eruptions, landslides, and other mass movements.

Hydrometeorological disasters are disasters caused by rainfall, humidity, temperature, and wind. Examples include floods, landslides, tornadoes, storm surges, and droughts.

In addition to causing fatalities, disasters also result in economic damage to both communities and the state. High-income communities generally bear greater economic losses due to their high asset value, yet low-income groups suffer heavier social and economic shocks due to limited resources for recovery. Globally, middle- and high-income countries bore approximately 82% of the total 1.3 trillion US dollars in disaster losses from 1970 to 2014, while low-income countries accounted for only about 4%, albeit with a relatively much greater impact—average losses reached up to 150% of national GDP. Below is the data on disaster impacts and mortality rates in the Asia and Pacific region.

Chart 3. Mortality Rate Due to Natural Disasters in the Asia & Pacific Region, 1970–2014



Source Data: UNESCAP

Not everyone experiences the impacts of disasters, such as floods or storms, in the same way. Differences in physical conditions, behavior, economic levels, and adaptive capacity make some people more vulnerable than others. Vulnerability to climate change is determined not only by weather factors, but also by social, economic, and environmental factors. Environmental degradation, such as that caused by deforestation or uncontrolled development, makes many areas increasingly prone to floods and storms. Nevertheless, advancements in early warning and evacuation systems have helped reduce the number of fatalities, even as disasters occur more frequently and with massive impacts. In the context of indigenous communities living in remote areas, disaster risks are much higher. A lack of infrastructure and communication access makes it difficult for them to receive early warnings. Furthermore, forest exploitation for plantations and mining around indigenous territories worsens environmental conditions and elevates the threat of disasters to an even higher level.

The Indonesian government has a number of regulations related to disasters and the environment, such as the Human Rights Law, the Disaster Management Law, the Regional Government Law, and the Environmental Protection and Management Law. Among these four regulations, only the Environmental Protection and Management Law explicitly regulates climate change as well as its

mitigation and adaptation measures. The Disaster Management Law does not yet explicitly address climate disasters such as heatwaves or extreme temperatures, while remaining focused on floods and droughts.

Table 2. Mapping of the Legal Framework and Implementation Links of Human Security, Human Rights, and Disaster Management-Climate Change

Law No. 39/1999 on Human Rights	Law No. 24/2007 on Disaster Management	Law No. 32/2009 on Environmental Protection and Management	Law No. 23/2014 on Regional Government
Article 6 - In the framework of upholding human rights, differences and needs within indigenous law communities must be respected and protected by the law, society, and the government. - The cultural identity of indigenous law communities, including rights to customary land, shall be protected in alignment with the times. Article 9 - Everyone has the right to life, to maintain life, and to improve their standard of living. - The protection of the right to life is closely linked to the fulfillment of other rights such as access to food, health, water, and housing.	The types of disasters addressed are quite comprehensive, covering tsunamis, earthquakes, volcanic eruptions, floods, droughts, storms, landslides, other natural disasters, as well as human-induced disasters.	Mentions in the considerations that climate change degrades the quality of the living environment. Article 9 Regulates the formulation of the Environmental Protection and Management Plan by the central, provincial, and regency governments, which also includes provisions on climate change mitigation and adaptation. The RPPLH becomes part of regional long- and medium-term planning. Article 12 The utilization of natural resources in a region is carried out based on the RPPLH.	Disaster management in regency/city areas. Implementation of community empowerment regarding disaster preparedness at the regency/city level. Matters concerning prevention, control, extinguishing, and management of fires. Formulation of vulnerability and food security maps. Management of food insecurity at the regency/city level. Stipulation and Recognition of Indigenous Law Communities (MHA), local wisdom, or traditional knowledge related to Environmental Protection and Management (PPLH). Capacity building for Indigenous Law Communities (MHA), local wisdom, or traditional knowledge related to Environmental Protection and Management (PPLH).

Source: Processed from various sources

2.2 Indigenous Peoples, Deforestation, and Climate Change

A study by Khairunisa (2025) outlines the perspective of the Dayak Iban Menua Sungai Itik indigenous community, who believe that the forest is a father providing food, while the land is a mother giving birth to flora. This finding offers a broader depiction of how indigenous communities in Indonesia live and depend on resources inherited from ancestors, which also serve as a medium to establish communication with ancestral spirits and preserve traditions/culture.

Research by Boga (2025) demonstrates that agroforestry lands in tropical regions are capable of restoring 50% of natural forest biomass within a 20-year timeframe. The results of this study indicate that agroforestry systems contribute significantly to reducing the impacts of climate change. Trees within agroforestry systems are capable of sequestering carbon dioxide 2 to 4 times more effectively compared to monoculture plantations.

Agroforestry practices are common methods employed by indigenous peoples to maintain forest sustainability. Indigenous peoples in Indonesia have long developed agroforestry systems that integrate forest trees, agricultural crops, and livestock within a single land management system. This practice helps maintain soil fertility, reduce erosion, enhance biodiversity, and sequester carbon. Agroforestry systems can be implemented through various methods, including:

1. Silvopasture: Combining trees with livestock grazing.
2. Silviculture (Intercropping): Cultivating plantation crops among timber trees.
3. Agrosilvopasture: Combining trees with agricultural crops, pastures, and livestock.
4. Silvihorticulture: Combining forestry trees with horticultural crops and plants, alongside various other combinations of trees, crops, pastures/livestock, and aquaculture.

Studies by Fox (2009) and Putra (2025) demonstrate that shifting cultivation systems in Southeast Asia (Laos, Thailand, Malaysia, & Indonesia) have transformed and even disappeared at a pace never previously experienced. Coverage by Ahmad Arif (2022) in *Harian Kompas* reported that residents of Kalumpang, Kapuas, Central Kalimantan, last practiced shifting cultivation in 2015.

In recent decades, the control of forests by indigenous peoples has come under threat from various regulations and development policies. Data from AMAN (2023) notes that approximately 2,578,073 hectares of indigenous territories have been expropriated by the state and corporations. The Ancestral Domain Registration Agency (BRWA, 2024) states that there are 28.2 million hectares across 1,452 registered maps of indigenous territories. Of that amount, only 13.8% or about 3,939,106 hectares have received formal legalization from local governments. Meanwhile, the central government through the Ministry of Environment and Forestry (KLHK) has only designated customary forests (*hutan adat*) in 11 indigenous communities, covering an area of 244,195 hectares. This stands in stark contrast to the promise made by President Joko Widodo in 2014 to allocate 12.7 million hectares of land to the people. By the end of President Joko Widodo's term, this promise remained unrealized, further deepening the disappointment of indigenous peoples toward the government (Lahay, 2024).

Lang (2009) calculated that global deforestation and degradation across thirty developing nations—including Bolivia, Brazil, Indonesia, Myanmar, and Zambia—serve as dominant sources of \$CO_2\$ emissions. A study by Hansen (2013) mapped forest loss in countries with the most extensive forest cover, namely Brazil, Canada, Indonesia, the Russian Federation, and the United States. Among these five countries, Indonesia exhibited the most rapid rate of forest loss, accounting for more than 60% of global forest loss from 2000 to 2012. A report by Walhi (2022) includes observations from the Climate Justice Coalition (KKI), which estimates total deforestation for the 2020–2030 period at 359,000

hectares per year—higher than the total deforestation projected in Indonesia's First NDC (2016) and updated NDC (2021), which stood at 325,000 hectares.

Studies conducted by Eilenberg (2022) and Putra (2025) regarding forest and land fires in Indonesia indicate that the vast majority are unrelated to traditional shifting cultivation activities, but are instead driven by the expansion of oil palm plantations. Slashing and burning land is considered a low-cost, time-efficient method. Furthermore, this practice aims to clear vast tracts of land through complex systems of patronage and collusion. Burned land also holds a higher appeal for investors or prospective land buyers compared to land that remains covered in thick shrubs.

Varma (2003) calculated the consequences of the worst forest fires that occurred in 1997, when six million hectares of forest and peatlands were cleared and burned, estimating damages at 20.1 billion USD. Page (2002) estimated that carbon emissions generated from the 1997 forest fires ranged between 0.81 and 2.59 gigatons, equivalent to 13–40% of the entire world's annual fossil fuel emissions. The emission levels produced by these forest fires nearly rivaled the annual emissions of the United Kingdom and Germany combined (Carrington 2015; NASA Earth Observatory 2015).

Another study by CIFOR (2015) on the impacts of the fires showed forestry and agricultural losses of approximately 8.5 billion USD, while losses from short-term health impacts and tourism amounted to 4.5 billion USD. Lamb (2025) calculated the health toll, noting half a million cases of acute respiratory infections in Kalimantan and Sumatra due to exposure to smoke from forest burning. Data from the Pollutant Standards Index (PSI) in the worst-affected areas exceeded 2,000 PSI, far above the hazardous threshold of 300 PSI.

Due to the frequent occurrence of forest fires in Indonesia, ASEAN member states established regulations and agreements in 2003 for the prevention of transboundary forest fires, namely the Agreement on Transboundary Haze Pollution. Although this agreement was initially not very effective, by 2015, the Government of Singapore initiated legal proceedings against Indonesian companies suspected to be behind the forest fires. This momentum was leveraged by the Indonesian government to correct policies, regulations, and forest/land fire prevention efforts by issuing Presidential Instruction (Inpres) No. 11 of 2015, which was later updated by Inpres No. 3 of 2020 on Forest and Land Fire Management. This instruction complements existing regulations regarding the prohibition of land burning, which are enforced under Law No. 41 of 1999 on Forestry, Law No. 32 of 2009 on Environmental Protection and Management, Law No. 39 of 2014 on Plantations, and the Job Creation Act (UU Ciptaker).

Table 3. Regulations Related to the Prohibition of Land Burning

Policy / Regulation	Penalties: Imprisonment	Penalties: Fines
Law No. 41/1999 (Article 78 Paragraph 3, Intentional)	Maximum 15 Years	Maximum 5 Billion IDR

Policy / Regulation	Penalties: Imprisonment	Penalties: Fines
Law No. 41/1999 (Article 78 Paragraph 3, Negligence)	Maximum 15 Years	Maximum 1.5 Billion IDR
Law No. 32/2009 (Article 108)	Minimum 3 Years & Maximum 10 Years	Minimum 3 Billion IDR & Maximum 10 Billion IDR
Law No. 39/2014 (Article 108)	Maximum 10 Years	Maximum 10 Billion IDR
Law No. 6/2023 on the Enactment of Government Regulation in Lieu of Law No. 2/2022 on Job Creation (Article 36 number 17)	Maximum 15 Years	Maximum 7.5 Billion IDR

Data Source: Compiled from various sources

Since the implementation of the land-burning ban policy in 2015, cases of criminalization against indigenous peoples have continued to rise. A prominent example is Sona binti Kulupmat, a woman from the Talang Mamak Indigenous Community in Indragiri Hulu who was arrested by police in August 2024 for burning land to farm. Based on monitoring from the Lancang Kuning application, the fire spread across 12 hectares within the Bukit Tigapuluh National Park area. Sona, who was merely trying to secure a livelihood, was ultimately sentenced to 1 year in prison and a fine of 500 million IDR, though she was released after serving 8 months of her detention period (Suryadi, 2025).

The prohibition on burning land has also had a major impact on the food security of indigenous peoples. In Kalumpang Village, Central Kalimantan, the Mantangai Indigenous Community still practices rotational shifting cultivation and carries out controlled land burning to fertilize the soil. According to Sanyo, a local customary elder, if burning had been done haphazardly, the Bornean forests would have disappeared long ago. Bans that fail to consider local wisdom instead exacerbate food insecurity while undermining the identity and social relations of indigenous peoples who have protected the forest for generations (Tisna, 2025).

2.3 Food and Climate Change

The 1996 World Food Summit defined food security as a situation that exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This definition of food security was subsequently adopted by the Food and Agriculture Organization (FAO) of the United Nations. Based on this definition, there are four pillars associated with food security: food availability, economic access, food utilization, and stability over time.

Scientists agree that climate change will worsen food production and supply. The Intergovernmental Panel on Climate Change (IPCC) states with high confidence that there is a decline in food quantity and quality, alongside disruptions to public access to adequate nutrition. This situation directly impacts child nutrition.

A report by UNICEF & Bappenas (2024) reinforces these findings. Climate change and its resulting shocks cause a decline in dietary diversity and quality, while simultaneously degrading the environment that supports child health. Beyond its direct impacts on food, climate change weakens family and community livelihoods and incomes, thereby amplifying existing socio-economic disparities. There are at least four aspects linking food and climate change.

Table 4. The Correlation Between Food and Climate Change

Aspect	Description
Food Production and Availability	Climate change decreases crop yields and food availability due to extreme weather, droughts, and floods.
Food Quality and Diversity	Elevated temperatures and altering cultivation patterns reduce nutritional content as well as the variety of food available to families.
Dietary Patterns and Child Care	Food crises make it difficult for families to provide nutritious meals and maintain optimal nutritional care patterns for children.
Income and Social Inequality	Climate disruptions lower the income of farmers and fishers, widening socio-economic gaps among different community groups.

The right to adequate food is explicitly recognized in Article 11 of the International Covenant on Economic, Social, and Cultural Rights (ICESCR), which has been ratified by the Indonesian government through Law No. 11 of 2005. This right encompasses two crucial aspects: as a component of human dignity and as a guarantee of health to ensure an individual enjoys a productive life.

In the year 2000, the CESCR issued General Comment 14 on the Right to the Highest Attainable Standard of Health (hereinafter, General Comment 14; CESCR 2000). In General Comment No. 14, the CESCR Committee emphasized food and nutrition as key social determinants of health for indigenous peoples. Paragraph 27 of the comment states that states are obligated to ensure indigenous peoples have control over the resources and services that support their health, including the protection of medicinal

plants, animals, and minerals that form an integral part of their lives. This comment underscores that the health of indigenous peoples is collective in nature and intrinsically bound to their lands and environment. Development that forces them to relocate from traditional territories or destroys local nutritional sources is considered a violation of the right to health and the dignity of indigenous peoples. This framework positions indigenous peoples as the primary subjects within local food systems, while strengthening their right to self-reliance in maintaining their food and health.

Making specific reference to indigenous peoples, Paragraph 27 of General Comment 14 integrates food and nutrition into a fundamentally new paradigm based on the rights of individuals within a group culture, the vitality of their collective, and the way human relationships with the environment and one another shape food, nutrition, and health. The following is an excerpt from paragraph 27:

According to Law No. 18 of 2012 on Food, food security means a condition where all people—from the state level down to the individual—can obtain sufficient, nutritious, safe, diverse, affordable food that aligns with their religion and culture to live a healthy and productively sustainable life. This law also addresses three other pillars:

1. Food Sovereignty: The right of a nation to regulate and determine its own food policies independently.
2. Food Self-Reliance: The capability to produce food domestically by utilizing local resources.
3. Food Safety: Efforts to ensure that consumed food is safe from hazardous materials and conforms to societal values.

The three concepts above are highly relevant to addressing the food challenges faced by many countries, including Indonesia. Experts predict that by the year 2050, the global population will reach 9 billion people (Kumar & Dubey, 2020). A population of this magnitude naturally requires a food supply that is sufficient, safe, and easily accessible to everyone. Meanwhile, indigenous peoples in Indonesia are still fighting to ensure that the territories they inhabit are not displaced by large-scale development projects and major industries. When they lose their ancestral land, they also lose the ability to fulfill their own food needs. Climate change further exacerbates the situation, as increasingly erratic weather patterns—such as extreme rainfall and prolonged droughts—disrupt their agricultural yields.

2.4 Indigenous Women, Natural Resource Management, and Climate Change

This section focuses on the discourse surrounding women and ecology, including climate change. In her book *Women's Role in Economic Development* (1970), Ester Boserup raised the question of why women in developing countries were increasingly marginalized from economic development, despite playing a massive role in food production and rural life. She argued that development policies have historically not been neutral, focusing instead primarily on men and ignoring the contributions of women. Yet, in many regions, women are the primary food producers and play a vital role in maintaining the family economy. Consequently, agricultural modernization often causes women to lose access to land, training, and technology. Boserup emphasized that development would be more successful if women were fully integrated, not merely as beneficiaries, but as primary agents. Her ideas subsequently influenced the policies of international agencies like the FAO, UNDP, and the World Bank to incorporate gender perspectives into agricultural and rural development policies. Ester Boserup's framework laid the foundation for the "Women in Development" (WID) approach, which later evolved into "Women and Development" (WAD).

Sherry Ortner, in her classic essay titled "Is Female to Male as Nature to Culture?" (1974), raised a more fundamental question: why do women universally occupy a subordinate position relative to men across various societies and cultures? Ortner sought to explain this through symbolic and cultural

constructions that place women closer to "nature," while men are identified with "culture." Ortner's primary argument is that human culture universally views nature as something to be controlled or transformed through culture. Because women are identified with biological functions such as childbirth, breastfeeding, and child-rearing, they are perceived as closer to nature. Conversely, men, who are engaged in the creation of cultural, symbolic, and social systems, are viewed as hierarchically superior. Thus, the subordination of women stems from the way society interprets the relationship between nature and culture, rather than solely from biological differences. Ortner's concept became a vital foundation in feminist theory and gender studies by showing how symbolic cultural structures create gender inequality. This essay remains a major milestone that opened new debates regarding the relations among gender, culture, and nature in anthropological and ecofeminist studies.

While Ortner examined why the position of women is universally subordinate, Merchant sought the origins of the oppression against women. Carolyn Merchant, in her book *The Death of Nature: Women, Ecology, and the Scientific Revolution* (1980), posed the central question of how the 17th-century Scientific Revolution altered the way humans view nature and contributed to the oppression of women and the exploitation of the environment. Merchant argued that prior to this revolution, nature was symbolically understood as a living organism and a life-giving mother. However, that view shifted when modern science began to see nature as a machine to be controlled and exploited for human benefit. The transition from the imagery of "nature as mother" to "nature as object" did not merely mark an epistemological shift in science; it also reflected a social transformation that placed women and nature in subordinate positions under the logic of patriarchy and capitalism. Thus, Merchant demonstrated that the modern ecological crisis is rooted in a shift in how humans think about nature and its relation to women, making her book one of the crucial foundations of ecofeminist thought.

Studies by Irene Dankelman and Joan Davidson provide a more complex overview, focusing on the agency of women. In their book *Women and Environment in the Third World: Alliance for the Future* (1988), the question raised was how the interconnections between women, poverty, and environmental degradation affect one another in Third World nations. They both argued that women, particularly in rural areas, are the group most severely impacted by environmental degradation because their roles heavily rely on natural resources such as water, soil, and forests to meet family livelihood needs. However, despite being the ones who feel the impacts most acutely, women are frequently ignored in development and environmental management policies. According to Dankelman and Davidson, solutions to the environmental crisis cannot be separated from the empowerment of women and their active inclusion in decision-making and natural resource management. This idea underscores that women are not merely victims of unsustainable development, but also vital actors in creating a more equitable and sustainable future for the environment.

In its report titled "Changing the Climate: Why Women's Perspectives Matter" (Dogherty et al., 2007), the Women's Environment and Development Organization (WEDO) emphasizes the vital importance of advocating for the integration of gender perspectives into global climate change policies. The report highlights that climate change is not gender-neutral; women, particularly in developing countries, frequently face more severe impacts. WEDO stresses that pre-existing gender inequalities—such as limited access to resources, information, and power—amplify women's vulnerability to climate change, manifested in increasing difficulties in collecting water and fuel in rural areas.

The report also underscores the significance of women's involvement in climate change decision-making. Women's local knowledge and experience in managing natural resources can support more effective adaptation and mitigation strategies. Furthermore, WEDO emphasizes justice and human

rights, highlighting that climate change can exacerbate gender inequalities and threaten women's rights to land, education, and protection from violence.

WEDO emphasizes that gender-sensitive data is indispensable for designing effective policies and that women must be involved at all levels of decision-making, from local to international. This report serves as a crucial reference in advocating for inclusive climate change policies and demonstrates how women's perspectives can strengthen the effectiveness and sustainability of such policies, even though their implementation still faces challenges stemming from existing social and political structures.

In her book *Gender and Green Governance: The Political Economy of Women's Presence Within and Beyond Community Forestry* (2010), Bina Agarwal highlights the relationship between gender, the environment, and natural resource governance, particularly forests. She argues that women's active involvement in community-based forest management not only strengthens their social positioning but also renders environmental management more effective and sustainable. Through research in India and Nepal, Agarwal found that forest groups that include women in decision-making and leadership achieve higher success rates in conserving forests and improving community welfare. She rejects the view that women are inherently or naturally more caring toward the environment, asserting instead that women's participation is shaped by social, economic, and political structures that provide space for them. Agarwal's insights offer a major contribution to ecofeminism and environmental politics by demonstrating that gender justice is key to successful, equitable, and sustainable natural resource governance.

In their book *Ecofeminism* (1993), Vandana Shiva and Maria Mies pose a central question that moves beyond previous inquiries: how do patriarchal systems and global capitalism intertwine to oppress women and exploit nature? They both argue that the roots of the modern ecological crisis stem not only from technological advancement and industrialization but also from a patriarchal worldview that separates humans from nature and places both in a relationship of dominance. In their view, women share a closer connection with nature due to their role in the production of life—such as childbirth, nurturing, and safeguarding food resources—meaning that the oppression of women and the destruction of nature share the same ideological roots. Shiva and Mies reject the growth-oriented, resource-exploitative capitalist development model, viewing it as destructive to ecological balance and local community life. Alternatively, they propose ecofeminism as a new paradigm that emphasizes the principles of ecological justice, solidarity, and sustainable living aligned with women, local communities, and nature. This book stands as a significant milestone in radical ecofeminist theory by unifying critiques of patriarchy, colonialism, and capitalism into a single, comprehensive analytical framework.

The discourse on women and the environment has evolved from acknowledging women's economic roles to a systemic analysis of gender injustice and ecological crises. Ester Boserup (1970) highlighted how women in developing countries, despite being primary food producers, were often marginalized in development, giving rise to the Women in Development (WID) approach. Sherry Ortner (1974) and Carolyn Merchant (1980) subsequently linked the subordination of women to cultural constructions and epistemic shifts in human views toward nature, building the foundations of ecofeminism that critiques both the domination of nature and gender inequality.

Subsequent literature emphasizes women as agents of change. Dankelman and Davidson (1988) alongside WEDO (2007) assert the importance of women's local knowledge in climate change adaptation and mitigation, while Bina Agarwal (2010) highlights the success of forest management when women are substantively involved. WEDO demonstrates the necessity of gender-sensitive data to ensure fairer climate policies, and Vandana Shiva together with Maria Mies (1993) emphasize women

as guardians of the subsistence economy and ecological sustainability. Overall, this discourse confirms that development and environmental governance can only be sustainable if women's perspectives are recognized, heard, and integrated into community policies and practices.

In the Indonesian context, monitoring by the National Commission on Violence Against Women (Komnas Perempuan) indicates that natural resource and spatial planning conflicts occur within a development framework that remains heavily oriented toward natural resource exploitation, macro-investment models, and massive infrastructure projects. The Commission identified that various cases since the early 2010s have been characterized by the neglect of due diligence procedures, failure to fulfill the right to information, and a lack of public participation, particularly among indigenous women. Notable examples occurred in regions such as the Kendeng Mountains in Central Java regarding limestone mining cases and plans for a cement factory. Meanwhile, in Papua, monitoring shows that the conversion of customary lands and forests has triggered the expropriation of indigenous women's livelihoods and forced displacement, aggravated by a disregard for the root causes of the conflict and an approach heavily dominated by mere defense-and-security frameworks.

Monitoring in East Nusa Tenggara—for instance, the dam construction project in Rendu Butowe Village—reveals that pregnant women, breastfeeding mothers, and the elderly experience heightened vulnerabilities when customary land and community water springs are expropriated, while women's involvement in decision-making remains virtually non-existent. Overall, Komnas Perempuan's monitoring reinforces that protecting the rights of indigenous women in natural resource conflicts is not merely a moral imperative, but is vital for socio-ecological justice and the sustainability of development in Indonesia.

Other findings in areas such as Mount Talang in West Sumatra, West Kalimantan, Central Kalimantan, Sumbawa, or within the Sunda Wiwitan community note that women embroiled in natural resource conflicts frequently face multi-layered human rights violations—ranging from losing access to land and livelihoods, the destruction of food sovereignty and local knowledge, to criminalization or violence for defending their ancestral domains. According to Komnas Perempuan, these cases represent a national pattern: indigenous women experience displacement, minimal access to information, and systemic exclusion from decision-making processes.

This literature review underscores that climate change is not merely a natural phenomenon but a consequence of human activities with far-reaching impacts on both the environment and social life. Global warming has triggered increasingly frequent and intense hydrometeorological disasters, ranging from floods and droughts to forest fires, bringing severe repercussions for public health, food security, and community livelihoods. Indonesia, as an archipelagic nation experiencing rapid deforestation, stands among the most vulnerable to these risks.

Indigenous communities maintain a unique relationship with the environment. Traditional land management systems, such as agroforestry and rotational shifting cultivation, help sequester carbon, maintain soil fertility, and preserve biodiversity. However, development pressures, plantation expansion, and regulations that disregard local wisdom all lead to the expropriation of customary land rights, threatening food security while exacerbating vulnerability to climate disasters.

Indigenous women occupy a position that is simultaneously crucial and vulnerable. They bear vital responsibilities in managing food, forests, and natural resources, yet they are frequently excluded from customary decision-making and government policy formulation. The double burden borne by women intensifies as resources deplete due to environmental degradation and climate change impacts.

Conversely, women also serve as pivotal actors in adaptation, safeguarding traditional knowledge, preserving local food systems, and contributing to community resilience.

The reviewed literature demonstrates the interconnected dynamics among climate change, food security, and gender issues. Addressing this nexus requires not only ecological mitigation measures but also an equitable social approach that recognizes the rights and engagement of indigenous women as an integral component of sustainable climate adaptation solutions.

Chapter 3 Research Findings

Indigenous communities have long been depicted as possessing traditions, cultures, and worldviews that respect nature and their surrounding environment, harvesting or utilizing resources in moderation, and practicing sustainable subsistence shifting cultivation amidst the various limitations encompassing them. Nature, which was once capable of fulfilling their needs for food, clothing, and shelter, has gradually begun to lose its carrying capacity as the environment deteriorates due to unsustainable natural resource exploitation practices carried out in the name of development.

Climate change occurring across different parts of the world has begun to impact indigenous communities, both through rapid-onset events such as floods and heatwaves, and slow-onset phenomena like rising temperatures and sea levels. Although they feel these shifts, the indigenous communities still interpret such changes as ordinary seasonal variations that will eventually return to normal, all while continuing their daily activities. Within the context of this study, these dynamics manifest through a series of turning points that reshape the relationship between indigenous communities and their environment, their ways of adapting to change, and their survival strategies that continue to evolve over time.

This chapter presents the research findings from each location by highlighting five main themes that reflect the prominent phenomena, namely: (1) the turning points when indigenous communities confront development policies that marginalize them, (2) climate change and disasters as consequences of exploitative development practices, (3) the transformation of food systems, (4) enduring traditions and cultures alongside emerging ones, and (5) the strategies of indigenous women and their socio-ecological resilience. We present narratives and testimonies from several informants representing the older, transitional, and younger generations, which were gathered during participatory research at the field sites from March to June 2025.

3.1 The Mentawai Indigenous Community

The Mentawai Islands are located off the western coast of Sumatra and consist of four main islands (Siberut, Sipora, North Pagai, and South Pagai) out of a total of 99 to 103 recorded islands. Covering an area of 603,400 hectares, the islands are home to approximately 97,000 people, with the majority of the population residing on Siberut Island, according to the latest census by BPS (Statistics Indonesia).

The research team conducted two field visits to the Mentawai Islands: in March to Malancan Village (North Siberut District); and in June to Saureinu Village (South Sipora District) as well as to Tuapejat, the capital of the Mentawai Islands Regency. The journey was undertaken using various modes of public transportation, illustrating the typical challenges of a 3T region—*tertinggal* (underdeveloped), *terdepan* (frontier), and *terpencil* (remote). Mentawai is categorized as a 3T area due to limited access to basic services, lagging socio-economic and infrastructural conditions, a geographical location far from the centers of government, and the hard-to-reach nature of an archipelagic region.

State Penetration and Capital Mobilization: The Disruption of Collective Memory and Hostaged Customary Institutions

After passing through a wide and winding river, surrounded by dense growths of mangroves, coconuts, and sago trees along the riverbanks, the first settlement finally comes into view: wooden houses with zinc roofs standing among areca palms and banana trees. The architectural style of these houses no longer features the traditional stilt structure; instead, it adopts the layout of conventional modern houses.

It is said that most of these houses were built by the Ministry of Social Affairs to encourage the centralized resettlement of the community. This is where Malancan Village is located.

The hamlets within Malancan Village are not situated within a single continuous expanse; they are separated by rivers, hills, swamps, and lands prone to landslides and flooding. These geographical conditions form part of the Mentawai social landscape: the flowing water, the undulating terrain, and the distances between hamlets create a distinct rhythm of daily life. Within this context, the history of migration and the establishment of new settlements took shape—a long journey of the Mentawai indigenous community from their ancestral lands to the place now called Malancan.

The village consists of nine hamlets—Malancan, Bakla, Langgurek, Kelak Bunda, Sinaki, Ukra, Sirilanggai, Sibeutacun, and Terekan Hulu—which are separated by river streams and stretches of tropical rainforest. To reach the hamlets of Malancan, Bakla, Langgurek, Kelak Bunda, and Sinaki, the team used boats, whereas the trip to Ukra, Bakla, and Sirilanggai hamlets was undertaken by motorcycle, taking about 30 minutes from the Pokai Harbor. The most challenging journey occurred when heading to Terekan Hulu Hamlet from Sirilanggai. The team had to trek for approximately three hours along riverbeds that are highly prone to flash floods during the rainy season.

In the past, this region was covered by a dense tropical rainforest that formed the foundation of the Mentawai community's subsistence economic system. Although located within West Sumatra Province—which predominantly adheres to a matrilineal kinship system—Mentawai clans are patrilineal and live egalitarian lives in small settlements along riverbanks, centered around a communal longhouse called the *uma* as the hub of social and ritual activities. Their livelihood was a blend of hunting, gathering, fishing, livestock rearing, sago processing, woodworking (particularly boat building), and small-scale cultivation, creating a self-sufficient system heavily dependent on the surrounding forests and rivers.

While the Mentawai people are not historically known as seafarers, some residents work as artisanal or small-scale fishermen who go out to sea for short periods and within close proximity to the shore. This subsistence equilibrium, supported by biodiversity and local ecological knowledge, sustained their material well-being as well as their rich cultural and spiritual heritage. It is this subsistence equilibrium, rather than industrial-scale production-consumption-distribution patterns, that explains how pressure on natural resources could be kept in check by the indigenous community over a long period.

Mentawai culture is rooted in the Arat Sabulungan belief system, which recognizes the presence of spirits in every living being and natural force. Within this system, all life activities—hunting, farming, building houses, to healing illnesses—are invariably linked to efforts to maintain a balance between humans and the spirit world.

The phase of transformation faced by the Mentawai Indigenous Community (KAM) in Malancan Village unfolded during the era when timber utilization concessions were granted in the early days of the New Order administration, beginning in 1969. At that time, the government handed over more than 600,000 hectares of Mentawai forests to timber corporations through Forest Concession Rights (Hak Pengusahaan Hutan or HPH). In a short period, six major companies—including PT Tjirebon Agung and PT Kayu Siberut—moved in and began large-scale logging operations. The once-dense forest was transformed into piles of logs waiting to be loaded onto ships.

The issuance of these concessions merely changed forms and continues to this day, one of which was granted to the timber company PT Salaki Summa Sejahtera (PT SSS). PT SSS holds a Business Permit for the Utilization of Timber Forest Products in Natural Forests (IUPHHK-HA), issued by the Minister of Forestry for land exploitation on Siberut Island. PT SSS is the metamorphosis of PT Tjirebon Agung,

which for 22 years depleted timber across 70,000 hectares of Mentawai forests starting in 1970. The government granted massive concessions under the pretext of development, and the timber companies did not hesitate to log forests around ancestral domains. Within a matter of years, the ecological space that was once a part of the Mentawai indigenous community's daily life slowly transformed. R, an activist who has worked for decades, recalled, *"Since the companies entered in the 1970s, the timber was stripped bare. Many hamlets in the forest became empty, abandoned by residents due to relocation through resettlement programs. Culture was also lost, obliterated. Many uma were burned down or abandoned."* These logging activities proved to trigger ecosystem degradation and caused massive flooding.

The majority of Malancan Village's population originates from Gorottai Hamlet, an old territory that has now been completely abandoned. Through the "Resettlement of Isolated Communities" (Pemukiman Kembali Masyarakat Terasing or PKMT) program implemented by the Department of Social Affairs, the state encouraged residents to live in large, centralized settlements and abandon their old traditions. The process of population relocation from Gorottai to Malancan began in the 1980s.

Mr. JRO, the head of the Malancan Village Customary Institution, explained: *"Barana ka rura 1980-an, amulelengngan sia ka pulanggajan sibau. Oto arapusabu ka malancan kalulut taibarana enungan simakolou, besikna ragaba puagaijan, samba ron tubu, kau purimanuaijan. Ikkik membuk Ken si puleleng ka Gorottai."* [Translation: "Since the 1980s, the resettlement process had already begun. The main reason the residents of Gorottai Hamlet moved to Malancan Village was the absence of regular transportation, the difficulty in accessing basic services such as education and healthcare, and also due to economic hardships. Today, no one lives in Gorottai anymore"]. The informant was born in Gorottai and moved to Malancan due to the pragmatic consideration of housing availability and the hope of farming more profitably. He had previously experienced a prolonged eight-month drought, where obtaining clean water was difficult because the water springs were far away.

A slightly different account came from Mr. BS, the Head of Malancan Village at the time. He explained that the dissolution of Gorottai Hamlet was carried out for administrative reasons: *"Ka bagan arat, sambek langgai, kau iali sangotu utet uma, oto ka Gorottai, mebuk iali beren nen. Kau onggok sapeu iali eba pak ali toban. Porak simaeruk, pinang, coklat, toiten, bara tauremna, kalulut memberin ibara eba, tui lek sia ka Malancan."* [Translation: "According to the regulations, a hamlet must have a minimum of one hundred household heads. Gorottai did not reach that number. Furthermore, the flooding there was severe; even stilt houses could be submerged up to their roofs. Even though the land there was incredibly fertile—*areca nuts, cocoa, coconuts, everything* grew well. But because it flooded so often, they moved to Malancan"].

From these two testimonies, it is evident that the migration that took place was not voluntary, but rather a forced migration emerging from a combination of natural disasters and administrative policy interventions. The resettlement program brought the community into a new space that was more connected to the state system—proximate to schools, healthcare facilities, and road access—but simultaneously distanced them from their fertile and sacred customary forest territories. Forced migration in Mentawai occurred as a direct consequence of government policies aimed at the dual objective of driving national economic growth and structuring administrative regions for basic service delivery.

The relocation to Malancan Village altered the residential patterns and social relations of the community. Settling arrangements that originally dispersed following the contours of rivers and gardens were now arranged in straight rows along the village road. The collective stilt longhouse (*uma*), which

once served as the center for rituals, deliberations, and social life, was replaced by rows of individual wooden board houses.

Mrs. KS, a woman farmer and fisherwoman in Sirilanggai, recalled: "Boboina kai sangasapeu let kai, ikkik sapeu muriok pasambek-sambek, kanak bara punen, tambuk mak nen beberen mai. Boboina moi tualak bebegen kau loingak ka бага. Ikkik, beberenna rakiliu, kanak toguruk kai ka talambaga nen rakua perusahaan sibakkatna, ra tangsiakennan kai." [Translation: "In the past, we lived together in one uma. Now, every house stands separately on its own. If there is a ceremony, it is not as crowded as it used to be. Back then, we could gather rattan and wood anywhere. Now, there are prohibitions everywhere. If we enter the forest that they say belongs to the company, we can be arrested"].

The changes occurred not only at the physical level but also at the level of cultural expression. The New Order government forced the community to abandon their customary expressions: men's long hair was forcibly cut, loincloths (kabit) were banned, and the Arat Sabulungan belief system—the ancestral faith practiced for centuries—was labeled as deviant. The sikerei (shamans) stopped performing rituals, and people were required to choose one of the state-sanctioned official religions to marry, attend school, or gain state recognition.

For the Mentawai indigenous community, the changes that occurred were not merely a shift in outward appearance, but the uprooting of their very way of life. Arat Sabulungan was not just a belief system, but traditional ecological knowledge—a way of reading rain signs, cutting down trees with the permission of forest spirits, and maintaining the balance of nature. When those teachings were suppressed, they lost the spiritual language to relate to their environment. This marked the process of modern lifestyle homogenization that displaced the traditional ecological identity of the Mentawai people.

Development in Mentawai forced the indigenous community to conform to definitions of modern progress introduced by the state and corporations, which ultimately severed the ties of the Mentawai indigenous community from its history and natural habitat. As a result, the Mentawai indigenous community lost access and control over its ecological space. Customary institutions—which functioned as cultural guardians, inheritors of tradition, regulatory authorities for social life and resource management, conflict peacemakers, political representations of the community, and centers for education and spirituality—were powerless to stem state penetration and capital mobilization efforts.

Forest Lost, Nature Confused: Deforestation, Local Climate Change, and New Vulnerabilities

"The big tree that used to be the dwelling place of spirits has now become a soulless piece of plank."

For the Mentawai indigenous community, the words above represent a collective memory of a stark historical fact depicting the changes that have transpired. The loss of natural forests triggered profound socio-ecological shifts, including local climate change.

"Siburuk ka leleu ka raik barasien beri lakok langgek. Oto iki tonggoilit lakok simaparalu maibetei langgek meuan bara" [Translation: "In the past, medicinal plants could already be found in the forest around the village. Now, tonggoilit (a type of parasitic plant that clings to trees) has become difficult to find, even though that plant is one of the essential ingredients for concocting medicine"], explained Mr. Bajak JP and Mrs. SR, a husband-and-wife Sikerei pair, born in 1949 and 1954, who originated from Gorottai and moved to Malancan due to the resettlement. They became Sikerei after experiencing a severe illness involving chills and being possessed by the spirits of ancestral Sikerei.

As tribal healers, both hope that even though modern medical treatments are now available, traditional medicine based on natural ingredients from the forest—introduced and taught by their ancestors—must

be preserved. This should be achieved by maintaining forest conservation and continuing to work so that the existence of Mentawai remains sustained. The hard-working ethos of the Mentawai indigenous community is captured in this proverb: "*Tak muloksembaga, tak murimanua okeu*" (*If you do not sweat, you will not live*).

However, hard work to preserve the forest and ancestral knowledge is inseparable from the new challenges they confront within nature itself. Alterations in weather patterns have begun to be felt by many residents, affecting how they understand the surrounding environment.

Most of the residents interviewed separately or in focus groups shared similar observations. "*Siburuk moi taiak manua. Sikinek tak iagai. Siburuk bara legeu sabeu. Bara uran simapalik ibailiu eba sabeu teret iopu aken uma.*" [Translation: *In the past, the weather was easier to forecast. Now it is more difficult. In the past, there was once a prolonged drought. There were also heavy rains and flash floods, to the point that house roofs were washed away*].

During every SIKAT discussion session involving a large number of participants, the majority of attendees stated, "*We do not really know what the term climate change means; all we know is that nature is no longer like it used to be.*" In Mrs. KS's view, nature has changed and the weather is difficult to predict. She attributes this to the loss of natural forests, which has created erratic seasonal patterns and a dwindling abundance of flora and fauna.

"Now we don't know when to plant, when to harvest," said Mrs. KS in Sirilanggai. "*Before, we knew from the sound of insects and the direction of the wind. Now, the signs of nature seem to have vanished.*" Mr. M, who was met on the journey from Terekan Hulu, chimed in, "*We used to know when to plant by looking at the clouds; now the clouds cannot be trusted.*"

This local climate change multiplies disaster risks. Flooding in Malancan and Saureinu is no longer an extraordinary event; it has become a part of daily life. The village head and residents provided testimonies of floods submerging roofs just a few weeks before the researchers arrived. "*Usually, floods come once every two, three, or four years. But now they are more frequent and arrive faster. The last time, the village office was submerged up to its roof. The current was extremely swift,*" noted Mr. TJ, the Head of Saureinu Village.

Continuing the story, Mr. MA, a resident of Saureinu, recalled one of the massive floods that occurred, "*This hamlet frequently experiences major floods. The water rose for two days and one night. The rain was torrential, all houses were inundated, and roads were cut off.*"

Flooding serves as evidence of local climate pattern shifts felt directly by the community. Floods are now not only seasonal but also more intense and unpredictable. Residents refer to it by the local term "confused nature"—a designation for an environment that has lost its equilibrium.

Drought in Mentawai represents another form of ecosystem imbalance triggered by climate change and forest degradation. In the collective memory of the Malancan community, the most severe drought occurred in the 1990s, when it did not rain for eight months. When trees were logged and the forest lost its capacity to store water, small rivers began to dry up, and clean water sources became increasingly difficult to find. Residents of Malancan still remember the driest period in the 1990s, when no rain fell for eight consecutive months. Mr. TJ recounted that at that time, all small rivers dried up, and residents had to walk long distances carrying large jerry cans of water.

Mr. MJ, a migrant who has lived in Malancan for a long time and previously held positions in the logging company and local government, added that to obtain clean water, people had to walk as far as two kilometers across steep hills. In situations like this, it is women who bear the heaviest burden.

Almost every day, they walk long distances, traversing uphill paths while carrying water jerry cans to ensure that their families can drink, cook, and survive amidst the intensifying water crisis.

The water crisis is also exacerbated by seawater intrusion experienced by residents in Saureinu. Mr. MA shared that the water in the main source now tastes salty, as if mixed with seawater. *"Our water source now tastes salty. Perhaps because seawater has entered,"* he remarked. When the dry season arrives, residents must travel long distances using motorcycles to find fresh water. Usually, the men set out, but when they are busy working in the gardens, the women take over the task. This situation demonstrates that seawater intrusion is not merely a natural symptom, but a clear sign of how climate change affects the daily lives of small island communities like Mentawai. Rising sea temperatures and upstream forest destruction disrupt the coastal water balance—seawater seeps into the ground, while fresh water sources continue to diminish.

Climate change in Mentawai is felt not only on land but also at sea, which serves as the source of livelihood for many families. Mr. MK, a farmer who also works as a fisherman, mentioned that they used to be able to read natural signs to determine when to go out to sea. *"Siburuk ka rura 2015 kuaik kai langgok samba talanggogoi me mai alak iba. Oto iki ke maeruk manua, ipatulut olop simakataik. Aba' ibailiu malunggek."* [Translation: *"Before the year 2015, we looked at the moon and the stars in the sky to catch fish,"* he said. *"Now, even though the sky is calm, a storm can suddenly arrive. Boats can capsize"J]. Mrs. S, the wife of Mr. MK whom we met in the field, added, "Siburuk, langgok, olop samba manua moi ibailiu tando, sibara sikinek meubu iagai. Ipatulut lek bara kataik manua ibailu meu iagai ta jagona."* [Translation: *"In the past, the position of the moon, the direction of the wind, and the color of the clouds served as reliable guides, but now none of that can be used as a benchmark. The weather changes too quickly, becoming difficult to predict"J].*

The description above illustrates that local climate change in Mentawai is rooted in spatial planning alterations and environmental governance that disregard ecological balance. Spatial utilization planning within a region, as articulated in the Regional Spatial Plan (RTRW), is supposed to create an orderly, harmonious, and balanced spatial layout across environmental, economic, social, and cultural aspects. The clearing of customary forests for HPH concessions and the expansion of economic lands—displacing the forest's ecological function as a natural climate regulator—accelerates temperature increases, disrupts rainfall patterns, and causes soil erosion that leads to extreme flooding and droughts.

Within the Mentawai context, deforestation and centralized resettlement programs that restructure the living spaces of the community have instead created new vulnerabilities: uniformly built houses in low-lying areas are inundated when it rains, while upland hilly regions lose their water sources during droughts. The spatial alignment process, which was originally intended to improve welfare and the accessibility of public services, ultimately triggered a local climate crisis where floods, droughts, and erratic weather have become embedded in the daily realities of the community.

The Vanishing Sago, The Collapsing Rice Fields: Women at the Forefront of Food Security

The majority of Malancan villagers live off their gardens and fields. The crops they plant are quite diverse: bananas (*Musa paradisiaca*), betel nuts (*Areca catechu*), jengkol (*Archidendron pauciflorum*), rice (*Oryza sativa*), taro (*Caladium*), as well as fruits like durian (*Durio zibethinus*) and mangosteen (*Garcinia mangostana*). Some residents also catch fish in the rivers and the sea; the catch is consumed at home, and any excess is sold in a small market in Pokai. The river serves as the lifeblood of the community: a transportation route, a water source, and a social space where villagers meet, bathe, or wash clothes.

Before modern development reached the Mentawai archipelago, community life centered around the *uma*—a collective stilt house that was not just a dwelling, but also a ritual center, an educational hub, and a forum for deliberation to discuss matters concerning the livelihood of the Mentawai clan/tribe. Within the *uma*, women shared roles with men to maintain traditions, secure food supplies, perform various rituals, and pass down noble values to the next generation; meanwhile, the *sikerei* (traditional shamans) led ceremonies and traditional healing. It was also from the *uma* that traditional ecological knowledge was inherited: how to read wind directions, determine planting times, or seek shelter during earthquakes. As for the surrounding forest, it served as a spiritual, economic, and social space—a place for hunting, cutting timber, foraging, mixing medicine, and harvesting sago.

Sago, in particular, was the heart of the local food system. It grew naturally along riverbanks without fertilizers or irrigation and was processed collectively through *gotong royong* (mutual cooperation). Men felled the sago trunks, while women pressed and processed them into flour that could be stored for a long time. This food pattern reflects a social ecology where humans, nature, and forest spirits are intertwined in a cycle of sustainability. *“If we eat sago, we can work all day in the fields. But if we eat rice, we get hungry again quickly,”* said Mrs. KZ. A similar statement was echoed separately by Mrs. R, a young mother who is also the wife of the chief of Terekan Ulu hamlet.

The early 1990s marked a major transition period. A rising demand for agarwood (*gaharu*) brought cash into the villages and introduced new consumption habits. *“At that time, people made a lot of money from agarwood. They started buying rice from stores. They said it was to be like city folks,”* said Mr. MJ. Rice, which was originally only cooked on major occasions such as weddings or customary ceremonies, turned into a daily staple. Rice became a symbol of status and the progress of modern life. This shift was also triggered by national food programs that distributed staples in the form of rice rather than local crops. Today, sago has become a rare commodity in several hamlets. Many sago gardens have been cut down or submerged by floods due to changes in water management. *“Sago cannot grow if the water is dirty,”* said Mrs. SR and Mrs. SA, sisters who are farmers and housewives from Sinaki Hamlet. *“Now many sago trees are dead and abandoned. If we want to eat sago, we have to buy it from other villages.”*

In the early 2000s, the government introduced the *cetak sawah* (paddy field creation) program in several villages, including Malancan and Saureinu. This program was intended to increase food security and meet rice demands. Swamplands, which previously served as the natural habitat for sago plants and traditional food sources, were cleared into rice paddies. *“When the government came, we were invited to create rice fields,”* said Mr. MK, a resident of Malancan. *“But our land is swampland; it gets flooded during the rainy season and becomes extremely dry during the drought. As a result, much of the rice rotted.”* This ecological condition highlights the mismatch between the enforced agricultural model and the tropical island ecosystem.

From a social standpoint, the paddy field project introduced new forms of labor that were alien to a community accustomed to shifting cultivation and crop diversity. Local knowledge about soil management—based on the principles of land resting and crop rotation—was replaced by intensive agricultural cultivation. *“We usually plant sago and bananas,”* explained Mr. JT. *“As for rice, we are not used to it. After the first harvest failed, many chose not to continue.”* He further added, *“The government used to build rice fields here, but it wasn't successful. There wasn't enough water, and the soil wasn't suitable. People here aren't used to planting rice. In the end, the fields turned into wild bushes.”* This technical failure demonstrates the gap between local knowledge and developmental interventions based on mainland agrarian models that rely heavily on irrigation.

The failed paddy field program left behind abandoned lands and traces of social exhaustion. Many residents admitted to losing time and energy, as well as losing their direction, while the sago lands had already been ruined due to the land conversion. This dilemma was illustrated by Mrs. MT through a local proverb: “Oto nik ikkik, anda raakek rua enungan. Kanak pamarentah tualiaken, mebuk sibabara. Kanak Toili kai ka mencak, porak mai membuk” (translated: “We are like being pulled in two directions. If we follow the government, there are no results. If we return to the old ways, the forest is already ruined”).

Before logging companies operated, forests and rivers were the primary sources of protein for the community. Wild boars (*Sus scrofa*), deer (*Cervidae*), wild fowl, eels (*Anguilliformes*), freshwater snails (*Filopaludina javanica*), and small fish were abundant. Indigenous communities engaged in hunting and fishing, sharing the catch equally among families. Women played a vital role in this chain, particularly in catching small fish and snails and processing them into family meals. However, when logging companies began clearing thousands of hectares of forest, the animals' living space shrank, and the rivers became murky. This change slowly wiped out the community's natural protein sources. The forest turned into a barren land that no longer provided game, while the murky rivers yielded fewer and fewer catches.

“Now, life depends on money,” Mrs. KZ said softly. “If there is no money, you starve.” This statement shows that the shift to rice consumption and the failure of the paddy field program marked a transition from a sustainable subsistence system to a food system reliant on markets and government policies. Consequently, the community's ability to meet their food needs no longer relied on the surrounding nature, but rather on the availability of cash and supplies from outside the island. When income drops or transportation access is disrupted, a food crisis immediately emerges.

“There was a time when the supply ship didn't come for several weeks due to bad weather. The price of rice and other necessities skyrocketed, so the residents finally went back to looking for sago,” said Mr. KS. This shows that the food security of the Mentawai people is highly dependent on supplies coming from Padang. Yet previously, their ancestors only utilized what nature provided. “Only sugar and tobacco were usually bought, because they simply don't exist in Mentawai,” Mr. KS added.

Climate change, which triggers floods and droughts, has prompted female farmers in Mentawai to return to local crops that are more adaptive to extreme conditions. After the government's rice field program failed because the swamp land was too acidic and easily flooded, the community replaced rice with bananas, taro, sweet potatoes, and betel nuts—crops capable of surviving without chemical fertilizers. *“The Mentawai people never use fertilizer; the soil is naturally fertile on its own,”* said Mrs. SA, an activist for a women's farming group and a Malancan village cadre from Sinaki Hamlet. She now relies on a mixed garden to meet her family's food needs. This planting pattern not only saves labor and costs but also maintains soil fertility. Women's local knowledge regarding planting times, land rotation, and signs of nature has once again become the key to food resilience amidst weather uncertainty.

When deforestation wiped out hunting grounds and rivers turned murky due to logging concession (HPH) activities, natural protein sources like eels, snails, and wild boars became increasingly difficult to find. Women then developed a local innovation by cultivating toek (*Bactronophorus* sp.), a type of wood-boring water worm mollusk from the bivalve class, raised inside logs placed in brackish river waters. Women on Sipora Island, especially in settlements close to the sea, have possessed the skills to cultivate toek for generations.

In the past, toek was only consumed by families as a protein source, but now it has become a source of family income. We met Mrs. LI along with a group of women harvesting toek in a large river that splits

Saureinu Village. She explained that toek cultivation is women's work; men only help fell the trees and roll the logs from deep within the forest to the riverbank.

“Usually, women take care of the toek, men only help find the wood,” said Mrs. LI. Floating logs from the tumung (*Arthrophyllum diversifolium*) and bag-bag (*Camptosperma auriculata*) trees serve as the habitat for toek. A toek has an average length of 30 centimeters. Its head is round like a marble and it has two fang-like teeth. It uses those teeth to eat the dead wood that serves as its nest. Its body is soft, filled with fat that is white, though some are brownish.

Toek can be eaten raw right away by first removing the head, tail, and its brown entrails. When eaten, it tastes fresh, similar to the flavor and aroma of raw clams. Mrs. LI and her friends enjoyed their harvest after working hard for about three to six months, which included spending long hours submerged in the cold river water.

This toek cultivation has become a blessing for indigenous Mentawai women. The toek harvested by these women is usually packed into plastic bags and sold at the local market for Rp 15,000 per 500 grams, marketed through WhatsApp status updates. Toek provides an additional income source of around one hundred thousand rupiahs per log. In the context of the ecological crisis, this activity showcases how women become agents of adaptation through ecosystem-based economic creativity.

However, toek cultivation is not without threats. Toek can only live in estuarine areas—brackish water zones where seawater meets freshwater. The ideal rivers for cultivation are those affected by ocean tides. Because it requires submersion, toek cultivation is vulnerable to the impacts of climate change. Prolonged dry seasons cause river levels to drop, meaning the logs are not perfectly submerged. The growth of the toek slows down; what usually takes three to six months to mature now requires eight to twelve months. Conversely, during heavy rains, the river overflows, and the water turns brownish due to the soil materials it carries. Whether in the dry or rainy season, the yields of toek cultivation are currently unsatisfactory; the effects of reduced water volume or murky water can change the color of the toek to a reddish-brown. When this happens, buyers are less fond of it.

The tumung trees, which used to grow abundantly along the riverbanks and in the fields, are also starting to deplete because they are frequently cut down for toek cultivation. Consequently, the women have now begun replanting trees along the riverbanks. This shows that they care about sustainability.

Aside from food production, Mentawai women also hold a central role in processing harvests to extend shelf life and maintain household resilience. In Malancan and Sirilanggai, they process bananas, jengkol, and sweet potatoes into chips or dried treats, and process sago into flour that can be stored for a long time. Food processing is not merely a domestic chore, but a form of reproducing ecological knowledge that sustains family independence amidst market dependency.

The story of the Mentawai women reveals a face of resilience born from daily experiences balancing climate change, the market economy, and local knowledge against the tides of modernization. When erratic rain and drought alter planting cycles, when sago—the heart of traditional food—begins to vanish, and government-made rice fields fail to yield results, women remain at the front lines keeping life in balance. They replant bananas, taro, and sweet potatoes on lands that can still be cultivated; manage water during dry seasons; and process garden yields into dried food so their families can still eat during hard times. In a situation where dependency on money and rice is increasingly high, women do not just survive; they adapt creatively—cultivating toek as a new protein source, selling processed products like banana chips and sago flour, and reviving the practice of gotong royong in food management.

This transformation reveals a shift from a nature-based subsistence economy to a market economy that demands calculation and cash. Yet, amidst that pressure, Mentawai women strive to preserve the core values of the economy of life—planting to eat, working for balance, and sharing for sustainability. They serve as a bridge between two worlds: the market that demands efficiency, and nature that teaches harmony. In this struggle, the resilience of Mentawai women is evident not only in their ability to endure, but also in their efforts to create new spaces for knowledge, solidarity, and food independence amidst an ever-changing ecological crisis.

Recreating Tradition: Safeguarding Customary Heritage at the Crossroads of Modernity and Identity Crisis

The culinary and cultural journey of the indigenous Mentawai people illustrates how ecological shifts, economic changes, and state policies intertwine to reshape the social order. From sago to rice, a profound shift occurred not just in consumption patterns, but in how the community understands the relationship between nature, labor, and life. The transition from sago to rice did not just alter diets; it overhauled the socio-ecological structure. In the past, stigma against sago was propagated by various institutions to push the community toward rice consumption. Residents recall past times when schoolteachers would scold students who couldn't answer questions, frequently linking foolishness to the habit of eating sago: "If you want to be smart, don't eat sago, eat rice."

This demeaning narrative surrounding sago was confirmed by Mr. KS. He often heard claims that sago and tubers consumed by the Mentawai people were animal feed, not human food, which is why it supposedly didn't make people smart or healthy. "But the reality today is that many people are being told by doctors to consume sago and tubers to avoid diabetes," Mr. KS added in comparison.

Some informants attribute the shift away from local sago consumption to the role of the government and schoolteachers. However, other informants hold different views regarding the causes of this shift, citing factors like increased family prosperity, food compatibility/completeness, and rising school participation rates among Mentawai children.

Mr. SJ, met in Terekan Ulu, mentioned that he and his family still consume sago, but only if there is fish as a side dish. "Sago tastes best when eaten with fish; if there is no fish, we eat rice, because rice can be eaten with any kind of side dish."

A different perspective was shared by Mr. J, who noted that the shift in sago consumption patterns occurred during the agarwood booming era. "During the agarwood boom, many families made quite a lot of money, which drove them to try new things, like building brick-walled houses and consuming rice," he said.

Another opinion was voiced by Mrs. M, who observed that the large number of children attending school in the sub-district center drove the change in consumption patterns. "Many of our children go to school in the sub-district center because there are no secondary schools in the village. Usually, we provide the children with rice while they are at the dormitory or staying with relatives. That's why every family with schooling children must have a stock of rice at home, because it has to be sent to the kids every week. We could give them sago as provisions, but they are usually embarrassed to bring it, and it's hard for children to process," she added.

As the community shifted to rice that must be purchased, dependency on the market and cash increased. At the same time, national food programs and paddy field projects reinforced this orientation by ignoring the damp, swamp-dominated ecology of the Mentawai islands. The dilemma between following the government's modern ways or returning to traditional practices illustrates the ambivalent

position of indigenous peoples: caught between a modernity that promises prosperity and progress, and a tradition that guarantees authenticity and sustainability.

It is at this exact juncture that Mentawai women display extraordinary adaptive capacity. When sago lands are damaged and rice harvests fail, they pivot to crops that are more resilient to weather changes—bananas, taro, betel nuts, and sweet potatoes—without chemical fertilizers and irrigation. Women's local knowledge about rainfall patterns, soil moisture, and seasonal signs forms the foundation of a new agricultural system that is more resilient to extreme climate conditions. They plant not just to eat, but to maintain family food security amidst market and environmental uncertainties. Women also innovate with protein sources, replacing forest resources lost to deforestation. Through toek cultivation, they create a sustainable micro-economy based on aquatic ecosystems. This activity not only supports family nutrition but also generates income, showcasing a form of economic resilience born from ecological creativity. Through these efforts, Mentawai women do not just adapt to change, but actively renegotiate the relationship between the market, nature, and custom.

Social changes, religious interventions, and state policies have placed Mentawai traditions at a crossroads. Some traditions still survive in remote, far-flung hamlets, some vanish with the passing of the elders, while others transform into new forms that adapt to the times.

The most threatened tradition is Arat Sabulungan—the indigenous Mentawai belief system centered on a harmonious relationship between humans, spirits, and nature. In this belief, every living creature possesses a soul (*ketsat*), and every action taken against nature must be balanced with spiritual reverence. “In the past, before cutting down a tree, we would offer sacrifices,” recalled Mrs. AM, an elderly woman from Sigapokna. “Now, no one does that anymore. The children say it's heretical work.”

The arrival of Christianity and Catholicism in the 1950s and 1960s, alongside the state's policy of “ordering beliefs” during the New Order era, caused many local spiritual practices to vanish or go underground. Many *sikerei* stopped performing healing rituals out of fear of being branded infidels. “When the missionaries arrived, they told us to burn the *uma* houses and replace them with crosses,” told Mr. GO. “They said the spirits in the *uma* were evil. But to us, that was the dwelling place of our ancestral spirits.”

The body tattooing tradition, *titi*, is also on the brink of extinction. Formerly, every tattoo stroke symbolized a person's identity and life journey. But since the 1990s, many young people have viewed tattoos as a symbol of the “old ways.” “Young people today are afraid of being laughed at or having difficulty finding jobs if they wear traditional tattoos,” said Mrs. KZ. “Yet that used to be a badge of pride.”

A slightly different view was offered by the younger generation, who rationalize the choice of whether or not to get tattooed. RA, an indigenous youth, said, “Young people today are more focused on prioritizing social acceptance and economic opportunities rather than preserving their own culture.”

The extinction of tradition is caused not only by external pressures but also because the younger generation is losing spaces to learn. The *uma*—which used to be the center for passing down customary values and knowledge—is now rarely inhabited. Many families live in individual houses provided by government resettlement programs. “Children don't know the stories of their ancestors because there is no longer a place to gather at night,” said Mr. M. “The *uma* is mostly empty now.”

Despite many traditions being abandoned, some endure—particularly in areas far from road access and cellular signals. In Sirilanggai and Sibeutocun, a few families still maintain the *uma* and perform small rituals to maintain balance with nature. “We still perform the *punen* ritual when we want to clear a

field,” said Mr. JT. “It’s not grand like it used to be, but chickens are still slaughtered, and prayers are read.”

The punen ritual serves as a subtle form of resistance against cultural homogenization. It preserves the idea that humans cannot separate themselves from nature. In this ritual, the community calls upon the guardian spirits of the forest to ask for permission before cutting or planting. “Otherwise, the field yields won’t be good,” said Mrs. SA. “We believe the spirits can get angry if they are not respected.”

The younger generation also agrees that punen remains relevant and aligns with the spirit of the times, even if it needs slight adjustments to accommodate monotheistic faiths. “When so much forest exploitation has occurred, which has begun to disrupt the balance of nature, punen is necessary, and we still organize it,” said MS, an indigenous youth whose father is a rimata (uma guardian), and who recently graduated with a degree in government affairs in Padang.

Furthermore, the system of gotong royong remains the foundation of social life. Amidst economic changes and modernization, mutual cooperation remains strong, especially among women. “If someone is sick, everyone comes to help,” said Mrs. MTO. “We don’t have much money, but we have time and energy.”

Funeral ceremonies also serve as a space where customary values are preserved. In the pulu ceremony, the extended family gathers to honor the deceased. Traditional gajeuma (drums) music is still played, and traditional foods are served. “That’s when we feel we are still Mentawai people,” said Mr. M. “Now, that’s the only place where we can see everyone gather.” The practice of sadat remains a common foundation for maintaining social bonds, showcasing the transformation of custom into another form.

Meanwhile, the younger generation of Mentawai is beginning to create new cultural expressions that differ from their parents’. Music, social media, and technology have become new outlets to express identity. “Children nowadays like making videos on TikTok,” said Mr. MK with a smile. “Sometimes they mix Mentawai songs with modern music.”

Some youths in Malancan and Pokai have started creating digital content about the forest, traditions, and local food. “We want people to know that Mentawai isn’t just about beaches and tourism,” said Y, a 22-year-old youth who actively makes short videos about sago gardens. “We also have a cool culture.” This new culture creatively reshapes narratives—stories about custom retold through new media. “In the past, stories were told through songs and tattoos,” said Mr. JT. “Now it’s through cellphones.”

While not everything is favored by the older generation, the emergence of these new expressions indicates a process of cultural adaptation. Culture shifts into new forms. In some places, youth have even begun blending traditional dances with modern performances during school events. “We perform wearing traditional attire but the music is remixed,” said SA, a junior high school student from Sirilanggai who is continuing her high school education in Padang. “So that outsiders also get interested.” This showcases a “rearticulation of custom”—an effort to voice tradition in a modern guise. It functions as a space to affirm identity amidst the current of global cultural homogenization.

Social media has also become a tool for villagers to conduct economic transactions. Toek is usually marketed by women through social media, including WhatsApp, catering to fellow villagers as well as serving orders from buyers in the regency capital, Tua Pejat. Social media is also utilized by a group of young women who have formed solidarity networks to reject logging permits and sand mining that threaten toek cultivation. They produce short videos detailing the condition of their rivers and ancestral forests, then upload them to social media to rally public support. Viral videos aimed at gaining government attention and public support have driven women to execute new advocacy strategies to

protect natural resources. Digital activism has become a new ritual—prayers are no longer just chanted in the *uma*, but also in the virtual realm.

Although many in the younger generation rarely witness traditional and cultural practices firsthand, several youths pursuing higher education in Padang still maintain a strong concern for forest protection and the culture of the Mentawai indigenous community. Transcending the geographical boundaries of Mentawai customary territories, the Mentawai youth diaspora is also actively advocating for policies affecting indigenous communities, both offline and online. MS, the Chairman of the West Sumatra Mentawai Student Forum, aggressively voices the concerns of the younger generation regarding the rampant issuance of forestry permits and corporate expansions that threaten the survival of the Mentawai indigenous community, particularly on Sipora Island. He emphasizes that the Mentawai indigenous people cannot be separated from the forest, which to them is not merely a natural resource, but a home, a source of life, and a vital piece of their identity and spirituality.

The Mentawai people now live in a hybrid state—the result of negotiations between old customs, religion, and modernity. As Arat Sabulungan is pushed aside by official religions and state policies, the community does not completely abandon it, but rather alters its form. Grand rituals become simple prayers, tattoos as identity symbols are not etched onto bodies but broadcasted digitally, and the quiet *uma* is replaced by bustling online spaces where youth share stories of custom. Women and youth play a pivotal role in this transformation. They bridge the spiritual and digital worlds, preserve the value of *gotong royong*, and practice ecological solidarity through new means: marketing *toek* via social media, documenting the forest, and voicing opposition to mining in digital campaigns. The hybrid culture of Mentawai demonstrates that custom is changing its face. In the hands of indigenous women and youth, ancestral heritage and custom do not die out—they change form, switch mediums, and find a new lease on life.

3.2 The Talang Mamak Indigenous Community

The journey to Simarintihan Hamlet is a journey back in time. From the center of Suo-Suo Village, the distance is about 57 kilometers, passing through a dirt road that turns into mud puddles during the rainy season and is filled with thick dust during the dry season. To the right and left of the road stand rows of acacia (*Acacia mangium*), eucalyptus (*Eucalyptus* sp.), and oil palm (*Elaeis guineensis*) trees belonging to corporations. Amidst these corporate tree plantations, there are still small remnants of primary forest where the Talang Mamak Indigenous Community (Komunitas Adat Talang Mamak - KATM) depends for their livelihood. KATM is referred to by the surrounding community as the Suku Tuha (Old Tribe), meaning the first people to arrive and open up territory in Indragiri Hulu and its surrounding areas. Geographically, most of the Talang Mamak people live in the Indragiri Hulu region, but a small portion chose to cross over into Jambi, specifically in Tebo Regency.

This study describes the multi-generational experiences of KATM regarding traditions, culture, and the climate change experienced in daily life. This description begins with the starting point of the origin of Simarintihan Hamlet. An older generation informant, B (aged 75–80 years), recounted that the migration process occurred long before Indonesia's independence, and they remain bound by customary ties with the community in Datai. B explained that most of the Talang Mamak people in Simarintihan Hamlet originated from Tuo Datai Hamlet located in Indragiri Hulu. He said, "I was still a child when I was brought by my parents to Simarintihan. Occasionally, I also visit Datai to meet with family." The connection between KATM in Simarintihan and KATM in Datai still exists, particularly regarding the practice of customary activities.

K, a 30-year-old young leader born in Simarintihan, corroborated the migration history from B. K heard from his father that the community moved to Simarintihan to find new land for gardening and farming. Initially, they settled around the Menggatal River, but as land began to narrow around the 1990s, they relocated to the vicinity of the Pao-Pao River. Not long after, the Ministry of Social Affairs offered the construction of permanent settlements around the Kemumu River, which has remained their place of residence to this day.

The KATM settlement at the Kemumu River is divided into two areas: the downstream area and the upstream area. The downstream area is dominated by houses built by the Ministry of Social Affairs, while in the upstream area, traditional wooden stilt houses still survive as markers of their old identity. Aside from physical features, another distinguishing characteristic is belief. The downstream area is inhabited by KATM residents who have embraced religions recognized by the government, whereas the upstream area still adheres to ancestral beliefs. Although they adhere to different beliefs and religions, KATM still practices customs and traditions originating from their ancestral teachings.

F, a community figure who also sits on the Village Customary Institution of Suo-Suo, reminisced about the time when Simarintihan still held the status of an independent village. "In the past, the village head was a patih," he said, "someone who was also the highest traditional leader of KATM." However, around the 1990s, the government demoted Simarintihan's status to a hamlet because its population was deemed not to meet the requirements. Simarintihan Hamlet subsequently became part of the territory of Suo-Suo Village.

This administrative change marked the loss of KATM's control over their land and living space. In the past, territorial boundaries were regulated by rivers, large boulders, and sacred forests. The socio-ecological adaptation strategy realized through migration was not only to meet land needs but also to preserve customary practices, intergenerational relations, and natural resource management. Relocation is a KATM strategy regarding land access that affects their well-being and sustainability. Through administrative policies, the government redrew maps with lines and coordinates to determine territorial boundaries. Ecological space transformed into administrative space: the "living forest of KATM" became "state forest."

Forest: From a Source of Life to a Root of Conflict and Disaster

Several years later, forestry companies began to enter, carrying "state permits"—first PT Dalek Hutani Esa (DHE), which was later replaced by PT Alam Bukit Tigapuluh (ABT). Although Simarintihan Hamlet is administratively part of the territory of Suo-Suo Village, its area is included within the concession area managed by PT Alam Bukit Tigapuluh (ABT). The research team had to obtain permission from PT ABT and pass through a guard checkpoint before entering Simarintihan Hamlet.

Since then, conflicts between KATM and PT DHE began to unfold. Residents witnessed the indiscriminate clearing of forests. F recounted that trees of vital importance to KATM, such as the Sialang tree used by bees to build hives, were cut down one by one. In addition, plants serving as sources of traditional medicine for KATM were completely slashed. Aside from conflicting with the company, KATM also faced outsiders known as illegal loggers who encroached upon their forests. Besides competing with KATM in gathering non-timber forest products, they also cut down trees prohibited by KATM. "Because these illegal loggers lack the climbing skills to harvest honey, they often just cut down the trees directly," said K. "As a result, our forest honey yield has decreased because the trees where the bees nest are reduced."

After PT DHE's concession period ended, a temporary vacancy occurred in the management of the concession land. This condition was subsequently exploited by forest encroachers. The government

then granted concession rights to PT ABT in 2015. PT ABT is known as a company with a vision to restore the buffer ecosystem in the Bukit Tigapuluh National Park area. The concession area owned by PT ABT was formerly the operation area of PT Dalek Hutani Esa (DHE). Under the promise of "ecosystem restoration," KATM witnessed the willful neglect of forest clearing by encroachers who had backing from security apparatuses. KATM's conflict with PT ABT shifted from forest clearing to forest fires.

In a meeting, T, a field manager from PT ABT, recounted to the research team that they frequently received calls from the Regional Disaster Management Agency (BPBD) and the police whenever hotspots appeared. "They have satellite detection tools," he said. "As soon as there is a hotspot, we are asked to check its coordinates. But when we arrived, nobody was there." When this statement was conveyed to F, he calmly replied, "It's not that nobody was there. They ran away because they were afraid of being arrested." For indigenous peoples, the presence of security forces amid the smoke is not a sign of help, but a threat. The experience of being accused of arson without evidence makes them choose to hide.

When land fires occurred, the Talang Mamak people often became the scapegoats. "Indeed we burn, but not carelessly," F explained. "Our land is small, less than one hectare, and we guard the fire so it doesn't spread." However, the accusations kept coming. "If the company starts a fire, no one gets arrested. They have backers. We are the ones accused." He let out a long sigh and added, "Once, due to government bans, we couldn't plant crops, and many suffered from food shortages. If a Talang Mamak person dies, nobody cares. But if an elephant dies, the whole world makes a fuss." His words reflected a bitter sentiment over the ecological and social inequalities they experience.

The clearing of large trees in the forest and their replacement with industrial crop expansion brought about ecological changes. The forest, which served as a natural climate regulator, turned into a closed zone of production and conservation. In the past, the forest functioned as a natural climate regulator: it retained rainwater, maintained soil moisture, cooled the air, and served as a home for thousands of species. Meanwhile, the fast-growing plants brought by companies do not possess ecological functions equivalent to those of natural forest trees. The loss of large vegetation also altered the local microclimate.

The destruction of the forest ecosystem also multiplied natural disasters. When the researchers arrived in Simarintihan Hamlet, F greeted them on the porch of his wooden stilt house. While carrying his child, he recounted that a week prior, the river water suddenly overflowed and submerged the downstream area up to the roofs of the houses. "Usually floods come during the rainy season, but now it's not the rainy season and the water has already risen. Now the seasons are unpredictable, nature seems confused."

"The rain that occurs during the dry season also affects a number of crops cultivated by KATM, such as the rubber plant (*Hevea brasiliensis*). High rainfall causes the latex production generated by rubber trees to decrease," stated Mrs. S, who is also a member of the women's farming group.

Meanwhile, K described the changes in the Kemumu River. According to his father's stories, the water of the Kemumu River used to be very clear and deep. It was so clear that one could see the stones at the bottom of the river. Now, the water of the Kemumu River is brown and filled with sand. After telling the story, K expressed his opinion, "We suspect this is caused by the destruction of the forest."

B recounted a different experience, namely the rise in temperature. When met by researchers at his farm, B said, "I usually go to the farm in the morning, not until noon. Later towards late afternoon I go

to the farm again. Even in the late afternoon like this, it is still hot, which is why I'm not wearing a shirt."

Ecosystem changes have also increased human-wildlife conflicts. Mr. B, a farmer, noted that in the past, elephants would come to the gardens only once every three or four years—and even that was considered a rare natural omen. But now, following the clearing of the forest by companies, the presence of elephants (*Elephas maximus sumatrensis*) has become almost routine. "Now elephants come almost every month," he said.

The stories and multi-generational experiences of the Talang Mamak Indigenous Community illustrate that local climate change is rooted in spatial and governance changes that ignore ecological balance. Forest clearing subsequently replaced by industrial crops as part of conservation has transformed the function of the forest from a natural climate regulator into a fragile production space. As a result, temperatures have risen, rainfall patterns have been disrupted, and wildlife has lost its habitat. Territorial management and governance efforts that were initially aimed at protecting the environment have instead spawned a local climate crisis—where floods, droughts, and seasonal uncertainty have become a part of daily life.

When Nature Becomes a Market: The Climate Crisis and the Shifting Meaning of Life

The local climate crisis has a significant impact on KATM's life in agriculture. The destruction of the forest ecosystem has impacted KATM's life, especially in farming. KATM manages land with strict rules. Pak B explained that in KATM there are two types of land utilization: opening fields (*ladang*) and secondary gardens (*rimpahan*). The difference lies in the types of crops planted and the planting locations. Rice plants may only be planted in fields, not in secondary gardens. Secondly, regarding location, fields are usually located far from houses, while secondary gardens are usually close to houses. Usually, before opening a field or secondary garden, KATM will ask permission from the rulers of the forest.

F recounted, "Before clearing the bushes, we place three stones on the land to be cleared. If within three days the stones move, it means the ancestors do not permit it. But if they stay in place, then the land may be cleared." After that, they farm for one year, then move to the next location so the old land can rest. This pattern is called connected fields (*ladang sambung*), and after seven years, they will return to the original land.

In addition, the tradition of land clearing is also carried out by paying attention to the land clearing on the immediate left and right of the area to be opened. The benchmark is always the land clearing on the right side. If the land on the right side is not cleared, then the land on the left side must not be cleared. When asked about this rule, no one could explain it. With narrowing land, if the right side cannot be cleared, residents owning land on the left will not be able to plant. This means the family is threatened with a lack of sufficient food.

B recounted changes in land clearing. "In the past, to cut down a tree this big, it took one or two hours with a machete," he reminisced. Pak B still remembers how all the residents of Simarintihan Hamlet would work together cooperatively (*gotong royong*) to clear land. There was no wages, only shared work and mutual assistance. Now, chainsaws are used to replace axes. And with a cooperative effort involving 30 to 40 people, one hectare of land is finished in a single day. However, cooperative work now incurs costs: gasoline, oil, and food for the workers. "A single land clearing can cost two to three million," he stated. Behind the use of technology for faster land clearing lies a sign of change: from work grounded in togetherness to work dependent on tools and money.

Unpredictable weather changes have now become a major challenge for the Talang Mamak community. K said, "Too much rain makes rubber production drop and forest honey decrease because bees have a hard time finding flowers." Meanwhile, B added that "crops are now more frequently attacked by pests such as brown planthoppers (Nilaparvata lugens), grasshoppers (Caelifera), and leaf-rolling caterpillars (kerunsung)." Even so, K wisely observed: "Caterpillars are living creatures too; they're just looking for food," he said softly. Reduced yields force residents to work harder to meet daily needs.

M, a friend of B, explained that they actually possess ancient knowledge to read natural signs and determine work times. During a full moon, for instance, residents are forbidden to go to the fields except to drive away elephants, and if it rains at night, the next day they do not go to the fields because it is considered a dangerous time. However, such rules and knowledge are now starting to be forgotten by the younger generation. Weather changes not only disrupt crop yields but also slowly erode the community's traditional ways of understanding and maintaining balance with nature.

Besides ancient knowledge about the weather, KATM also still preserves knowledge about seeds. K, a female farmer, added that they still use ancestral rice seeds, although sometimes mixed with seeds from outside. "Grandmother's rice must still exist," she said. Women are tasked with sowing, planting, and tending crops—rice (*Oryza sativa*), cassava (*Manihot esculenta*), chili peppers (*Capsicum*), bananas (*Musa paradisiaca*), to sweet potatoes (*Ipomoea batatas*)—all growing without fertilizers or pesticides. In the past, they could estimate when the harvest would happen and how much the yield would be. But now yields are often erratic: soil dries out quickly, pests arrive in greater numbers, and river water flows too swiftly during prolonged rains.

The Talang Mamak women members of the Floren Simarintihan Women's Farming Group (Kelompok Wanita Tani - KWT) have their own way of understanding weather changes. They record important times in the planting cycle to adapt to an increasingly unpredictable climate. S, a group member, recounted that during 2023–2024, they cleared land in June, burned in July, and started planting in August. "From that pattern, rice managed to grow, but corn (*Zea mays*) and cucumbers (*Cucumis sativus*) failed," she said. She still remembers the difficult times in 2020, when rain poured continuously so the fields could not be burned and all crops failed to grow. "2015 failed too, that was when the forest burned extensively," she added.

The climate crisis not only shakes up field yields but also disrupts the daily lives of the Talang Mamak community in meeting basic needs such as water. Their fields depend entirely on rain, while drinking water is drawn from the Kemumu River. When the dry season arrives, the river becomes shallow and is frequently contaminated by the feces of passing elephants. "During the dry season, children often get diarrhea," said T, a traditional midwife. Women shoulder greater responsibilities—every morning and afternoon they walk carrying ten-liter jerry cans to fetch water from sources that are no longer always clean. Ti, M's mother, reminisced about the long dry spell before 2001: "The river dried up, we walked an hour upstream just to get water."

The water crisis is also accompanied by changes in non-field food sources. H recounted that during the 2020 pandemic, many wild boars (*Sus scrofa*) died in the forest and rivers, "we saw their mouths foaming, probably poisoned," she said. Now, game is increasingly scarce, and rivers are no longer safe places to catch fish for long periods. At home, they raise chickens (*Gallus gallus domesticus*), but rarely eat them. "These chickens are like family now," said F.

The stories above illustrate the resilience of women amidst weather changes that alter their lifestyles and livelihoods. When erratic rain reduces rubber, honey, and rice yields, and river water becomes increasingly scarce and polluted, women remain at the front lines maintaining life's balance: they plant,

record the weather, schedule planting times, and ensure families still have water and food. Talang Mamak women show resilience not only in surviving but also in adapting creatively—turning crises into learning spaces, and sustaining life amidst a nature that can no longer be predicted.

Weather changes also impact family financial management. In the past, the life of the Talang Mamak community in Simarintihan was almost entirely moneyless. Field and garden yields were enough for daily meals. "We had our own rice, for vegetables we just picked cassava shoots, if we wanted cassava we just dug it up in the garden, for fruits we just looked in the forest," B recounted with a smile. Their lives were simple, but sufficient, because nature provided almost all necessities. Now, that story is beginning to change. H, a resident in downstream Simarintihan, admitted to having to economize because the rice yield from the fields has decreased. "In the past we could eat rice three times a day, now in the morning we eat cassava first, then at noon and night we eat rice," she said.

This change feels heavier for large families like M's, who now live outside the hamlet. With eight to nine family members, they must spend around one hundred thousand rupiahs per day just for rice, anchovies (*Engraulidae*), tempeh, and cooking oil. Food prices are high because there is only one shop around them. On the other hand, upland rice (*Oryza sativa*) takes six months to harvest, and the yield is not sold, reserved solely for family consumption. When harvests fall short, they seek additions from the forest—dragon's blood resin (*Daemonorops draco*), forest honey, rattan (*Calamus*), jengkol (*Archidendron pauciflorum*), and wild fruits—or from new gardens such as rubber (*Hevea brasiliensis*) and coffee (*Coffea arabica*) originating from corporate CSR programs.

The kitchen needs and dietary patterns of the Talang Mamak community reflect a broader shift: from nature-based food self-sufficiency to dependence on markets and weather. In the past, food was the result of labor, time, and nature; now, food also depends on money, rain, and distance. The transition from a subsistence economy to a market economy forces Talang Mamak women to adapt quickly. In the past, they lived off field and forest yields without depending on money, but now they must manage family finances because many necessities must be bought.

New economic demands drive new forms of KATM adaptation. KATM's participation through PT ABT's programs shows how the market economy is becoming increasingly rooted in their lives, replacing the subsistence system that once relied on forests and fields. The distribution of rubber and coffee seeds from CSR programs, for example, has shifted community orientation from planting to eat to planting to sell. If previously the harvests of rice, cassava (*Manihot esculenta*), or forest honey were sufficient to meet family needs, now the community has begun to consider the exchange value of garden yields in the market. Income from rubber sap or coffee beans has become a new way to meet daily needs like rice, oil, or children's school supplies—things that used to not be a priority because everything could be obtained from nature.

This change reveals ambivalence: the market economy opens up new opportunities, but it also alters how the Talang Mamak interpret their relationship with land and forests. Forests once viewed as "a place to live" are now also viewed as "a source of income." However, amidst those changes, the community—especially women—continues to strive to maintain an economic ethos that places life, not profit, at its center. KATM women, in the process of learning to navigate two worlds at once—a market demanding efficiency and nature teaching balance—are simultaneously seeking new forms of sustainability born from their own experiences.

Traditions & Customs at a Crossroads: Threatened, Enduring, and Newly Introduced Cultures

Climate change in the Talang Mamak region is not merely a matter of extreme weather, but also about the loss of a "social season" for many customary practices. Traditions rooted in the rhythms of nature—

such as melambas (a ritual for clearing land) or the determination of planting timelines by the Dukon Padi (rice shaman)—have now lost their reference points as rainfall and drought patterns become erratic. In the past, natural signs like three distinct rain events during the dry season or shifts in wind direction served as indicators for the planting timeline; today, these signs can no longer be trusted. Consequently, the ecological knowledge passed down through generations has become irrelevant, and the position of the dukon as guardians of human-nature harmony has lost its spiritual and ecological foundation.

The climate crisis also affects the availability of raw materials for medicine and rituals. Many forest plants commonly used for healing—such as durian leaves, wild katuk, and wild forest banana blossoms—are becoming difficult to find due to temperature shifts and land fires. This prevents the traditional healing practices of Talang Mamak women from being fully executed, as nature, the very source of their knowledge, transforms alongside them. Traditions are not going extinct because they are forgotten, but because the ecosystems supporting them have become fragile.

Amidst these changes, a number of traditions endure as resilience strategies against the climate crisis. The tradition of betogak—erecting a hut in the fields—is still practiced because it provides practical and ecological protection. These stilt structures allow residents to easily monitor their gardens for pests, which now appear more frequently due to weather imbalances. This demonstrates how local cultural structures function as a form of micro-adaptation to environmental changes.

Medical traditions and maternal care provided by the Dukon Bidan (traditional midwife) also endure, albeit in a more flexible form. Women now cultivate medicinal plants themselves in their home gardens, adapting to conditions where the forest is difficult to reach or where wild plants no longer grow due to excessive rainfall. They also replace missing medicinal ingredients with new plant species that are more resilient to weather fluctuations. Through these small actions, women serve as the primary authors maintaining continuity between ancient knowledge and new ecological conditions—a tangible manifestation of resilience that does not merely endure, but actively transforms.

The climate crisis has also paved the way for a new culture rooted in market logic. As upland rice harvests decline due to unpredictable seasons, the community is shifting toward commercial commodities like rubber (*Hevea brasiliensis*) and oil palm (*Elaeis guineensis*). These crops are deemed more resilient to weather fluctuations and provide rapid economic returns. However, this shift carries a profound ambivalence: while the economy strengthens, the meaning of land shifts—from a source of life into a production asset.

The younger generation of Talang Mamak is now more familiar with the price of oil palm fruit bunches than they are with seasonal signs. They have begun to define success not by a harvest sufficient for consumption, but by cash income. On the flip side, the unstable climate leaves them even more dictated by the market system: when palm oil prices drop or harvest failures occur due to floods, they lose both their income and their identity.

The influx of technology and the digital world—ranging from mobile phones to online games—has become part of a new culture reflecting global interconnectedness. However, it also weakens the younger generation's bond with nature. Today, nature is no longer a classroom, but merely a background for the digital world they consume daily. For women, this challenge demands a restructuring of their roles: shifting from guardians of environmental knowledge to mediators between two worlds—the fading world of tradition and the modern world that demands new adaptations.

Climate change in Talang Mamak does not only alter the weather, but also the order of life and culture. Traditions that once followed the rhythms of nature have now lost their footing because nature itself

has lost its rhythm. Yet, amidst this uncertainty, women stand at the center of resilience—maintaining the continuity between the past and the future, weaving old knowledge with new practices.

The resilience of Talang Mamak women manifests not only in their efforts to preserve traditions, but also in their capacity to re-read a changing world: replacing crop varieties, cultivating new medicines, recording seasons, or adjusting rituals. Nevertheless, they must also confront the ambivalence of a market economy that offers opportunities while simultaneously unsettling long-held values.

It is here that the new face of Talang Mamak culture is being forged—living between climate change and a market economy, where women serve as the bridge between a fracturing earth and a constantly moving future. They do not merely survive; they seek new ways to live, to plant, and to sustain life in the midst of a world that can no longer be predicted.

The Role of Women & Gender Construction Since Birth (Resilience, Spaces for Negotiation, and Adaptive Leadership of Women)

In the KATM community, gender construction is determined from birth. According to Dukon Bidan T, a newborn's biological sex is identified through traditional symbols—a parang (machete) for boys and aajak (hoe/weeding tool) for girls—following the delivery process. The parang is typically used by KATM to fell trees, whereas the ajak is used to clear grass or other invasive weeds in the fields. This practice is rooted in the belief that the guardian spirits of the forest can endanger infant boys, as men will eventually clear the forest. From this stems the division of roles: men are tasked with clearing and burning land, while women are responsible for planting, tending, and harvesting crops.

Although the position of women is structurally limited within formal customary institutions—where the majority of customary functionaries are dominated by men—women still maintain a strategic space through the role of the Dukon, such as the Dukon Bidan (traditional midwife), Dukon Padi (rice shaman), and Dukon Kemantan (shaman/healer). This knowledge is passed down from one generation to the next. T recounted how she involves her daughter in the birthing process so that the younger generation understands customary rituals alongside practical skills related to health and agriculture.

The resilience of KATM women is vividly apparent in agricultural activities and resource management. Women dominate activities that demand meticulous care, such as *menugal* (making holes in the soil for seeds), *memerun* (clearing small debris after burning), planting, and harvesting. They adjust planting patterns to match the erratic weather conditions caused by climate change, selecting crop varieties that are resilient to drought or high rainfall. By mastering these agricultural processes, women wield vital socio-ecological influence, because the success of the fields determines the food security of the family and the community. This also opens up a space to negotiate customary rules regarding the division of labor in the fields.

Beyond agriculture, women are actively engaged in gathering non-timber forest products, such as *jengköl*, *longan*, *durian*, and tapping rubber. They manage these yields for both household consumption and commercial sale, thereby holding a strategic role in family economic resilience. Poor and hazardous market access routes—frequently traversed by herds of Sumatran elephants (*Elephas maximus sumatrensis*) or Sumatran tigers (*Panthera tigris sumatrae*)—limit the role of men in selling certain forest products, presenting women with opportunities to influence economic decisions at the household and community levels.

Women also play a vital role in customary rituals, such as *betogak*, where they hold and erect the main pillar of the field hut. This symbolic practice affirms women's responsibility over both the household

and the fields, granting social legitimacy and a position in local decision-making, even though formal institutional structures remain male-dominated.

In the realm of education, shifts have occurred that signal an increasing community awareness toward providing equal opportunities for boys and girls. However, access remains constrained; formal schooling in the village only goes up to the elementary level, forcing many women to stop their education or marry young. While these conditions limit women's opportunities to acquire new knowledge, they continue to develop local skills and adaptive strategies to cope with social and ecological challenges.

In social life, women also serve as mediators in gender interactions, upholding strict customary rules and mitigating potential conflicts. For instance, men are forbidden from meeting a woman alone, they cannot use the same eating utensils, and marriage laws are highly stringent. Women's positions as managers of fields, forest products, and as dukon afford them the legitimacy to negotiate and adjust several customary practices, rendering certain rules more adaptive to community needs and environmental changes.

Researchers' observations of the KATM community indicate that indigenous women, despite their formally limited positions within customary institutions, are capable of creating strategic spaces for negotiation through various socio-ecological practices. The management of fields, the gathering of forest products, and their roles as dukon do not only maintain food and economic security, but also expand women's influence in community decision-making.

This space for negotiation emerges from legitimacy based on expertise and tangible contributions: women's success in ensuring food production amidst climate change, preserving the forest, and transmitting traditional knowledge makes their decisions difficult to disregard. In this context, women do not merely conform to existing customary rules; they adaptively intervene in customary practices, negotiating changes that enable the community to endure under ecological and social pressures.

This reflection underscores that women's resilience is the core source of the community's adaptive capacity. By leveraging their positions in domestic, economic, and ritual spheres, women build an influence that reinforces their role in collective leadership regarding climate change mitigation and adaptation. This strategy demonstrates that leaders of change within indigenous communities do not always hail from formal positions, but rather from the ability to create spaces for negotiation that merge traditional knowledge, practical skills, and social leadership.

Consequently, the KATM case provides a critical illustration of the importance of viewing women as agents of eco-cultural change capable of driving adaptive responses to climate change, while simultaneously renegotiating customary practices to be more responsive to environmental challenges. The spaces for negotiation they create do not only strengthen the position of women, but also enhance the overall capacity of the community to endure and transform when facing ecological and social dynamics.

3.3 The Bara and Cindakko Indigenous Communities

The Bara, Cindakko, Baru, and Tanete Bulu Indigenous Communities are collectively known as the Toddo Appaka Ri Bulu (the four customary mandates or four brother kingdoms in the mountains). These four indigenous communities share similarities in terms of tradition, culture, and customary institutions, and they are located within the Tompobulu District territory, Maros Regency. The Bara & Cindakko Indigenous Communities (Komunitas Adat Bara & Cindakko or KABC) reside within the Bara & Cindakko Hamlets, which are administratively under the jurisdiction of Bonto Somba Village.

Bonto Somba Village consists of three hamlets: Bonto-Bonto, Bara, and Cindakko Hamlets. In the Makassar language, Bonto translates to high, while Somba means role model or king. Thus, Bonto Somba can be interpreted as the Highest King who serves as the community's role model.

Generally, KABC residents rely on farming and livestock rearing for their livelihoods. Their rice fields are rain-fed lands that are alternately planted with rice and corn. Additionally, residents manage gardens cultivated with crops such as cocoa (*Theobroma cacao*), coffee (*Coffea canephora*), cassava (*Manihot esculenta*), bananas (*Musa paradisiaca*), sugar palm (*Arenga pinnata*), peanuts (*Arachis hypogaea*), and various fruits. The primary types of livestock are chickens and cattle, which are free-grazed without enclosures.

This study was conducted within the Kacoci region. The rationale was that a rice harvest was underway at the time, enabling researchers to directly observe the community's tradition of mutual cooperation (*gotong royong*). The journey to Kacoci was arduous. The roads traversed were mostly steep, rocky dirt paths, and the journey required crossing a 15–20 meter wide river via a rudimentary bamboo bridge that frequently washes away during the rainy season. The travel time to reach Kacoci from Baru Hamlet takes about 3 hours by a combination of two-wheeled motorcycle and walking. Meanwhile, the travel time from Baru Hamlet to Bara Hamlet is approximately 1 hour using a two-wheeled motorcycle.

Kacoci stands as the most marginalized area in terms of development compared to other regions within Cindakko Hamlet. The Kacoci region still relies on solar power plants for electricity, which only operate at night, and residents face severe difficulties accessing basic education and health services. Kacoci also lacks any telecommunication network grid. To communicate via the internet, community members must spend funds to purchase time-bound vouchers (data packages). Even then, the internet connection frequently experiences disruptions, leaving the community cut off from the outside world more often than not.

Farming on Restricted Land

A portion of the Bara & Cindakko Hamlet territories lies within or directly borders the Bantimurung Bulusaraung National Park (Taman Nasional Bantimurung Bulusaraung or TN Babul). The establishment process of TN Babul began with pressure from UNESCO in 1993, urging the Indonesian government to protect the Maros–Pangkep karst landscape. Following extensive assessments and the consolidation of five pre-existing conservation zones established between 1970 and 1980—Bantimurung, the Pattunuang Cave, the Bantimurung Nature Reserve, the Kareanta Nature Reserve, and the Bulusaraung Nature Reserve—the government officially designated TN Babul through the Decree of the Minister of Forestry No. 398/Menhut-II/2004, spanning an area of 31,843 hectares. The Babul National Park comprises 21,343.10 hectares of protection forest, 145 hectares of limited production forest, and 10,355 hectares of permanent production forest. TN Babul was subsequently designated as an ASEAN Heritage Park on October 25, 2019. For the community, this decision fundamentally transformed the forest from a feature of daily life into a heavily guarded zone.

Mr. DA, a Gallarrang (customary leader) in the Baru Indigenous Community, recalled the era before the national park boundaries were legally drawn: “Jari punna erokki katte pare' balla, kayu lani pakea nialle battu ri romang adat ka, mingka anjo kayua tena kulle ni balukang. Jari ri kammayya anne susah maki ngalle kayu karna mallaki ri petugas TN Babul. Mingka manna na ni pisang kai tatta'ji ngalle kayu, ka tena lana pangngallei kayu maraeng. Ni issengji kana ni larangi mingka kima'e maki langngalle maraeng, sedang kang masyarakatka ta'tambahi turusi.”

(Translation: “In the past, if we wanted to build a house, the wood would be harvested from areas strictly designated by custom. Wood harvested under this rule was forbidden from being

commercialized. However, that customary law eventually collided with a harsher state regulation. TN Babul officers forbid residents from taking timber from the forest zone, even for personal subsistence. Now, we can no longer harvest wood freely because the officers forbid it. Despite this, residents still desperately take wood out of sheer necessity, even though they are chased by the national park rangers.”)

The establishment of the TN Babul zone naturally marked the beginning of disputes between the National Park authorities and the community. The government drew boundaries based on ecosystem protection and the structural integrity of the karst landscape. Conversely, the community possesses its own method for defining forest boundaries, relying on natural landmarks, river systems, and historical land-use patterns passed down through generations. It is at this juncture that tensions flare between the state’s logic of conservation and the logic of sustainability rooted in indigenous knowledge.

Similar constraints apply to agricultural land. Prior to the national park’s designation, community members were free to clear land within the forest to plant rice and other crops in accordance with customary law. However, since the zone was declared a conservation area, farming activities inside the forest have been deemed illegal. S, a youth leader from KABC, shared that many residents in Bara Hamlet establish rice fields within the TN Babul forest zone. He explained the reasoning, stating, “We know this is prohibited, but we also have to survive, especially since our population continues to grow.” This conflict has persisted for a long time, and while talks have taken place to resolve the dispute, an appropriate solution remains elusive.

Based on discussions with KABC residents, the mapping of conflicts between citizens and TN Babul reveals two primary categories: zoning boundary disputes and forest resource utilization conflicts. Furthermore, the territory’s status as part of a national park disrupts infrastructure development. Local government agencies are legally prohibited from building basic infrastructure, such as schools or public service facilities, because the territory falls inside the TN Babul zone. This structural barrier was directly conveyed to the research team by representatives of the relevant local government agencies (Organisasi Perangkat Daerah) in Maros Regency.

To defuse conflicts with the community, the management of TN Babul has attempted to divert residents away from forest encroachment and land clearing by promoting pine tree cultivation and encouraging the utilization of the national park as a tourism destination. To this day, pine resin tapping activities continue to operate within the KABC region as an approved form of utilization permitted inside the TN Babul zone.

Bara and Cindakko Hamlets, which border the Bantimurung Bulusaraung National Park (TN Babul), have borne witness to sweeping transformations since the Maros–Pangkep karst landscape was designated as a national park. For indigenous communities, this decision transformed the forest from a vital living space into a territory restricted by state regulations. Customary traditions that previously governed the utilization of timber and land now clash with conservation regulations that outlaw farming activities and the harvesting of forest products. The tension between indigenous knowledge and the state’s logic of conservation persists, triggering conflicts over territorial borders and resource utilization. While resolution efforts have been introduced through pine cultivation and tourism development, the root issues concerning management rights and the community’s living space remain unresolved.

Customary Rituals and Unpredictable Weather

The primary source of livelihood for KABC is as farmers and breeders. Each household owns rice fields and gardens of varying sizes, generally under 1 hectare. The narrowing of agricultural land occurs due to two main reasons: the division of inheritance among children and the restriction of cultivation space

caused by the establishment of the Babul National Park. This is what drives residents to clear land within the national park area. The presence of the national park has not changed the forest ecology, but it has limited the community's management space. Generally, rice fields rely on rainfall. In the Kacoci and Bara Hamlet areas, there are actually many water sources, but there are no reservoirs or water storage systems that residents can use during the dry season.

The rice-planting season usually takes place in December or January. Nevertheless, KABC residents must follow customary rituals during the rice-planting process. DJ recounted that residents typically observe the rice planting carried out by the pinati, whose duty is to determine the timing for planting rice. If the pinati has not yet planted rice, other residents are not allowed to do so. When visiting Bara Hamlet, we received information that the pinati does not always reside in Bara Hamlet. DB stated that the pinati migrated to East Kalimantan to work as a laborer in palm oil plantations. He only returns to Bara Hamlet when it is time to plant rice.

In this situation, customary rituals remain an important guideline. The determination of when to plant and harvest rice continues to follow the decision of the pinati (the customary leader). Residents are not permitted to plant before the pinati plants first. However, modernity has penetrated this social order—the pinati now has to migrate to East Kalimantan as a palm oil plantation worker, and only returns when the planting season arrives. Such migration reflects changes in rural labor resulting from restrictions on cultivation spaces.

Rice fields in KABC are generally planted with rice and corn, two commodities prioritized by the central government in national food policies. Communities now use short-lived superior seeds provided by the government, replacing local seeds such as Padi Banda which they used to plant. Padi Banda has a growing period of 6 to 7 months and is known to be pest-resistant, but it is considered inefficient because its yields are lower and its growing season is long. This consideration led residents to switch to the superior rice seeds promoted by the government. When using current rice seeds, 50 kg of seeds can yield about 15 sacks or approximately 1.5 tons. Based on information from S's wife, who has kept Padi Banda seeds for about 20 years, researchers suspect that around the 2000s, a transition process took place from local rice varieties to superior rice varieties. This change reflects a shift in orientation from agriculture for household food security toward productivity and efficiency standards dictated by the market.

The use of chemical fertilizers and pesticides has become part of this new practice. The intensity of their use varies because not all residents receive fertilizers matching their land needs according to each family's economic capacity. I shared his experience that during the planting season, it is often difficult to obtain fertilizer, prices are increasingly expensive, and furthermore, their area is located at the top of a hill, requiring additional transportation costs. As a consequence, the price of fertilizer is quite high. The price of one sack of urea fertilizer is around Rp 90,000, but due to poor road infrastructure, the price of a single sack of fertilizer in both locations can reach Rp 200,000.

Aside from fertilizers, pesticides referred to as "poison" are used in almost all stages—from land preparation, planting, to harvesting. DB, a farmer in Bara Hamlet, mentioned that during land preparation, residents buy weed killer. When the rice plants are filling out, they buy pesticide for pests. "I myself spend 2 million rupiahs on poison," he stated. Without assistance from agricultural extension workers, residents mix various poisons with the belief that the mixture is more effective, even though it poses risks to health and the ecosystem.

The use of superior seeds and pesticides, which should theoretically increase yields, instead brings ecological and economic contradictions. Pest attacks have increased; researchers witnessed various

types of pests on unharvested rice plants. I pointed out several pests such as grasshoppers, brown planthoppers, and a type of mite. I said, "Pest attacks are increasing from year to year. We don't know what the cause is." Pest attacks reduce rice production. KABC typically uses the number of sacks as a benchmark to see whether annual rice production is increasing or decreasing. For example, this year's harvest compared to last year's has declined. Previously, harvests reached 19–20 sacks; now we only find about 15 sacks from a plot of less than 1 hectare.

Besides dealing with crop pests and diseases, residents also face disruptions from birds, monkeys (*Macaca fascicularis*), wild boars (*Sus scrofa*), and deer (*Cervidae*) that damage gardens. This leads residents to choose to stay in their gardens or even sleep there. DN, a Galarang (customary official) in Bara Hamlet, shared that there is actually ancestral knowledge that can be used so that newly sown seeds are not destroyed by monkeys. "When sowing plant seeds, one should turn their back on the monkeys while digging the ground to plant the seeds. Because if we face the monkeys, they will find out the location where the plant seeds are planted."

Although the agricultural system has changed, the community still holds fast to customary rules in farming. They believe that planting must follow the calculation of moon phases and auspicious days. These calculations are related to the timing when pests will appear during the planting process. "The calculation process follows the determination of the new moon within the Islamic calendar system. Months 1–5 (marked by a full moon) are usually auspicious months, whereas month 7 is usually an unfavorable month to begin agricultural activities." He continued, within every auspicious month there are also specific days permitted for planting. "The first to the fifth day (calculated from the full moon) are usually auspicious days, while the seventh day is unfavorable. Subsequently, the ninth to the eleventh days are auspicious days." If these timing guidelines are not followed, the seeds will usually be eaten by animals like rats or face the potential of crop failure.

KABC also still applies several rules regarding land clearing established by their ancestors. DJ noted that everyone is prohibited from opening agricultural land near water sources. Additionally, residents are forbidden to cut down cindrana, rita, and karotti trees, which are believed to protect water sources. Anyone violating these rules is subject to customary fines.

KABC residents do not have barns or specialized storage places for harvested rice. Generally, sun-dried grain is put into sacks and stored in their respective homes. It is no wonder that in all residents' homes, we find dozens of sacks filled with dry grain. For daily food needs, on average, each family consumes 9–10 sacks of grain per year. The remaining grain is usually sold or bartered for daily necessities. DB explained, "Sometimes when a fish vendor comes to the hamlet, we trade rice for fish. Likewise for other necessities." If there is a surplus, the grain or rice can be sold or exchanged for other needs. As DB's story illustrates, "Sometimes when a fish vendor comes to the hamlet, we trade rice for fish. Likewise for other necessities." This method shows that residents rely more on direct exchange among neighbors rather than buying and selling with money as in a market. The exchange rate is determined not by price, but by needs and mutual trust. This system keeps their economic life running through mutual assistance and sharing.

In addition to growing rice, KABC residents also depend on making palm sugar. Sugar palm trees (*Arenga pinnata*) grow abundantly around gardens and the Babul National Park area. Actually, the fruit of this tree can also be utilized for kolang-kaling (sugar palm fruit), but according to I, "If the fruit is harvested, the sap yield decreases." Therefore, residents prefer to tap the sap to make palm sugar, which commands a higher price—around Rp 17,000–18,000 per kilogram, and can even reach Rp 23,000 during Ramadan. In a day, a family can produce about 10 kg of palm sugar. The production process remains traditional, using firewood and molds made from coconut shells or dried bael fruit (maja).

Residents usually cook palm sugar almost every day for eight hours, then sell the yield to the market once the quantity is sufficient.

Besides farming, KABC residents also raise native chickens (*Gallus gallus domesticus*) and cattle (*Bos taurus*). On average, a family owns 3–4 cattle, and researchers even found residents owning a dozen cattle. Cattle are usually left to forage on their own without barns, frequently resulting in deaths due to falling down steep slopes or falling ill from poor hygiene conditions. For residents, cattle are considered a living savings account that can be sold anytime when urgent money is needed. Meanwhile, chickens are raised not for sale, but for customary ritual purposes. In a year, a single family may require up to 23 chickens. At a price of around Rp 150,000 per head, the cost for these customary rituals can reach about Rp 3.45 million per family per year.

Although severe ecological degradation has not occurred in the KABC region—since the forests around the Babul National Park area remain relatively well-preserved—climate change is felt through shifts in weather patterns. The rainy and dry seasons are no longer as predictable as they used to be. Weather changes impact palm sugar production in KABC, especially when rain falls continuously. According to I, "If it keeps raining, the palm sap that comes out decreases." Moreover, residents also face difficulties cooking sugar because firewood becomes wet. Even when using firewood, they only use fallen or small-sized wood.

Although the locations of Bara & Cindakko Hamlets are surrounded by the forests of Babul National Park, daytime temperatures are quite hot. During joint rice-harvesting activities with residents, researchers heard identical complaints from participating residents that the hot weather made them tire quickly. One resident mentioned that usually he could work until 12 noon, but by 11 AM he was already extremely exhausted. Researchers also noticed that residents rarely wore hats or head coverings when working in the fields. During a visit to Bara Hamlet, DB shared that several residents fell ill after participating in rice-harvesting activities. Symptoms included high fever and body heat. Usually, rice harvesting in KABC is carried out consecutively and involves all residents. Even after harvesting, landowners do not rest but proceed with the rice threshing (*dros*) process, which continues until near dawn. The intensity of consecutive harvesting activities has the potential to cause exhaustion among residents. However, researchers suspect the symptoms described by DB are closely related to heat stroke, which frequently occurs when exposed to sunlight for too long.

Although there are several water sources in KABC, they have experienced droughts lasting quite a long time. Water reduction inevitably affects plant productivity, especially rice plants. S shared with us that Bara Hamlet once experienced a drought, forcing residents to fetch water from more distant locations. Water-fetching tasks are performed by both men and women, but women generally do most of it. The water collection site is quite challenging as it requires climbing up and down hills to trace water sources in the upper river reaches.

The location of Kacoci, situated atop a hill, is also highly vulnerable to strong winds. Strong wind gusts not only damage rice plants but can also blow down the stilt houses characteristic of local architecture. DR, a customary stakeholder in Kacoci, recounted that around 1985, a strong wind occurred that damaged residential houses and rice crops.

When Eating Defers to Rituals

The land owned by KABC residents consists of fields/rain-fed rice paddies (*ladang*) and gardens (*kebun*). The *ladang* fields are typically used to alternately cultivate rice and corn as the primary commodities. Meanwhile, the gardens surrounding their houses are generally used to plant various types of crops such as coffee, cocoa, and fruits. However, based on observations and discussions with

residents, it was revealed that their dietary pattern is quite monotonous. Almost every day, for breakfast, lunch, and dinner, the consumed menu consists of only two types of food: rice and a legume/bean vegetable dish.

This unvaried dietary pattern inevitably impacts nutritional adequacy. DJ, one of the residents, complained that his legs frequently ache and make walking difficult; after an examination at the hospital, he was diagnosed with gout. Protein intake is usually fulfilled only during customary rituals, as residents slaughter chickens or cattle as offerings at those times. Interestingly, according to S, in their tradition, individual families do not consume the chickens they cook themselves; instead, they eat the chickens cooked by other families as a form of mutual sharing after the ritual concludes.

DB stated that the quantity of livestock required for customary rituals is quite substantial, particularly regarding chickens. The annual rice planting ritual alone requires no fewer than 23 chickens. The price of a single free-range chicken (*ayam kampung*) in the Bara & Cindakko region reaches Rp 150,000. Consequently, the monetary cost incurred can reach up to Rp 3,450,000 per family.

Nonetheless, residents occasionally consume eggs or fish sold by mobile vendors. DB noted that the price of fish sold in the KABC region is quite expensive, and the fish is generally no longer fresh. To consume just 3 to 4 fish sold by a mobile vendor, residents must spend between Rp 30,000 and Rp 40,000. Sometimes, residents also barter raw rice for fish. These mobile fish vendors do not visit the hamlet every day; in fact, their visits have become very rare now. This is likely due to the prohibitively expensive price of the fish, which results in few residents purchasing it.

Rice consumption within each family is considerably high. This aligns with the heavy physical activities performed by residents in their daily lives. I explained that, on average, a household consisting of 5 family members can consume 3 liters of rice per day. Therefore, the total volume of rice consumed in a month reaches 90 liters. DNM, a hamlet imam, corroborated the research team's observations, noting that the amount of side dishes consumed by the KABC community is small. They consume more rice due to the limited availability of side dishes and the overall socio-economic welfare conditions of the community.

Despite having consumed rice as a staple food for a long time, several customary elders encountered mentioned that in the past, KABC residents actually consumed a type of wild forest yam (*Dioscorea hispida*), locally known as *sikapa*, which grows abundantly in the forest. Wild forest yam is known to contain toxins that can cause dizziness and vomiting if not processed correctly. DJ mentioned that he still continues to consume *sikapa*. "Usually, it is only the elderly who still consume it; I have never seen young people consume *sikapa*. If they miss *sikapa*, they will forage for it in the forest." No one knows for certain the exact transition process from consuming *sikapa* to rice. Researchers suspect that the consumption of rice and *sikapa* may have coexisted as substitutes, or occurred during times of harvest failure.

Shifts in food consumption patterns among KABC residents are also evident from the emergence of small stalls and shops selling processed or instant foods. These include instant noodles, sausages, and various snacks and soft drinks. Children have become the primary consumers of these commercial instant foods.

Agricultural shifts in KABC have occurred alongside the shrinking of arable land due to the zoning restrictions of the TN Babul area. Residents are no longer free to clear new gardens as they did in the past, while increasingly unpredictable weather patterns—such as prolonged rainfall or delayed monsoons—complicate the rice planting schedule and reduce harvest yields. Under these conditions, women have taken on the role of planting various crops in backyard gardens, such as cassava, corn, and

root vegetables, as well as processing palm sugar. However, when agricultural yields fall short, some residents—including women—are forced to enter the national park zone to forage for firewood or forest food sources. This action is not merely a legal violation but rather a survival strategy amidst economic pressure and land limitations, highlighting how conservation policies frequently clash with the basic needs of the community.

Safeguarding Nature Through Customary Rituals

KABC is recognized as an indigenous community that firmly upholds ancestral traditions and culture through rituals, even though they now face challenges from changing times. Various rituals in KABC reflect the close relationship between humans, nature, and intergenerational beliefs. Within the rice agricultural cycle, **the Appanaung Ri Je'ne** ritual is performed before preparing the soil as a supplication for sufficient water that does not bring disaster, marking a reverence for natural elements prior to planting. KABC views water as a vital element for rice crops; if water is scarce, the rice plants will die. Conversely, if it is excessive, water can bring peril not only to the crops but also to humans. **The Appanaung Ri Je'ne** ritual is typically attended by at least 4 customary functionaries who pray at their respective designated sites in the Saukang.

Subsequently, **the Appalili'** ritual marks the beginning of the planting season. Led by a pinati (shaman/ritual leader), it is performed in the rice fields/plots owned by the pinati. During this ritual process, the pinati presents offerings consisting of betel leaves (**leko'**), areca nuts, and lime. Another ritual performed before planting is **Accera' Sapi**, which pays homage to the cattle used for plowing fields—a practice that has now been adapted to the use of machinery (**Accera' Traktor**). Previously, a chicken would be slaughtered at the house of a customary leader, and its blood would be collected and blessed at the Saukang. Afterwards, the blood was smeared onto the cow's body. Because some residents in Bara Hamlet now use hand tractors to plow their fields, the chicken blood is smeared onto the tractor engines instead.

The Pakkanre Lappassang ritual is conducted when the rice begins to sprout, during which women play a crucial role in preparing offering foods and distributing them in a spirit of communal togetherness. This ritual is performed to celebrate the growth of the rice crops and in the hope that the plants will yield an abundant harvest. **The Pakkanre Lappassang** ritual is usually led by a pinati who recites prayers while calling out the names of family members, so that each family is granted the strength to protect their crops and harvest successfully. When the rice begins to form grains, **Accera' Solongang** is performed so that the flowing water brings fertility. The ritual procession involves channeling chicken blood into the irrigation channels that feed the fields. The purpose of this ritual is to ensure that the rice grains fill out completely and do not suffer from a lack of water. The execution of the **Accera' Solongang** ritual is typically carried out at the water springs flowing through the jurisdiction of each customary leader. Similar to **Appanaung Ri Je'ne**, each customary functionary prays at their respective water source, while individual families stand along the irrigation channels leading to their specific plots.

Following the harvest, the community holds the **Gaukang Appapole**, also known as the harvest festival. This ritual is usually held at a sacred site recognized by KABC called the Saukang and is led by customary leaders such as the pinati, galarang, and customary elders (tautoa adat). In this procession, each family must prepare approximately 7 to 10 chickens, though in the Bara Indigenous Community, the number can exceed 10 chickens if the acquired harvest yield is substantial. Once the prayers at the Saukang conclude, the offered dishes are eaten communally. Even visitors who do not hail from the Bara & Cindakko Hamlets are welcome to enjoy the feast. Usually, the harvest festival is enlivened by

A'lanja', an activity to test physical strength and endurance by clashing shins. This activity is joined by children, youth, and adults alike.

In addition to organizing various customary rituals, KABC possesses spaces that are deemed sacred, one of which is the Saukang. This location is shaded, overgrown with ancient trees, and situated near a water stream. Customary leaders simultaneously perform rituals at the trees, water streams, the baruga (communal hut), or an open stage. Each family brings offerings consisting of traditionally packaged food. Once the ritual is complete, the food is distributed to be eaten together by community members and attendees.

Another vital ritual site is the **Ba'Lasa'** River, which is believed to be the place where To Manurung (sacred ancestral deities) descended to earth. It features two primary zones: **Ba'Lasa' Lompoa** (large) in Cindakko and **Ba'Lasa' Ca'di** (small) located between Baru and Karaeng Bulu. The Cindakko community also possesses **the Pabbesiang**, a sacred heirloom weapon used for prayers and conflict resolution rituals among residents. If a dispute remains unresolved, each conflicting party is asked to take an oath upon **the Pa'bassiang**, which is believed to make the prayers and oaths manifest into reality. As with other sacred sites, visitors bring offerings when praying there.

KABC also maintains traditions to ward off disasters and protect customary laws. **The A'Tumpi** ritual is performed to seek protection for the entire territory and its people from calamities. This ritual is typically carried out once every three years by the indigenous community. It is named the A'Tumpi ritual because one of the primary offerings presented is the tumpi cake, made from glutinous rice (*Oryza sativa* L. var. *glutinosa*), palm sugar (*Arenga pinnata*), and coconut (*Cocos nucifera*). Aside from the tumpi cake, other offering materials include betel leaves, areca nuts, whole pieces of coconut, raw rice, and candles made from candlenuts (*Aleurites moluccanus*). Women hold a critical role in this tradition, as they prepare the ingredients and food offerings, and subsequently guard them throughout the night. KABC believes that the tumpi cake represents their rice fields or nature; if a single tumpi cake goes missing, it signifies the loss of one rice field. Therefore, during the process, each family closely guards their tumpi cakes. The A'Tumpi ritual is usually led by a sanro (female shaman/healer) who possesses the ability to perform healing arts throughout the night.

KABC also enforces a customary law known as A'liing, which prohibits certain activities, especially prior to the harvest. Its implementation is announced through the A'Bombong ritual by hanging coconut or palm leaves in designated territories. Violations of A'liing can incur fines, such as the slaughtering of a chicken. Specifically, A'liing forbids residents from carrying out specific activities—mainly related to agriculture, such as cutting grass, felling trees, hunting, or processing palm sugar—during a set period, typically leading up to the rice harvest. The enforcement of A'liing is announced through the A'Bombong ritual, where customary leaders hang palm and coconut leaves across customary territories or pathways frequented by residents. For the general public, A'liing usually lasts for 3 days, whereas for customary functionaries, it lasts about 7 days. In the past, A'liing could last up to 30 days, but today the duration has become shorter.

KABC believes that violating A'liing will bring misfortune upon oneself. Violators must also pay a customary fine, such as slaughtering one chicken. A'liing helps provide a period of rest for both the body and nature, ensuring that residents have sufficient energy to work collectively during the rice harvest season.

Another highly critical ritual is Paentiengi Adat, which translates to upholding custom. This ritual is typically performed to enforce customary law within KABC whenever a resident commits a violation. For instance, if residents engage in silariang or elopement (running away with a partner to marry)

without receiving parental blessings, they must pay a fine determined by custom upon their return to the indigenous community as a prerequisite for reintegration. The acceptance process is finalized by holding the Paentiengi Ada ritual, during which the violating residents slaughter a chicken or a cow in accordance with the ruling issued by the customary leaders.

The customary institutional structures across KABC share similarities, comprising the Karaeng, Pinati, Galarang, and Totua Adat. DN, a customary leader in the Kacoci region, shared that specifically for the Cindakko territory, there are several other customary apparatuses, such as the Bali Karaeng, Panre (blacksmiths), customary witnesses, and elements of the hamlet government (hamlet heads and neighborhood heads/RT). Each customary leader holds an equivalent position and function. The decision-making process by customary leaders requires unanimous consensus from all functionaries. If even one customary leader disagrees, a decision cannot be made. This demonstrates that decision-making prioritizes dialogue and mutual understanding among leaders.

One vital tradition that continues to be practiced is mutual cooperation (gotong royong) in clearing fields, planting, and harvesting rice. In the Kacoci community, all residents participate regardless of age or gender because, as I noted, "we cannot do it alone." Gotong royong is also applied to other activities, such as building village roads, with the land owners providing food according to their financial capacities. While this tradition remains strong in Kacoci, it has begun to face threats in Bara, where some residents pay others to replace them. Furthermore, KABC still rigorously executes customary rituals, particularly those led by customary functionaries, most of which relate to the rice planting process from land preparation to harvest.

Although customary traditions and rituals in KABC are still maintained, practices like gotong royong are beginning to face challenges due to community interactions with outside groups. DB recounted that in Bara Hamlet, the tradition of gotong royong is starting to erode; previously, every family was obligated to assist one another from planting preparation to the rice harvest, but now some residents have begun paying others to replace them at a rate of around Rp 50,000 per day. Even providing meals for gotong royong workers has occasionally been turned into a matter of social prestige; some only provide rice and eggs, while others provide rice with chicken. DA, a customary leader in the Baru Indigenous Community, mentioned that gotong royong is virtually non-existent in his region because everyone demands to be paid. The daily net wage reaches Rp 50,000 per person, and the landowner must also provide food and drinks for the workers.

The decline of gotong royong was likely triggered by the government's construction of paved (concrete) roads. While DA still respects the remaining gotong royong tradition within KABC, he expressed doubts that this tradition will survive if road infrastructure leading to Bara and Kacoci is developed by the local government.

During field visits to KABC, the research team found it difficult to encounter young people, as the population is predominantly dominated by the elderly. The youth from both hamlets mostly work outside their home regions. Low education levels result in most of them working in the informal sector, such as laborers or domestic helpers; even a pinati and several residents from Bara Hamlet have migrated to East Kalimantan to work on oil palm plantations. This condition indicates that agriculture in both hamlets remains purely subsistence-based and has not yet been able to improve community welfare. The young people who choose to stay attempt to develop agriculture by planting cash crops like coffee and cocoa, but land constraints and limited knowledge remain major obstacles.

Internet access has also influenced their views on progress. Young people like S utilize social media to voice the poor state of infrastructure and education, and these voices have begun to garner attention

from various citizens across South Sulawesi. Consequently, the Regent of Maros eventually visited Bara Hamlet to provide aid to a makeshift school (*sekolah kolong*) pioneered by the residents. Furthermore, Bara Hamlet has also started to receive attention from local universities through student community service programs (KKN) and research initiatives. However, interaction with social media also drives urbanization, as some young people leave the hamlet to pursue success in urban areas.

Women Nurturing Nature & Safeguarding Tradition

Women play a highly strategic role in the life of KABC. This stands in contrast to other indigenous communities where women do not occupy strategic positions within the customary society. In KABC, women actually hold strategic positions as customary functionaries. An example is DE in the Cindakko Indigenous Community, who serves as a *galarang*. Previously, DE's brother was appointed; however, because he was deemed incapable, DE replaced him. The process of appointing someone as a customary leader cannot be separated from their familial ties to previous officeholders. Nevertheless, an individual can also decline the position, or it can be passed to someone else who possesses the required capability. DN explained that he is not actually the original *galarang* in the Bara region: "My wife was supposed to be the *galarang*, but because she was unwilling, I took over the position."

Women also have a role in the ritual to ward off disasters, namely the A'Tumpi ritual. Symbolically, this process can be interpreted as women being the protectors of nature or the community's source of livelihood. Beyond serving as customary functionaries, women also play an important role in agriculture. The processes of seedling preparation and rice planting are carried out by women. DS, a customary elder (*totua adat*), explained that men and women have distinct roles in their respective activities. For instance, in making palm sugar, men climb and tap the palm trees as well as forage for firewood, while women cook the palm sugar. In farming, men clear and plow the land, whereas women sow the seeds and tend to the plants. During harvest time, both men and women are equally involved in the rice fields. When it comes to selling the harvest, women and men actually have equal access. However, due to the considerable distances and damaged roads, men more frequently sell the produce to the market.

Regarding household chores, although a division of labor exists—where women are heavily involved in domestic affairs such as cooking, cleaning the house, and childcare—in practice, the research team also found many men actively involved in child-rearing.

In terms of access to education, S, a teacher at the elementary school in Bara Hamlet, observed that the community's level of awareness regarding education is beginning to improve. This is evident from the fact that the students attending school are predominantly female compared to males. In the past, parents were indeed afraid to send their daughters to school because the school was far from home. Additionally, the abduction of girls (elopement) frequently occurred, which led to boys being sent to school more often. A different condition occurs in Kacoci, where the research team found many school-aged children (both boys and girls) not attending school. In fact, many children are not yet fluent in reading. I explained that the reason children in Kacoci drop out of school is because the teaching and learning activities at the elementary school are irregular. Frequently, the teachers are absent, even though the children have walked quite a long distance to the school. Furthermore, parents do not yet see the tangible benefits that education can provide toward improving their welfare.

3.4 The Baduy and Kasepuhan Indigenous Communities

The Inner Baduy (*Baduy Dalam*) and Kasepuhan indigenous communities are two customary groups in Lebak Regency, Banten, that still maintain the traditional value systems and way of life of Sunda Wiwitan. Both serve as reflections of the two faces of classical Sundanese cultural sustainability, taking

different paths in responding to modernity. The Inner Baduy community is known for closing itself off from outside influences, while the Kasepuhan community opens up space for adaptation to new knowledge and technology without abandoning their cultural roots.

The Inner Baduy and Kasepuhan Indigenous Communities were selected for this study to strengthen the comparative analysis. Both indigenous communities are viewed as robustly maintaining tradition, culture, natural resources, and their food security systems. Both are considered to possess agricultural knowledge and climate adaptation capabilities, as well as the ability to adapt to advancements in science and knowledge without discarding the traditions passed down through generations.

In June, the research team visited several neighboring villages: Kasepuhan Jamrut in Wangunjaya Village and Kasepuhan Pasir Eurih in Sindanglaya Village, Cigemblong District; and the Inner Baduy in Kanekes Village, Leuwidamar District, within Lebak Regency, approximately 90 kilometers from Serang. The visit coincided with the Seren Taun activities, which represent one of the stages of the rukun tujuh (seven agricultural pillars) covering the process from land preparation to rice harvest.

Seren Taun is not merely a spiritual ritual, but also a socio-cultural gathering that reunites residents who have migrated away. The peak moment of this agricultural ritual is not carried out simultaneously. Each kasepuhan waits for instructions from its parent kasepuhan. For example, Kasepuhan Jamrut awaits instructions regarding the auspicious day for holding Seren Taun from Kasepuhan Cicariang-Cibeber as their parent kasepuhan.

This customary ritual marking gratitude for the rice harvest also serves as a momentum for homecoming—returning to one's ancestral land—as explained by CS, a Kasepuhan indigenous youth, who quoted a Sundanese proverb: 'muncang rubuh ka canirna, kebo balik ka kandangna, anak balik ka kolotna' (the candlenut falls to its root-buttress, the buffalo returns to its pen, the child returns to their parents). This expression illustrates the deep emotional attachment of the indigenous community to their homeland and ancestors.

The Turning Point of Modernization

Although both indigenous communities continue to manage natural resources in accordance with traditions and culture passed down through generations, they also grapple with internal and external challenges. The designation of a portion of the Halimun and Salak forest area covering 40,000 hectares in 1979 as the Halimun Nature Reserve marked the starting point of tension between the indigenous communities and the government. In 1992, the status of the Mount Halimun Salak nature reserve was elevated to the Mount Halimun Salak National Park (TNGHS). Efforts to expand TNGHS continued; in 2003, the government expanded the TNGHS area by 113,357 hectares, encompassing Lebak, Bogor, and Sukabumi Regencies.

The penetration of the government and corporations has also affected the community's control over and access to natural resources. Since 1978, Perum Perhutani (the state-owned forestry company) obtained concessions within the kasepuhan territory. The situation changed in 1992 when the kasepuhan territory was included in the National Park area, which was subsequently expanded in 2003 to approximately 113,357 hectares. Additionally, gold mining companies and cement factories also operate around the kasepuhan region.

In Wangunjaya Village, agriculture is the primary activity for the majority of residents, with around 80 percent working as farmers whose main products are rice and palm sugar. JM, the Village Head who is also a martial arts master (pendekar), explained that his village possesses potential not only for agriculture but also for natural and cultural tourism. Most of the kasepuhan territory is considered

sacred, such as the Pondok Tondo forest, Mount Batu Putih, and Mount Rahong. The designation of these sacred zones demonstrates how agricultural activities, environmental management, and spiritual values are intertwined: the land used for agriculture exists in balance with spaces that are sacredly guarded, preserving ecological sustainability while respecting the traditions and beliefs of the community. Out of the village's total area of around 2,800 hectares, 733 hectares are managed by Perum Perhutani, 356 hectares by PT Pertiwi Lestari, and the remainder includes the TNGHS zone, reflecting a land use division that balances economic needs, nature conservation, and respect for sacred territories.

Before 1992, the indigenous community was still permitted to utilize the forest, but their agricultural yields were subject to a one-tenth levy by Perhutani. After becoming part of the National Park, conservation management policies instead restricted the community's access to the forest that had long been their source of livelihood. Those caught merely collecting twigs could face sanctions and be required to pay compensation at the national park management center office. This condition instilled fear and forced some residents to cultivate the land secretly. "Despite having a close relationship with the forest, we are often not recognized as the rightful owners, making us frequently anxious about entering the forest," added ID, a Kasepuhan youth.

"Dibatasina aksés masarakat pikeun ngagunakeun leuweung adat mawa dampak badag ka wanoja-wanoja Kasepuhan, kusabab urang biasana metik pakis, lalaban, ubar, jeung hal séjén pikeun kaperluan urang sapopoé. Urang ayeuna teu bisa deui bébas nutup kaperluan ieu kusabab aya ancaman ti pihak TN" ("Restricting the community's access to utilize the customary forest has a major impact on Kasepuhan customary women because we usually gather ferns, fresh vegetables, medicinal plants, and other things for our daily needs. We can no longer freely secure these needs due to threats from the National Park authorities,") said TR, a Kasepuhan customary youth from Cikareo who is currently studying physical education, sports, and health at Setia Budi University Rangkasbitung, Wanasalam Branch.

The change in the area's status from a nature reserve to a national park has had an impact on the Kasepuhan and Inner Baduy customary communities who depend on it. One of the traditional practices directly impacted by the designation of TNGHS is the practice of ngahuma. Ngahuma is essentially rotational rain-fed agriculture, also known as shifting cultivation, but this practice is deemed illegal because it does not align with national park management.

Furthermore, the Kasepuhan indigenous community also has regulations regarding the utilization and management of the forest. They divide the forest (or leuweung in Sundanese) into three zones: hutan titipan (entrusted forest), hutan tutupan (closed/protected forest), and hutan garapan (cultivated forest). Hutan titipan, or leuweung kolot, is an area believed by the ancestors to be preserved and is considered sacred, so the community is forbidden from clearing land in this zone. Hutan tutupan functions to maintain ecology and natural balance, while hutan garapan is the territory allowed to be utilized for daily needs," as stated by M, a young person active in the Kasepuhan Jamrut customary institution. The principle of leuweung titipan forms the core of the ecological and spiritual system of the indigenous community, particularly around Mount Madur, Mount Kembang, Karang Bokor, and Mount Pondok Sodong, which are believed to be sacred spaces for maintaining harmony between humans and nature.

A turning point in the struggle occurred in 2011 when the Indonesian Green Youth Institute (Rimbawan Muda Indonesia - RMI) facilitated a dialogue between the community and village heads. Since then, advocacy for customary rights began to find a clearer direction, until finally in 2013, the community's struggle gained legal legitimacy through the Constitutional Court Decision Number 35/PUU-X/2012, which affirmed the recognition of customary forests as part of the rights of customary law communities,

followed by the formal designation of rights over Customary Forests in 2016. All of this became an important milestone for the recognition of indigenous peoples in Banten.

FA, an RMI activist, emphasized the importance of involving the indigenous youth, customary women, and elders in identifying customary territories through participatory spatial mapping. "In this way, the indigenous community can demonstrate that they have managed the territory long before Indonesia's independence, and their presence is also recognized by non-indigenous communities. This identification process simultaneously provides a stronger legal basis for the recognition of customary territories," said FA. Only about 10 percent of the land is actually owned and managed by the indigenous community, while the remainder is recognized by the government as state forest areas.

Since 2015, CS and his peers have been active in collectively mapping the outer boundaries of their customary territories. They gather in the Lebak Customary Territory Consolidation and Advocacy Forum, abbreviated as the KAWAL Forum. This forum is a collaboration between RMI and indigenous youth from various Kasepuhan communities, including the Baduy, to strengthen solidarity, share knowledge, and fight for the recognition of customary territories in Lebak, Banten.

This forum endeavors to detail the extent of forests, cultivated lands, and settlements. "The ultimate goal of mapping is the legal recognition of customary territories," continued CS, which was nodded along by his colleague ID. The active involvement of these two Kasepuhan youths has, to some extent, provided inspiration to their peers of the same generation.

This participatory mapping is an effort to urge the Banten Provincial Government to provide a legal basis for protecting the customary rights (*hak ulayat*) of indigenous communities. Consequently, two local regulations were issued—namely Regional Regulation (Perda) No. 32 of 2001 and Regional Regulation No. 8 of 2015—which recognize the existence and customary rights of the Baduy and Kasepuhan customary law communities. This policy is an important step in safeguarding the sovereignty of indigenous peoples over their land, forests, and natural resources. However, its implementation still faces major challenges, particularly in confronting external pressures such as land expansion, infrastructure development, and illegal logging by outside parties.

The Kasepuhan and Inner Baduy indigenous communities have different ways of practicing ancestral customs and adapting them to the times. The Kasepuhan is known to be flexible because it is capable of adopting modern knowledge and technology while still maintaining its traditions and culture. As illustrated by Abah MM, a teacher who is also the son of a Kasepuhan Pasir Eurih customary leader, through the Sundanese proverb: '*miindung ka waktu – mibapa ka zaman*' (literally meaning an invitation to mother the time and father the era as a guide). Abah MM mentioned that this proverb simultaneously serves as a life philosophy regarding the universality of time and the significance of the era. The Kasepuhan indigenous community is pliable in following the developments of the times so they can survive without being swept away by the current of change.

It is not surprising that when observing the agricultural patterns applied by the kasepuhan residents, they have also begun to adopt modern agricultural approaches that utilize fertilizers, pesticides, and high-yielding rice seed varieties that have short planting periods and higher yields. According to information from JZ, the village secretary, the use of these superior seeds is only permitted after the planting season of *pare gede* (ancestral local rice) which is still cultivated by the Kasepuhan Indigenous Community. Not all residents are capable of planting rice twice a year, as it is only feasible in locations where the irrigation system is sufficiently good.

Meanwhile, the Inner Baduy are stricter in guarding their traditions and culture by closing themselves off from outside influences. According to Ayah MS, the Baduy community has a *pikukuh* or life rule that must be followed as follows:

“Lojor teu meunang dipotong, pendek teu meunang disambung. Eta hartina nya sakitu bae, ulah dileuwihan, ulah dikurangan. Nu teu meunang dileuwihan jeung dikurangan tah eta adatna, cabak tincakna. Eta nu hayang diperteguh “ (Translation: "What is long must not be cut, what is short must not be pieced together. That means it must be just as it is, do not add to it, do not subtract from it. What must not be added to or subtracted from is the custom and the way of life. All of that is what we want to keep strengthening.")

The Baduy community chooses to isolate themselves from the current of modernization, reject government programs, and enforce customary laws that bind all members. In making decisions, the Baduy indigenous community opts for a democratic principle where all issues are discussed together in the meeting hall, which is also used to celebrate weddings or circumcisions.

For the Kasepuhan indigenous community, openness to knowledge and technology is considered a way to adapt without losing cultural roots. Televisions, radios, and even internet access are now present in the middle of settlements, allowing the community to communicate more broadly and obtain information regarding agriculture, markets, and development policies. Meanwhile, the Inner Baduy community remains steadfast in maintaining distance from modernity. In their residential areas, the use of electronic gadgets and the internet is banned by custom. Nevertheless, relations with the outside world are still maintained through the interactions of the Outer Baduy (Baduy Luar) who move in and out of the villages to trade, attend school, or participate in social activities outside the customary territory. Interaction with the outside world also occurs through tourism activities that allow people from outside the village to visit. These two approaches demonstrate how the value of Sundanese *pikukuh*—loyalty to the harmony between humans, nature, and ancestors—is carried out within the context of a changing era.

The Baduy and Kasepuhan indigenous communities are also experiencing changes due to the penetration of various modern institutions and programs. Although customary practices such as *seren taun*, the seven agricultural pillars (*tujuh rukun tani*), and rituals of reverence for nature are still maintained, the flow of modernization slowly brings socio-economic consequences that are difficult to avoid. The entry of schools, markets, and other public services influences and changes the lifestyle of the younger generation. Many young people choose to migrate to pursue education or work outside the agricultural sector, such as becoming waste collectors in urban areas, while interest in cultivating fields and maintaining local food systems declines. Consumption patterns have also shifted: from a reliance on field yields to the consumption of market products that require cash exchange. This change marks an important turning point for indigenous communities: how to balance the preservation of cultural values and practices with modern economic needs without losing the cultural identity that forms the foundation of their lives.

The Baduy and Kasepuhan communities now frequently face ecological threats such as landslides and flash floods because their settlements are located in hills and valleys, while deforestation outside the customary territory continues to increase. Their agricultural lands and fields are often damaged by erosion and rainwater runoff, which leads to the loss of harvests and weakens the community's food security. For them, disasters are not merely natural events, but also spiritual warnings from the Creator for humans to return to harmony and balance. In this way, disasters are understood as moments of collective reflection that reinforce customary values and social solidarity to face future challenges.

This entire process indicates that changes in indigenous communities due to modernization occur through a combination of education, government regulations, corporate penetration, and the legal struggles of the residents. Each factor influences the other and demands that indigenous communities adapt without losing the cultural identity and ecological balance that form the foundation of their lives.

Knowledge & Awareness of Climate Change

The Kasepuhan and Inner Baduy (Baduy Dalam) indigenous communities have different ways of practicing ancestral customs and adapting them to the times. The Kasepuhan is known to be flexible because it is capable of adopting modern knowledge and technology while still maintaining its traditions and culture, remaining pliable in following the developments of the times so they can survive without being swept away by the current of change. Meanwhile, the Inner Baduy are stricter in guarding their traditions and culture by closing themselves off from outside influences. In making decisions, the Baduy community opts for a democratic principle where all issues are discussed together in the meeting hall, which is also used to celebrate weddings or circumcisions.

Regarding the issue of climate change, the residents of both indigenous communities are considerably exposed to the issue and have even directly felt its impacts. The residents of Kasepuhan Jamrut are more open to modern technology to obtain information from various media channels such as television, radio, and the internet. On the other hand, the Inner Baduy community, despite closing themselves off from modern media, remains exposed to the issue of climate change through interactions with visitors or outsiders. They use these opportunities to discuss changes in nature. Upon learning that the research team was interested in exploring the issue of climate change and indigenous communities, several residents enthusiastically shared local weather changes and their impacts on crops as well as the forest products they have been gathering. These include high rainfall intensity that disrupts the production of wild forest bee honey, erosion in fields/gardens, and crop pests.

The Kasepuhan and Inner Baduy indigenous communities use a lunar calculation system similar to the Islamic calendar as a guide to seasonal changes, though it differs such that the date of Eid celebration is difficult to predict and the number of months each year can exceed 12, depending on harvest yields. Knowledge of this seasonal calendar is typically held by customary functionaries; however, the younger generation is beginning to take an interest in learning it through the Kawal Forum, which encourages them to engage in discussions with customary elders and understand traditions as well as customary rituals. For instance, the seasonal calendar used to determine the planting and harvesting times for rice helps them adjust agricultural activities to erratic weather conditions. This effort is vital for maintaining agricultural practices as a source of livelihood while simultaneously adapting to climate change.

The prohibition of private ownership of land or public goods, alongside the Baduy community's push for the government to protect the forest from external interference, functions as an instrument for climate change adaptation. This is because the practice preserves ecological balance, prevents resource exploitation, and implements sustainability principles that integrate environmental, economic, and socio-cultural aspects into daily life.

The agricultural territory of the Inner Baduy community is located on steep slopes and experiences high rainfall (approx. 3,000 mm/year). The scientific relationship between increased rainfall and land erosion has been proven, where erosion potential can rise by more than 12% if rainfall increases by 10-20%. According to several Inner Baduy residents met by the team, the increasing intensity of rain damages rice crops. Their agricultural lands and fields are frequently damaged by erosion. To prevent this, some residents plant ginger (*Zingiber officinale*) and tuber crops as part of their rain-fed land management system.

In addition to high rainfall, both communities also face the issue of drought. Although both communities are surrounded by well-preserved forests, droughts still occur at certain times. Drought impacts the growth of rice plants, which can lead to a decline in the productivity of rice harvests. Beyond its impact on rice crops, it also affects the fish aquaculture practiced by the Kasepuhan community.

Apart from tenurial and governance issues, ecological threats such as landslides and flash floods have now become realities frequently faced by the Inner Baduy and Kasepuhan communities. The location of their settlements in hilly areas and valleys makes them prone to disasters, especially as deforestation escalates.

In the view of the Inner Baduy and Kasepuhan communities, disasters are not merely natural events, but rather spiritual warnings from the Creator for humans to return to harmony and balance. In this manner, disasters are understood as a process of collective reflection—a momentum to reinforce customary values and social solidarity in order to face greater challenges in the future.

Farming Traditions, Nature Preservation, and Food Security

The Kasepuhan Jamrut and Inner Baduy indigenous communities generally work as farmers. They still maintain rice cultivation using local seeds. For example, the Kasepuhan Indigenous Community cultivates the local Pare Gede seeds, which have many variants that can be distinguished by the color and size of the grains.

The farming pattern of the Kasepuhan Jamrut Community has become sedentary, with varying sizes of rice fields. Generally, the land ownership is below two hectares. The rice planting pattern adjusts to the rainy season, as most fields do not yet have irrigation systems. Usually, rice is planted once a year, but now some residents have begun planting twice a year, utilizing local seeds for the first planting cycle and government-provided seeds for the second. This change was triggered by increasing rice consumption and declining harvest yields, demonstrating how their agricultural traditions remain alive while simultaneously adapting to current needs.

Several residents of Kasepuhan Jamrut have also begun using fertilizers and pesticides in agriculture. Although their use is still limited, this type of practice will likely be adopted by all residents in the future. Increased pest attacks have been one of the factors driving residents to use pesticides. In fact, within the tradition of the Kasepuhan community, there is a known practice called ngubaran pare (treating/curing rice). In this tradition, Kasepuhan residents typically receive a concoction that has been blessed by an olot (elder), which is then scattered by the residents toward the four cardinal directions of the rice field.

For the Kasepuhan indigenous community, farming is not merely an economic occupation, but a way of life that binds humans, nature, and the Creator. This value is reflected in the tujuh rukun tani (seven agricultural pillars), a series of sacred stages regulating the planting, tending, harvesting, consumption, and storage of rice. Each stage encompasses not only technical rules but also spiritual, social, and ecological values that maintain the balance between humans and the environment. The rukun tani is passed down through generations as a guide for living, strengthening the solidarity of the indigenous community and its relationships with non-indigenous communities. Understanding the seven agricultural pillars means understanding the Kasepuhan worldview, where rice is not just a food source, but a symbol of life and the pillar of the value system that guides all community activities.

Table 5. The Stages of the 7 Agricultural Pillars (Rukun Tani) in the Kasepuhan Indigenous Community

No	Stage Name of the Agricultural Pillar	Description & Ritual	Actors & Community	Function & Cultural Value
1	Asup Leuweung (with a slight variation in Cibarani called "asup leuweung ngasah pakarang")	The land clearing stage, entering the forest or garden together to prepare the planting area. This can include physical clearing (grass, shrubs, small trees) as well as a ritual to request permission from the forest spirits (leuweung). It is sometimes referred to as ngasah pakarang (sharpening tools to clear land).	Customary figures (sesepuh, abah, or olot, and baris olot); men usually lead the ceremonial events/customary rituals, women prepare and manage consumption, and the youth are involved as participants, particularly in documentation.	This stage builds communality, ensuring that land clearing is not done unilaterally, which ecologically protects the areas of hutan titipan (entrusted forest) and hutan tutupan (protected forest).
2	Nibakeun (also known by the term ngaseuk)	Once the land is ready, a ritual is conducted to sow or broadcast the seeds. At this stage, the community requests permission from nature spirits/ancestors, offering prayers so that the seeds grow fertile and yield a bountiful harvest full of blessings.	Led by customary figures and elders (sesepuh); the entire farming family participates. Youth may assist with physical tasks (preparing seeds, nursery beds).	Soil is important for the seeds as the beginning of life, conveying a message to safeguard local seeds from being carelessly replaced; it also embodies religious values and gratitude to the Almighty.
3	Ngubaran pare	Tending to the rice plants after the seeds are sown to ensure proper growth:	Carried out through mutual cooperation (gotong royong) by farmers/village	A crucial stage in maintaining productivity. It embodies the value

No	Stage Name of the Agricultural Pillar	Description & Ritual	Actors & Community	Function & Cultural Value
		including weeding, protecting against pest attacks, tilling the soil, and potentially applying organic fertilizers or traditional medicine ("treating" the rice). It can also include a ritual petition for the plants to remain healthy.	farmers, guided by customary functionaries. Women are frequently involved in caring for the young plants and taking on smaller tasks like weeding.	of harmony between nature and humans: if the plants are cared for, they will yield results; if neglected, pests and diseases can destroy them.
4	Mapag Pare Beukah	When the rice begins to flower/bloom ("beukah" = blooming flower). This is a critical period for the crops: the emergence of flowers signifies that the plants are maturing toward yielding grain. At this moment, a ritual is conducted to ensure the flowers remain intact, minimize failure (flowering failure/empty grains), and mitigate the impacts of weather or pests.	Customary figures, all primary and assistant farmers along with residents. Sometimes special rituals, prayers, and customs are led by the elder (sesepuh).	Reinforces the belief that physical effort alone is not enough, but spiritual intervention and recognition of natural/spiritual forces are also essential. It also serves as a time of reflection; how well the tending was done will determine the subsequent yield.
5	Mipit / Beberes	The harvesting stage—when the rice has matured and is ready to be reaped. A ritual is performed	Family farmers, residents, and youth; guided by custom; the role of women is typically in collecting	A highly anticipated stage: the results of collective labor and ritual blessings

No	Stage Name of the Agricultural Pillar	Description & Ritual	Actors & Community	Function & Cultural Value
	(harvesting)	to ask permission from nature so that the harvest proceeds smoothly and yields maximum results. "Mipit" is the local term commonly used for harvesting.	and separating the grains. The harvest is performed through mutual cooperation (gotong royong).	are manifested. It emphasizes gratitude, work solidarity, and the recognition that humans rely on nature and ancestors to yield output.
6	Ngadiukeun / Nganyaran	The storage stage: transferring the unhusked rice/harvest to the customary granary (leuit) or local rice storage facilities; organizing the yield to prevent damage, maintaining reserves, and performing rituals so that the stored harvest remains safe from pests and adverse weather.	Guided by custom/elders (sesepuh); usually assisted by village residents; a portion of the customary wealth is visible in the leuit that manages and stores the rice.	This serves as a symbol of stability and food reserves: the leuit stores seeds/rice not just for immediate consumption but as a reserve for lean seasons (paceklik); it preserves local varieties and safeguards the community's food security against external disruptions (weather, markets, external intervention).
7	Seren Taun	The peak thanksgiving ceremony: after the entire cycle is complete, a customary ceremony is held to celebrate the harvest, offer prayers of gratitude, and feature	Customary figures lead, the entire community attends, and the youth play traditional music, arts, and dances; there are offerings or ritual components dedicated to the ancestors or earth	Functions as an expression of gratitude, a cultural celebration, and a renewal of the community's pledge to nature, maintaining the continuity of varieties and

No	Stage Name of the Agricultural Pillar	Description & Ritual	Actors & Community	Function & Cultural Value
		traditional entertainment, music, and performances. Gathering at the Imah Gede (grand house) or customary sites, it strengthens social and spiritual bonds. It serves as both a closing and the beginning of preparation for the next planting cycle.	spirits. In Cirompang, the research team witnessed the indigenous community presenting songs and dances accompanied by traditional musical instruments, including saweran.	rituals; it reinforces the Kasepuhan identity as a living indigenous community and acts as a public moment to demonstrate cultural sustainability to outsiders.

**Source: quoted from interviews with informants*

The implementation of the Seven Agricultural Pillars (Rukun Tani) in the Kasepuhan indigenous community is not merely a sequence of farming activities, but a value system that safeguards food security, social solidarity, and ecological balance. Through the storage of local rice in the leuit (granary) and the preservation of traditional seeds, the community is able to sustain indigenous varieties that are resilient to local environmental conditions. This practice not only guarantees food availability but also strengthens the community's independence from reliance on industrial seeds. The agricultural process, carried out through mutual cooperation (gotong royong)—ranging from land clearing to the execution of Seren Taun—reflects a high spirit of togetherness and solidarity. Within this system, no one is permitted to precede certain ritual stages in order to maintain harmony and respect the customary order.

Furthermore, the Rukun Tani contains a deep spiritual dimension. Each ritual is viewed as a form of reverence toward nature and the ancestors, reinforcing the belief that nature is not just a resource, but a living part whose balance must be preserved. Through the execution of these rituals, the younger generation of Kasepuhan learns to recognize their cultural roots, ancestral values, and how to understand the environment wisely. Ecologically, the Rukun Tani also functions as a natural regulatory system: regulating the timing of land clearing, planting, harvesting, as well as the procedures for caring for the soil and forest plays an important role in preventing erosion, maintaining the water cycle, and controlling pests. The prohibition against clearing land indiscriminately, the obligation to protect the leuweung titipan (entrusted forest), and the practice of forest patrolling are tangible manifestations of custom-based conservation that supports ecosystem sustainability while simultaneously reinforcing the community's cultural identity.

The Baduy and Kasepuhan indigenous communities currently face challenges in agricultural productivity, particularly related to the decline in rice yields due to quite troubling pest attacks. Many

residents of Kasepuhan Jamrut have used pesticides to handle the pests, but according to the testimonies of several residents, the level of pest attacks has still not decreased. To safeguard harvest yields, the residents of Kasepuhan Jamrut store their rice in specialized granaries known as *leuit*, which are usually placed separately from the residential area to reduce fire risks. Aside from rice, the community has also begun developing other agricultural commodities; in Kasepuhan Jamrut, they plant pepper (*Piper Nigrum*), whereas in Inner Baduy (Baduy Dalam), residents plant ginger (*Zingiber Officinale*) and aromatic ginger (*Kaempferia Galanga*), which fetch a fairly high price in the market and provide additional income for families. Consequently, indigenous communities do not only maintain rice farming as a tradition, but have also begun diversifying commodities to support economic and food security.

The Kasepuhan and Inner Baduy indigenous communities actually possess a considerable diversity of food. Although they make rice their staple food, both communities still consume sweet potatoes (*Ipomoea Batatas*) and cassava (*Manihot Esculenta*). In addition, the Kasepuhan Jamrut community cultivates freshwater fish as a source of protein. Although not all residents own ponds for fish aquaculture, they also obtain fish by fishing in the river. As a result, fish has become the side dish most frequently consumed by the Kasepuhan residents. In the *Seren Taun* tradition in Kasepuhan Jamrut, we still witnessed food offerings that were heavily dominated by the richness of the local food supply. Examples include various kinds of snacks made from rice, glutinous rice (*Oryza Sativa* var *Glutinosa*), or palm sugar (*Arenga Pinnata*) which are widely produced by the local community.

However, food consumption patterns are beginning to change in both communities, especially among children in the Inner Baduy community. Modern and even ultra-processed snacks such as grilled sausages, candies, meatballs (*bakso*), *pisang molen* (fried banana pastry), as well as various other fast foods like instant noodles have begun to enter and become their favorites. A young child we met while spending the night in the community had been whining since morning, wanting to buy meatballs for breakfast. This habit is clearly different from the consumption pattern of the parents' generation, who were accustomed to devouring traditional foods like boiled sweet potatoes or cassava. As an impact, many parents now have to allocate a larger shopping budget just to fulfill their children's desire for snacks, demonstrating how the penetration of modern food is beginning to affect daily life and household economics in this indigenous community.

Although agriculture remains a promising sector in Kasepuhan Jamrut, the mindset of the youth is now beginning to change. Expanding internet access and communication networks enable the younger generation to see opportunities outside the village. They are beginning to perceive agriculture as a less attractive occupation, and are more interested in migrating to the city, even though the jobs they choose often fall under informal employment. This change indicates a shift in the values and aspirations of the younger generation, who are now more focused on economic mobility and new experiences compared to maintaining the family's agricultural tradition.

Changes resulting from interaction with outsiders also occur in Inner Baduy. Tourism visits have become an entry point for interaction and the introduction of instant culinary items to the local community. On one hand, interaction with the outside world provides economic opportunities, but it also presents new challenges such as changes in children's food consumption patterns, increasing plastic waste, and violations of customary rules (many Inner Baduy children play online games on mobile phones outside the community settlement).

To avoid commercialization and the pressure of mass tourism that could alter the cultural meaning and daily life of the indigenous people, the community, together with the village government, has established formal regulations through Kanekes Village Regulation Number 01 of 2007 concerning

Saba Budaya (Cultural Visits) and the Protection of the Tatar Kanekes Indigenous Community, which functions as a legal foundation in regulating visit procedures and protecting Baduy cultural values.

Ayah and Ambu MD, a husband and wife who are customary leaders in Inner Baduy, reject having their village referred to as a commercial tourist village because they do not want their customary life to be treated as an exotic object, but rather as a living space of encounter between humans, nature, and spiritual values. “The implementation of Baduy Saba Budaya must be clearly regulated, including determining the routes that are allowed or forbidden to pass to reach the village, as well as permitted or prohibited activities,” said Ayah MD during a long conversation at his house. According to him, the concept of Saba Budaya was developed to maintain a balance between openness to better new things and the steadfastness to preserve good and beneficial old traditions, with village regulations and customary law as the formal legal foundation. Herein lies both the strength and the challenge of modernization: how to maintain openness to change without negating the spiritual meaning and ecological balance inherited for centuries.

Women Caring for Nature and Tradition While Questioning Patriarchy

In the life of the Baduy and Kasepuhan indigenous communities, the rhythm of women's space and time blends completely with the cycles of nature. On ordinary days, indigenous women spend most of their time on productive activities—especially agriculture, food processing, and weaving—as well as on domestic work related to caring for the family and home. They do not only plant, harvest, and store seeds, but also ensure that every processed food maintains its nutritional value and the sacredness of its origins. In many homes, the sound of the mortar pounded by women blends with the angklung played by men, creating a harmony that reflects the community's socio-ecological mechanism: the work of men and women is different but mutually supportive.

However, the socio-ecological harmony that shapes the daily life of indigenous women is inseparable from social structures that place them within certain boundaries. In Inner Baduy, for instance, the marriage system still relies heavily on arranged marriage mechanisms, and on average, women marry in their teenage years. It is not uncommon to see very young girls already carrying babies while pounding rice, weaving cloth, or sweeping the yard; a sign that reproductive and domestic roles arrive sooner than the opportunity to build other life choices. Early marriage is considered normal, primarily because there is no obligation to pursue formal education. The absence of an educational system as a prerequisite for adulthood means that age is not a barrier to entering marriage and domestic roles, while simultaneously reinforcing the patriarchal structure that frames women's lives from an early age.

In the midst of strong customary structures, women—despite shouldering immense responsibilities in nurturing daily life—often do not have the same space to influence the rules that govern their lives. Herein lies the importance of looking at how customary autonomy runs alongside practices that restrict women. The national legal framework actually provides recognition for the existence and rights of indigenous communities, as stipulated in Article 18B paragraphs (1) and (2) of the 1945 Constitution, which asserts that the state respects customary law community units along with their traditional rights as long as they align with the principles of the Unitary State of the Republic of Indonesia (NKRI). This recognition allows communities like the Baduy to self-regulate through the customary governance system and enforce ancestral rules, including those related to marriage, division of roles, and resource management.

This state recognition is subsequently manifested in various regional regulations, such as Lebak Regency Regional Regulation Number 32 of 2001 concerning the Protection of the Baduy Community's Customary Land (Hak Ulayat) and Kanekes Village Regulation Number 1 of 2007 concerning Saba

Budaya and the Protection of the Tatar Kanekes Indigenous Community. The presence of these regulations gives space for the Baduy to manage their own customary law, but at the same time, it also affirms that social structures and gender relations exist within a framework deemed legitimate by the state. This means that the practice of early marriage, an unbalanced division of labor, or the restriction of women's space to participate in customary deliberations are indirectly reinforced through formal legitimacy.

Nevertheless, indigenous women do not simply become passive subjects in this system. In major customary rituals like *seba Baduy*, when thousands of Kanekes residents bring earth crops to be presented to the local government as an expression of gratitude, women play an essential role in preparing food, managing provisions, and executing the symbolic work that allows the ritual to take place. They understand that tradition is a source of identity, but at the same time, a space for negotiation. When the *puun* (highest spiritual leader) delivers the mandate to protect the environment and requests legal protection for the Baduy community, women are behind the entire process that ensures the community's life keeps running—and it is through these workspaces that they initially question the patriarchal boundaries governing their lives.

Behind this seemingly equal division of labor lie customary norms that frame these relationships. Research indicates the presence of descriptive norms—unwritten rules that serve as guidelines for daily behavior—that shape everyday practices: women and men are equally responsible for nature, but women hold certain sacred functions that cannot be replaced by men. Rice ceremonies such as *ngaseuk*, *mipit*, *nganyaran*, to *ngalaksa*, are believed to be spiritual encounters with "Nyi Pohaci", so only women are allowed to perform them. An elder once said that in rice rites, "women are the keepers of the gate of life," an expression that affirms the position of women not as subordinates, but as holders of a very high cosmological role. Yet interestingly, even though women are the determinants of food sustainability and the sacred relationship with nature, their voices remain absent from the customary governance structure and decision-making bodies.

The absence of women in the structures of customary institutions is reflected upon by TR. She observes that women shoulder most of the ecological work, food knowledge, and life care, yet they still lack representation to sit in customary leadership, and there is no precedent for it to this day. TR understands that what appears balanced in daily work is not necessarily reflected in the power structure. She begins to question that empty space: "if women can guard the rice, forest, seeds, and children, why are they not involved in guarding the customary institution? Why can sacred customary ceremonies be entrusted to women, but customary decisions cannot?"

Questions regarding the place of women in customary institutions are barely audible amidst the busyness of the fields, rituals, and customary deliberations dominated by men. There are no written rules that deliberately exclude women from customary leadership—not a single manuscript, proverbial saying (*petatah-petitih*), or ancestral mandate forbids women from speaking or taking strategic roles. However, "because there has never been a prior example," said Jaro MMN, who currently leads the village and holds an influential position in the customary institution, "we naturally feel that it is not a woman's place." Behind that simple expression lies a social reality that shapes invisible boundaries: that tradition is not just a collection of rules, but also habits that are inherited, reproduced, and rarely questioned.

TR recently arrived at an important awareness regarding her identity as part of an indigenous community, a moment that opened the door to a series of critical reflections about the traditions and social structures around her. This awareness is not always easy; she has to grapple with various constraints in thinking critically and confront values that have long been considered unquestionable.

However, this process precisely drives her to keep learning—gathering knowledge, rereading experiences, and expanding horizons about customs, culture, as well as her own position within them.

Through her active involvement in the Kawal Forum, TR and her friends have found a space to ask questions, discuss, and challenge the norms that have restricted them so far. The more she understands the social dynamics of her community, the stronger her courage becomes to challenge the deep-rooted patriarchal system and question inequalities, particularly the absence of women in Kasepuhan customary leadership. For her, the question “why is there no female representation in the customary structure?” is no longer just a critique, but an initial step toward a fairer and more equitable change for the younger generation of indigenous people—especially women—whose voices have been marginalized for so long.

Chapter 4 Analysis

This research is designed to answer the main question: "How does climate change affect the vulnerability and resilience of indigenous women in securing food and preserving cultural practices, and what locally-based adaptation strategies can be supported to ensure a fair and sustainable response?" This overarching question combines the issues of climate change, gender, the vulnerability and resilience of indigenous women, local food systems, culture, and adaptation strategies.

This study is structured as a comparative analysis to understand how four indigenous communities in Indonesia respond to climate change and ecological pressures across distinct contexts. These four communities were chosen because they represent a diversity of landscapes and livelihood systems: the Mentawai in the island region, the Talang Mamak in the lowland forests, Bara and Cindakko in the mountainous region, and the Baduy and Kasepuhan in the peri-urban agrarian region.

The researchers' position in this study is not to place themselves "as outsiders," but rather to adopt a reflective standpoint equal to that of the residents. The author acts as a re-narrator of the experiences of indigenous communities and women in this study as human beings living in the present and fraught with contradictions.

To answer the main question, we integrate four key concepts to understand the dynamics of indigenous communities in Indonesia facing climate change.

First, the climate risk framework (IPCC 2014; 2021) helps explain how indigenous peoples face risks through three aspects: exposure to climate hazards such as droughts, floods, and land degradation; sensitivity to these changes due to dependence on natural resources; and adaptive capacity formed through local knowledge and social solidarity. This IPCC framework not only reveals the specific vulnerabilities of indigenous peoples, but also highlights their social-ecological capital in responding to the climate crisis, while providing a scientific basis for designing contextual adaptation strategies.

Second, through the concept of social-ecological resilience (Atallah, 2019), we examine how indigenous communities are able to adjust their livelihood systems and resource governance to survive and transform amidst climate and modern economic pressures.

Third, the approach of the living economy and the ecology of care (Shiva, 2005) emphasizes the role of indigenous women as guardians of ecological balance, particularly in the management of food, water, and forests. The values of nurturing and safeguarding life that they practice form the basis of a living and sustainable economy.

Fourth, Shared Socioeconomic Pathways (SSP) provide an overview of how the direction of national and global development—such as the expansion of extractive industries or conservation policies—will affect the living spaces and future of indigenous communities in Indonesia. By integrating these four concepts, we seek to demonstrate that indigenous peoples are not merely vulnerable parties affected by the climate crisis, but also agents shaping the future direction of change.

Building upon these four frameworks, subsequent analysis needs to highlight how power relations, knowledge, and lived experiences—particularly those experienced by indigenous women—color social-ecological dynamics at the community level. Herein lies the importance of ecofeminism and intersectionality approaches, as both enable us to read not only how indigenous communities respond to climate change, but also how patriarchal structures, capitalism, and layered discrimination shape both their vulnerabilities and their strengths. This approach provides an analytical bridge to understand

practices of environmental care, survival strategies, and forms of indigenous women's resilience as recorded in the research findings.

Ecofeminism is an approach that combines feminist analysis with ecological thought to understand how power relations shape humanity's relationship with the environment. This perspective views that patriarchal and capitalist structures not only oppress women, but also exploit nature through mutually reinforcing and interconnected patterns of domination. In this regard, ecofeminism rejects various diametrical dualisms—such as humans versus nature, reason versus emotion, and environmental, nurturing, and lived experience factors (nurture) versus genetic or innate factors (nature)—which have historically justified rigid separation and hierarchy between the two.

Instead, ecofeminism emphasizes the importance of an ethics of care, a commitment to social justice, and the recognition of the plurality of ecological knowledge, particularly that born from the experiences of indigenous communities and women who live closest to nature. To deepen this understanding, the intersectional approach becomes essential—an analytical framework that examines how various social identities—such as gender, ethnicity, beliefs, and indigenous status—intersect to create distinct forms of vulnerability or inequality.

4.1 The Turning Point of Indigenous Communities' Transformation

Tracking climate change and its impacts on indigenous communities requires looking beyond current conditions to examine the track record and struggles of each community in facing altered natural situations and conditions, which have driven shifts in indigenous worldviews. Examining the turning point of transformation across these indigenous communities reveals two crucial authorities (auktor) that have driven changes in the lives of indigenous peoples, as well as the environments where they live and depend on the natural resources provided. These two authorities are the state and corporations.

State developmentalist policies that remain exploitative can still be witnessed today, manifested in forest clearing in the name of development for plantation activities, mining, or simply timber extraction. Such exploitative natural resource utilization practices not only destroy the livelihoods of indigenous communities, but also eradicate the identity of their traditions and cultures.

In Mentawai, major changes began with the entry of Timber Concession Rights (Hak Pengusahaan Hutan - HPH) in 1969 and the resettlement program around the early 1980s. The state and timber corporations became the primary actors introducing the logic of extraction and formal ownership systems over forests. Consequently, the traditional social system based on the communal longhouse (uma), which served as the center of social activity and the guardian of Arat Sabulungan values, was lost. Forests that functioned as sources of food, medicine, and indigenous identity were destroyed. Many families lost access to shared gardens and game animals—the primary sources of the community's food and cultural resilience. Mentawai indigenous communities, which usually relied on hunting and gathering, were forced to transform into producers of commodities demanded by the market, such as planting bananas, betel nuts, jengkol, and searching for rattan.

The government also pushed for the consolidation of old Mentawai indigenous settlements in the form of uma into village-style models to facilitate government service delivery. The Department of Social Affairs (now the Ministry of Social Affairs) became the primary actor that constructed settlements in Malancan Village. The identity of Mentawai indigenous people, who traditionally lived in a single uma, now had to occupy segmented houses for individual families. Kortanius Sabaleake, former deputy regent of the Mentawai Islands, illustrated the uma as the Regional Development Planning Agency (Bappeda) and the Development Planning Deliberation (Musrenbang), serving simultaneously as a deliberation forum and an authority that formulated indigenous community development planning.

Without the *uma*, planning, strategizing, and community priority setting practically cease to exist. "I understand Mentawai tradition/culture because since childhood I always played in the *uma*."

The absence of the *uma* caused the consolidation process of indigenous communities in defending their ancestral territories to weaken; corporations took advantage of this to negotiate with individual indigenous clans to willingly surrender their land for timber extraction. Indigenous communities received a fee known as *plajumone*.

The willingness of many indigenous clans to surrender their land use to companies was also driven by various changes within indigenous societies. The current needs of indigenous communities are no longer limited to clothing, food, and shelter, but extend to schooling children and fulfilling other requirements that form the standard of living in the modern era, such as owning vehicles, furniture, electronic devices, and others.

According to Rifai, Director of the Yayasan Citra Mandiri Mentawai, the relationship between indigenous communities and forests is complex and cannot be reduced merely to economic matters. Forests possess multi-functions encompassing social, ecological, political, and spiritual aspects; they are a "living pharmacy" providing medicinal plants, as well as spaces for customary rituals. The concept of *Pumonean* or agroforestry that they practice integrates the fulfillment of all needs—economic, energy, health, social, and spiritual—sustainably. Therefore, when companies enter and log the forests, not only do biophysical impacts like landslides and floods occur, but the entire life system intertwined with the forest vanishes, and the compensation in the form of *plajumone* offered will never be proportional to the commercial and cultural value lost. "If this happens, life can change. Economic sources are obtained by working for companies. But if companies cannot absorb [labor], economic and non-economic values will disappear forever."

The destruction of forest resources also led to a shift in production modes within communities from hunting and gathering to producing market-demanded commodities. Additionally, another consequence is that many young people leave the village due to the scarcity of reliable livelihoods locally. Many young people migrate to the provincial capital and other cities, adapting to new jobs. For example, R, a young Mentawai indigenous woman, migrated to Padang with the hope of working in a salon as a beauty technician—a profession previously unfamiliar to her. This shift marks a disruption of social structures and cultural identity when *Arat Sabulungan* is no longer the primary guide.

Kortanius Sabaleake, Deputy Regent of the Mentawai Islands for the 2017–2022 period, could not hide his anxiety regarding the future fate of the Mentawai younger generation. "Our education system should not teach different and less relevant things to these young people, but rather how they can recognize and develop their inherent strengths and the natural resources they possess. Because here we have plenty of timber, we should be the ones who become master carpenters and great forest conservationists."

Similar to the condition in Mentawai, the Talang Mamak indigenous community faces changes arriving through two major forces: companies exploiting forests and plantations, and the state establishing ecosystem restoration areas. Monoculture plantations (rubber, eucalyptus, and oil palm) transform forests into industrial gardens, while conservation cuts off access to ancestral lands under the pretext of preservation and protection of endangered species (elephants, orangutans, and Sumatran tigers). Both concessions and conservation have stripped Talang Mamak residents of their living space and control over nature, which was once the source of their life and livelihood, including their identity as an indigenous community.

This economic shift also disrupted customary social order. Traditional leaders lost their authority because many decisions are now made by village government officials or partner companies whose

concession areas encompass Simarintihan Hamlet. Customary ceremonies are still performed, but often function more as ceremonial events rather than sacred parts of daily life. This change leaves many Talang Mamak youth living in a dilemma. They are demanded to "act indigenous" in public, but in real life, they grapple with harsh modern realities.

While the Mentawai and Talang Mamak indigenous communities face the state and corporations, the Bara and Cindakko communities face pressures from conservation policies and agricultural land intensification pressures. The establishment of the Bantimurung Bulusaraung National Park introduced a logic of "nature preservation" that actually expels indigenous communities from the forests and water sources they have managed all along. Traditional farming is deemed a violation of national park rules, while access to forest products and water is strictly restricted, ultimately forcing communities to exploit their cultivated land with excessive agricultural inputs that disrupt ecological balance.

This change shook the customary order. Indigenous women, who once played crucial roles in guarding water and food, became the most heavily impacted group. Yet they did not remain silent. Figures such as the galarang and totua adat—spiritual guardians of water sources—emerged as vital figures negotiating with national park officials through rituals and water-care practices. Within limitations, they maintained their customary role as guardians of natural balance.

Meanwhile, the youth of Bara and Cindakko face a dilemma similar to other indigenous communities. Diminishing cultivated land and scarce employment drive many of them to migrate, not only to cities in Sulawesi but even as far as Kalimantan to work in plantations, including their traditional leaders. Today, the lives of the Bara and Cindakko indigenous communities exhibit a paradox: conservation intended to protect nature actually drives human exodus from the ecological landscapes they have tended for centuries.

In Kasepuhan and Baduy, changes unfold more subtly, wrapped up while still leaving deep wounds. The primary pressures stem from the bureaucratization of tradition and the currents of cultural tourism. The state and tourism actors view tradition as something that needs to be regulated while maintained as an attraction. In this process, tradition no longer serves fully as a guide for life, but also becomes part of cultural management and promotion systems.

Ceremonies such as Seren Taun in Kasepuhan or the life of the Inner Baduy (Baduy Dalam) community now frequently become public spectacles. Rituals and daily practices once executed within a spiritual context increasingly appear as performative displays designed for guests or media spotlights. Behind preservation efforts lies the bureaucratization of meaning—when tradition is safeguarded not only by belief, but also by policy and tourism interests.

The systems of sacred forests (leuweung larangan) and traditional rice barns (leuit) still survive, but their meanings are slowly shifting. If they once functioned as expressions of ecological spirituality and regulators of life's balance, they are increasingly interpreted as symbols of ethnic identity—markers of who they are before the outside world. On the surface, indigenous life appears harmonious. Yet underneath, indigenous communities continuously negotiate their position amidst the modern world: balancing the purity of tradition with openness to change. Tradition remains alive, but now also functions as a language of representation—a way for communities to introduce themselves while surviving in a world that demands them to remain "authentic," yet in forms acceptable to bureaucracy and the market.

All four communities demonstrate how the forces of capital and the state manifest through different faces: from resource exploitation, exclusive conservation, to the bureaucratization of identity. Yet all share a common pattern: the shift in human-nature relations from value- and responsibility-based

connections to ownership- and regulation-based relationships. This penetration often occurs through rational mechanisms—development, conservation, tourism, or administration. However, behind this technocratic language lies a process of standardizing ways of thinking about nature, values, and life. Below is a comparative table of the penetration of capital and state forces into the lives of indigenous communities, which will be discussed further in the subsequent sub-chapter.

Table 6. Comparison of Capital and State Penetration in Indigenous Communities

Aspect	Mentawai	Talang Mamak	Bara & Cindakko	Baduy & Kasepuhan
Form of penetration	HPH (Forest Concession Rights) + Resettlement	Plantations + Corporate Conservation	State conservation	State Conservation, Customary Bureaucratization + tourism
Dominant author	The State & logging companies	The State, corporations & conservation institutions	Central and regional governments	Central & regional governments as well as tourism operators
Logic of capital	Timber extraction	Agrarian expansion and “green capitalism”	Conservation economy	Conservation Economy, Cultural commodification

**Data source: processed from observations, in-depth interviews, and group discussions*

4.2 Capital and State Penetration as the Basis for the Exclusion of Indigenous Women

Development approaches that provide space for capital and nature conservation, on one hand, come with the intention of improving welfare, but at the same time, give rise to forms of social exclusion across the four indigenous communities. Indigenous peoples are marginalized due to the expansion of the extractive economy and the commodification of culture, which transform land, forests, and traditions into economic assets. Indigenous peoples, who once faced no difficulty in securing food, must now depend on markets that supply food.

Meanwhile, the younger generation is driven out of their communities due to the narrowness of local economic opportunities. The promises of development frequently only give birth to new inequalities: educational, health, and clean water services remain difficult to access, while state conservation and spatial planning restrict the community's access to their own sources of life. On the other hand, within social and political spaces, tradition is bureaucratized and detached from its spiritual value. A standardized language of development marginalizes local knowledge and disregards the experiences of indigenous women. The human-nature relationship, which was once based on responsibility, shifts into a relationship based on ownership and regulation. Today's exclusion no longer presents itself harshly,

but rather through a mindset that presumes nature, culture, and life can be regulated, measured, and controlled like any other development project.

Ecological degradation and local climate change within indigenous communities are the results of a combined pressure from capital, state conservation policies, and the severing of the human-nature relationship. The general pattern observed in Mentawai, Talang Mamak, Bara & Cindakko, and Kasepuhan & Baduy is the reduction of forest cover, which disrupts the water cycle, intensifies floods and droughts, and creates uncertainty regarding planting and harvesting seasons. In Mentawai and Talang Mamak, industrial expansion and conservation displace the community from their living spaces, disrupting planting systems and food sources. Meanwhile, Bara & Cindakko experience soil degradation due to intensive agriculture reliant on chemical fertilizers and pesticides. Conversely, the Kasepuhan & Inner Baduy regions face droughts and floods resulting from increasing deforestation in the surrounding areas. This reinforces the fact that local climate change is not merely a natural phenomenon, but a relational crisis born from the loss of balance between humans and nature. When traditional ecological knowledge is marginalized by the logic of capital and technocratic policies, the adaptive capacity of indigenous communities weakens, and disasters become increasingly frequent and destructive.

The penetration of capital, state interventions that frequently disregard the rights of indigenous peoples, and ecological degradation that accelerates local climate change have formed a pattern of social exclusion that is most intensely felt by indigenous women. In this context, women do not only face economic and ecological pressures, but are also constrained by socio-political structures that impede their ability to determine the life path and future of their communities. The combination of capital penetration, the state, and ecological degradation driving local climate change creates a form of social exclusion for indigenous women. This situation manifests clearly in three primary forms of exclusion: from the market, basic services, and political and social spaces.

Exclusion from the market occurs when indigenous peoples lose access to and control over the resources that have sustained their lives so far. Gender inequality in the agricultural economy—which existed long before climate change—is further exacerbated by extreme weather, because women have less access to land, capital, and decision-making. Consequently, they bear a double workload when food production is disrupted or when men migrate to seek additional income. In conditions of harvest failure, families shift to more expensive food consumption, causing the cost of living to rise and household food security to decline. The economic migration of the younger generation also reduces productive labor within the community, while simultaneously disrupting the sustainability of the customary economic system.

In the realm of basic services, exclusion manifests through a lack of access to clean water, health, education, and social protection that is sensitive to climate risks. When basic infrastructure is unavailable, women are forced to fill the vacuum with their own resources. During the dry season, they travel longer distances to obtain clean water, while floods frequently destroy fields and add to the burden of maintaining family food security. The location of indigenous communities within national parks or areas with geographical difficulties is often used as a reason by regional governments for not providing basic services, which are fundamental human rights as citizens.

Climate change also triggers various health threats, ranging from an increase in vector-borne infectious diseases such as dengue hemorrhagic fever, malaria, and chikungunya due to changes in temperature and humidity, to waterborne diseases like diarrhea that frequently emerge due to minimal sanitation post-flooding. Extreme heatwaves also cause heat stroke, dehydration, and high-grade fevers. Forest fires and deteriorating air quality increase cases of acute respiratory infections (ISPA) and asthma.

Additionally, disruptions to food production trigger nutritional insecurity, an increase in pathogens, and the risk of zoonoses (diseases transmitted from animals to humans). Beyond physical impacts, climate change also impacts mental health through chronic stress, trauma, anxiety, and depression, particularly for vulnerable groups living close to natural resources.

Political and social exclusion deepens this vulnerability when indigenous peoples are not recognized or are excluded from decision-making regarding resource management. Exploitative development policies—such as the expansion of forest concessions, extractive industries, and the designation of conservation areas—frequently disregard the spiritual and ecological relationship of indigenous peoples with their land. Amidst increasingly erratic seasonal patterns, traditional ecological knowledge loses some of its reference points, leaving the community more vulnerable to crop failures and declining productivity. When this connection is severed, the younger generation loses their customary learning space, and the process of inheriting ecological values is disrupted. Exposure to modern education and digital media also brings new values that sometimes contradict customary worldviews, thereby triggering identity crises and driving young people out of the community. In climate policies, indigenous women are rarely given space to contribute, despite possessing knowledge that is highly relevant to adaptation and sustainability strategies.

Despite being in a condition of layered exclusion, indigenous women and indigenous communities continue to demonstrate resilience. It is precisely from these pressures that the seeds of social inclusion emerge, growing through capacity, opportunity, and dignity. Their capacity is formed not only by the need to survive, but also from ecological creativity, social solidarity, and the wealth of local knowledge passed down across generations. Several forms of capacity held by indigenous women are as follows:

Ecological capacity: Customary agricultural systems such as the Pumonean agroforestry in Mentawai, leuweung larangan in Kasepuhan–Baduy, and mixed gardens (Rimpahan) in Talang Mamak and Bara-Cindakko demonstrate the community's ability to safeguard ecosystems while meeting food needs. This capacity is a response to market exclusion and climate change that threaten productive land, wherein the community develops a regenerative economic model based on natural balance.

Social capacity: The practice of mutual cooperation (gotong royong) to safeguard local food security, the enhancement of knowledge among women's farmer groups, and intergenerational solidarity strengthen social networks to confront climate disasters, droughts, and floods. In the midst of exclusion from basic services and gender inequality, social solidarity becomes a collective safety net for vulnerable indigenous families.

Adaptive capacity: Women integrate light modern techniques (crop dryers, moisture-resistant seed storage containers) to process agricultural and forest products; crop diversification, alternative livelihoods, and innovations in processing local food—such as sago flour or jengkol crackers—are a few examples carried out in indigenous communities. This capacity emerges as a response to market exclusion and the double burden caused by climate change, allowing women to maintain family food supplies while simultaneously opening up new economic opportunities.

Knowledge capacity: The revitalization of traditional knowledge, such as the customary planting calendar, rituals for natural balance, and reading weather signs, strengthens collective learning capacity between generations. This capacity becomes a way for the community to resist epistemic exclusion and the disruption of local knowledge caused by development policies that sever the human–nature relationship.

With the strengthening of this capacity, various forms of opportunity begin to open up—opportunities to participate, obtain economic benefits, and expand life choices amidst changing social and economic structures. Several forms of opportunities for indigenous women include the following:

Economic opportunity: Women's initiatives emerge in local entrepreneurship, such as weaving, basketry, processing non-timber forest products, and food products based on local resources. This opportunity strengthens the family economy while preserving cultural identity, serving as a form of resistance against market systems that are exploitative and gender-biased.

Participation opportunity: Women are beginning to get involved in farmer groups, customary forest management forums, and local climate policy advocacy spaces. This involvement expands women's participation in socio-political spaces that were previously closed, creating bottom-up inclusion.

Educational opportunity: The younger generation of indigenous people—particularly women—gain access to formal education and culture-based climate adaptation training. In the midst of limited public services, education becomes an important pathway to build new agency for the future generation of indigenous people. The awareness to attend school does not only belong to individuals but also receives support from customary leaders. Diminishing forest resources have made indigenous peoples realize the need to enhance their human resource capacity. However, this effort has not been maximized due to the economic limitations faced by indigenous peoples. It is rare to find children from indigenous communities who complete higher levels of education.

Social innovation opportunity: In all locations targeted by the research, we can witness a fairly striking change in the younger generation of indigenous people. Although they live in remote locations, this does not hinder them from keeping up with the latest developments, particularly through social media. On one hand, technology creates space to enhance knowledge capacity, but on the other hand, it can also uproot the younger indigenous generation from their own traditions and culture. For example, this relates to worldviews regarding resource utilization as well as the traditions and culture that have served as the identity of the indigenous community so far.

From these capacities and opportunities, a form of restoration of dignity emerges—a sense of worth, being respected, and recognized—which is vital for the sustainability of the lives of indigenous women and communities. Some of its forms include:

Cultural Dignity – Spiritual and Symbolic Leadership: Indigenous women continue to lead food rituals such as *Seren Taun* in Kasepuhan and *Punen* in Mentawai, ensuring that the spiritual meaning of tradition is not lost despite being commodified by tourism or state interventions. Their leadership affirms the role of women as guardians of the community's morals and sacredness.

Social Dignity – Negotiative and Communitarian Leadership: Indigenous women negotiate their positions within customary structures and lead through social trust, rather than formal office. They mobilize food management, ecological work, and community education as forms of social dignity that strengthen collective life.

Ecological Dignity – Care Leadership and Nature Ethics: Women safeguard forests, seeds, and water sources as a moral responsibility. This ecological leadership becomes a subtle resistance against resource exploitation, while simultaneously maintaining the spiritual relationship between humans and nature.

Generational Dignity – Transformative and Educative Leadership: Indigenous women act as intergenerational bridges: they encourage education, digital literacy, and environmental activism to

ensure customary values remain relevant. This leadership is transformative, combining tradition and technology for the sustainability of the community.

4.3 Ecological Degradation and Local Climate Change

Environmental changes across various indigenous communities demonstrate a similar pattern: the reduction of forest cover serves as the primary source of broader ecological shifts. In Mentawai, deforestation since the entry of the HPH (Forest Concession Rights) in the 1960s did not only clear timber, but also eliminated sources of food, spirituality, and identity as an indigenous community. The loss of natural vegetation accelerated land degradation, caused alternating seasons of floods and droughts, and altered climate patterns at the local level. The community's disconnection from the forest also caused them to lose the space to manage water sources and land, which had historically formed the foundation of their traditional life system.

A similar condition occurred in Talang Mamak, where the expansion of monoculture plantations and conservation policies displaced the community from their customary lands. In fact, the Talang Mamak Indigenous Community also has to compete for space in natural corridors with protected wildlife. If their fields are left unguarded, they will be raided by elephants. Such conditions could potentially create vulnerabilities in future food production. Another threatening aspect is the ban on shifting cultivation and land-burning practices—which have been practiced for generations—imposed by the government and corporations. Changes in land cover alter the balance of nature, eliminate food sources, decrease community welfare in utilizing non-timber forest products, and cause water catchment areas to narrow. This condition is further exacerbated by erratic weather, making it difficult for the community to determine the timing to begin cultivating the land, causing a decline in field yields and the availability of clean water, as well as an increase in flood disasters.

In the mountainous region of South Sulawesi, the Bara and Cindakko communities confront another complex form of ecological degradation. Although the forest generally still appears well-maintained, state conservation policies that restrict traditional management have conversely severed the long-established ecological balance. The ban on shifting cultivation practices not only halts the natural vegetation cycle and the maintenance of water sources, but also forces residents to shift toward sedentary agricultural systems dependent on chemical inputs. This new dependency threatens their ecosystems and livelihoods; the excessive use of chemical fertilizers and pesticides contaminates the soil and water sources, while the economic burden swells because they must allocate a significant portion of their income to purchase these inputs. A chain reaction is inevitable: water debit decreases drastically, the soil loses its natural absorption capacity and fertility, crop pests emerge, and the region becomes more vulnerable to droughts and erosion. Shifts in daily temperatures and erratic rainfall patterns, which are symptoms of local climate change, are no longer solely caused by deforestation, but rather by the severing of the mutualistic symbiotic relationship between humans and the forest.

Meanwhile, in Kasepuhan and Baduy, forest cover remains relatively good thanks to the *leuweung larangan* (forbidden forest) system, but they are beginning to feel trans-regional climate effects from deforestation, the emergence of factories, and gold mining in the surrounding areas. Seasons are shifting, droughts are prolonging, and agricultural productivity is declining. The forest indeed still stands, but its ecological resilience now depends on the broader landscape conditions outside the customary territory.

Field findings demonstrate that social changes and ecological degradation across various indigenous communities do not stand alone, but are intertwined within a single system of increasing vulnerability. The loss of forest cover, disruptions to the water cycle, and land-use shifts have accelerated the

emergence of recurring ecological disasters—floods, droughts, landslides, and seasonal uncertainty. On the other hand, the decline in the community's adaptive capacity due to diminished control over their living spaces and natural resources makes the impacts of climate change increasingly difficult to address.

Based on these conditions, this research utilizes the climate change risk assessment framework from the Intergovernmental Panel on Climate Change (IPCC) to understand the interconnectedness between exposure, sensitivity, and adaptive capacity within each community. This approach enables a more comprehensive evaluation of how ecological degradation and social change reinforce climate risks at the local level.

In brief, the assessment process begins by identifying specific climate hazards that threaten particular communities. In the context of indigenous peoples, these hazards encompass extreme weather, changes in rainfall patterns and amounts, droughts, floods, and pest infestations for the agricultural sector, as well as changes in sea temperatures and sea-level rise for the traditional capture fisheries sector. This step does not merely record these threats, but also analyzes their likelihood, intensity, and the geographic reach of their impacts, thereby providing a comprehensive climate hazard map.

The next step is the impact assessment, which analyzes the consequences of these hazards by looking at the interaction of three components: hazard, exposure, and vulnerability. The vulnerability of indigenous peoples is unique; on one hand, they possess high sensitivity due to their dependence on natural resources, limited mastery of technology, and minimal livelihood diversification. Yet on the other hand, they possess an adaptive capacity rooted in local wisdom, such as traditional ecological knowledge in natural resource management (for instance, the Pumonean agroforestry in Mentawai or the forbidden forests in Baduy-Kasepuhan), and mutual cooperation (gotong royong) practices that reinforce their resilience.

It must be acknowledged that since ancestral times, indigenous communities have demonstrated resilience and innovation in adapting to their surrounding nature. However, in the context of climate change, it appears that indigenous communities need assistance to recognize the impacts of ecological shifts that can no longer be predicted using the traditional methods they have historically relied upon. Stilt houses that could previously withstand flood conditions are no longer adequate today because the scale and intensity of current floods are higher than those stilt houses. Ecological destruction also leaves indigenous communities highly vulnerable to crop failures and the threat of starvation due to increased pest and disease attacks, as well as government restrictions on traditional land cultivation practices.

It is from the synthesis of these three elements that primary climate risks can be determined. The resulting impacts include a decline in agricultural productivity, economic losses, and threats to food security and health. Overall, the greatest risk is the rise of poverty, social vulnerability, and environmental degradation that erodes their livelihoods and cultural practices. Therefore, efforts to mitigate these risks must focus on strengthening local adaptation capacity by supporting existing traditional wisdom, while reinforcing it with access to technology, information, and the recognition of the rights of indigenous communities.

Climate change tangibly undermines the foundations of indigenous community life, starting from fundamental aspects such as food, clean water, and health. The uncertainty of seasonal patterns disrupts planting and harvesting times, threatening food security. Various observed health risks include heatstroke, dehydration, and heat stress resulting from heatwaves—particularly for vulnerable groups such as the elderly, pregnant women, children, and outdoor workers. Meanwhile, floods and stagnant water increase the spread of diseases such as dengue hemorrhagic fever, malaria, skin diseases, and

diarrhea; droughts worsen sanitation issues and the availability of clean water; and deteriorating air pollution from haze and land burning further exacerbates respiratory illnesses and premature mortality.

Moreover, these shocks ripple into the ecological and socio-cultural aspects that constitute their identity. Ecosystems and biodiversity, which are the foundations of their lives, are disrupted. Most concerning is the threat to indigenous knowledge itself. Seasonal calendars and marine navigation systems passed down by ancestors for generations are now losing their accuracy and relevance. Indigenous communities now face increasing difficulty in maintaining their traditional practices, indicating a cultural crisis triggered directly by climate change. The following section maps the results of the climate change risk assessment across the four indigenous communities in the research locations to observe the extent to which each region confronts interacting ecological and social pressures in shaping local climate risks.

Table 7. Analysis of Climate Change Risk Components

Risk Component	Indigenous Community: Mentawai	Indigenous Community: Talang Mamak	Indigenous Community: Bara & Cindakko	Indigenous Community: Baduy & Kasepuhan
Hazard	Floods Droughts Extreme Temperatures Sea Level Rise	Floods Droughts Forest & Land Fires Extreme Temperatures	Droughts Landslides Strong Winds High Rainfall Extreme Temperatures	Floods Droughts Erratic Rainfall Patterns Extreme Temperatures
Exposure	Households relying on agriculture, capture fisheries & natural resources Communities living along riverbanks and coastal areas	Households relying on agriculture & natural resources Communities living or owning fields along riverbanks	Households relying on agriculture & natural resources Communities living in hilly highlands with stilt house architecture made of wood that are frequently shaken by strong winds	Households relying on agriculture & natural resources

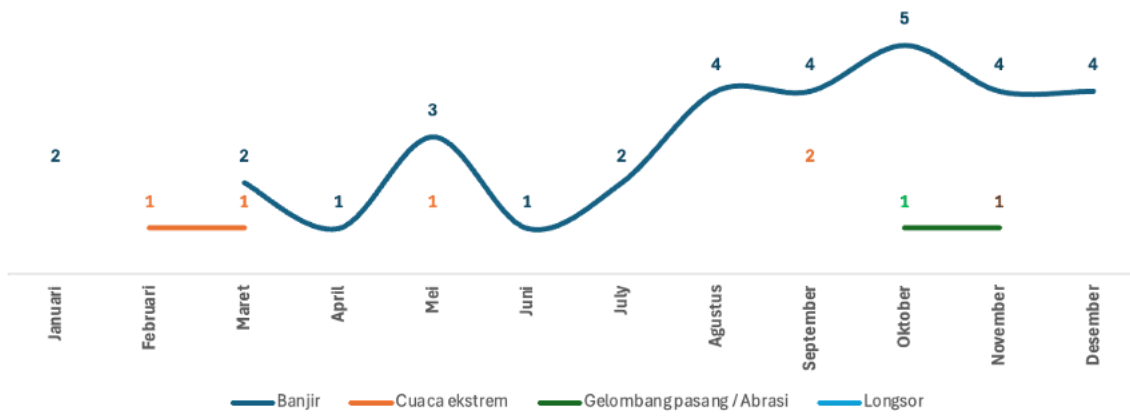
Risk Component	Indigenous Community: Mentawai	Indigenous Community: Talang Mamak	Indigenous Community: Bara & Cindakko	Indigenous Community: Baduy & Kasepuhan
Vulnerability (who, where, within what kind of system)	Communities with limited access to climate information, early warning systems, and adaptive infrastructure Indigenous peoples who are poor, unschooled or have low literacy, indigenous women, the elderly, toddlers, infants, children	Same as above	Same as above	Same as above

*Data source: processed from observations, in-depth interviews, and group discussions

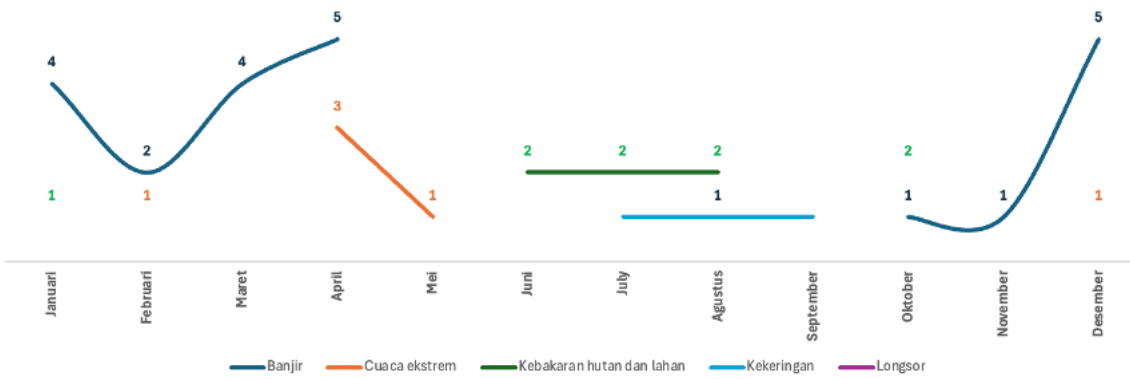
Data from the National Disaster Management Authority (Badan Nasional Penanggulangan Bencana / BNPB) provides a clear picture that what indigenous communities have been experiencing so far—such as increased rainfall intensity, erratic weather patterns, prolonged droughts, and increasingly frequent floods—is not merely storytelling, but scientifically proven facts. The intensity of natural disasters even occurs throughout the year with an unprecedented scale of devastation. The following outlines the patterns of natural disasters occurring in the locations of the indigenous communities.

Chart 4. Natural Disaster Patterns in Research Target Locations From 2009–2024

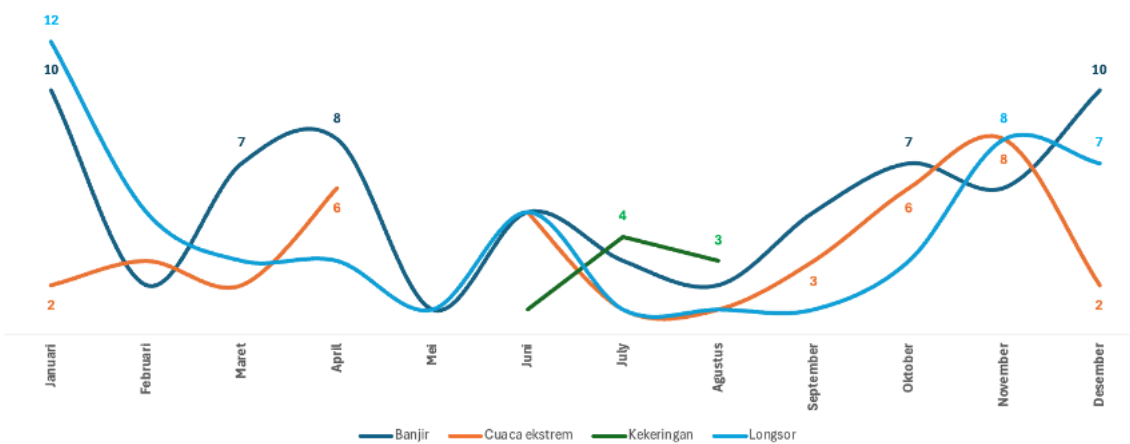
Kabupaten Kepulauan Mentawai



Kabupaten Tebo



Kabupaten Lebak



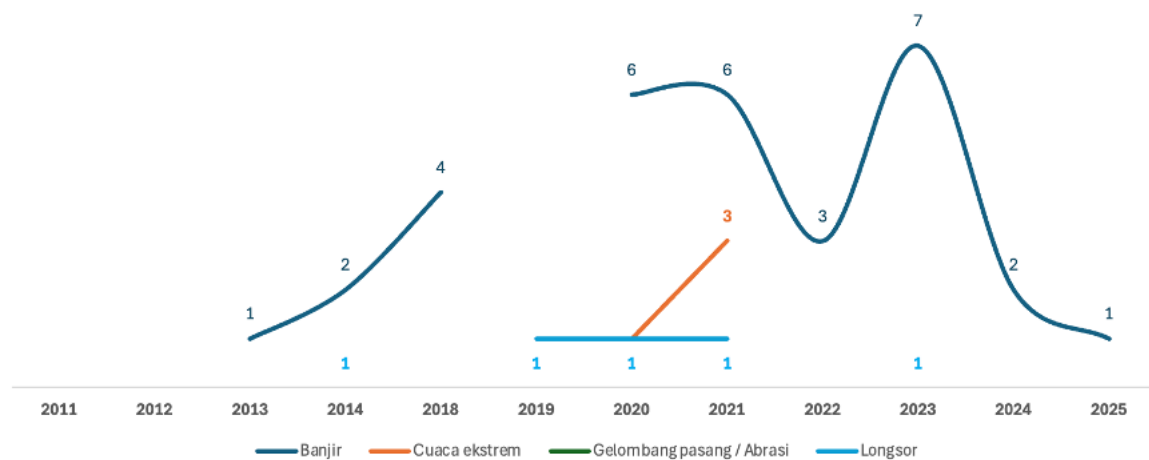
*Data Source: National Disaster Management Authority

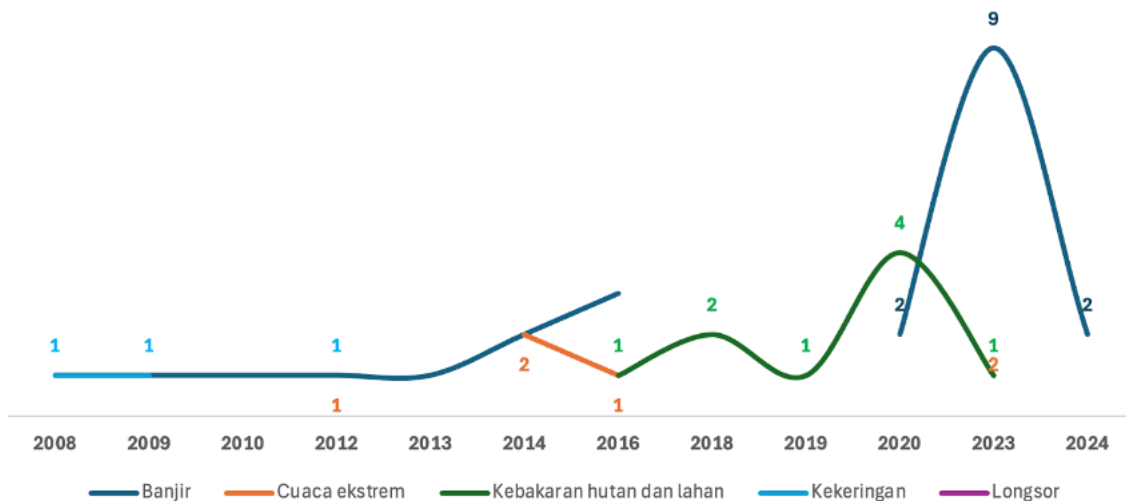
The disaster pattern data above indicates the vulnerabilities faced by indigenous communities at all times, given that the risk of disaster events occurs almost all year round. This condition undoubtedly demands preparedness from indigenous communities to adapt to these circumstances. Considering the habits of indigenous peoples, who have not yet fully recorded or documented natural disaster events in writing, assistance is required to help explain the shifting patterns and intensities of these natural disasters. Another equally important aspect is the strategy employed to adapt to these conditions. For instance, given the intensity of flood disasters and the rising water levels during floods, the stilt house structures owned by indigenous peoples are deemed no longer adequate to withstand such disasters. The same applies to the context of forest and land fires.

1. Floods Occurring Throughout the Year

According to BNPB records, floods are the most frequently occurring disaster in the research areas, such as the Mentawai Islands and Tebo Regency. In Mentawai, an increase in flooding began to be felt in 2018 and reached its peak in 2023. Meanwhile, in Tebo Regency, major floods recurred almost every year, with 2024 recorded as the most severe. Floods in Malancan Village and other areas in Mentawai used to only occur during the rainy season; however, currently, floods also happen during the dry season. This indicates that the forest's function in absorbing and retaining water has been damaged. Rainwater is no longer stored in the soil but flows directly into residential areas. The following is the disaster event data compiled over a specific period in the Mentawai Islands and Tebo.

Chart 5. Natural Disaster Events in the Mentawai Islands & Tebo Regencies

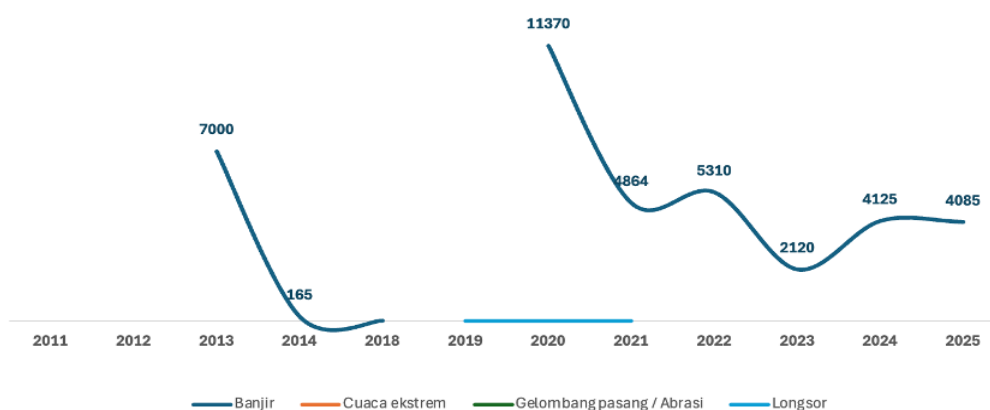


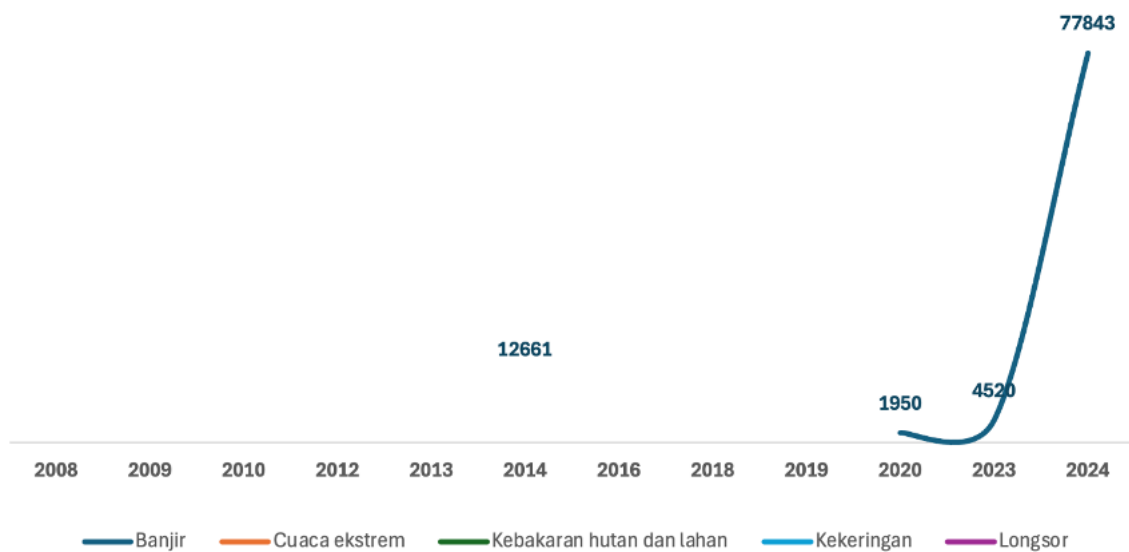


*Data Source: BNPB

The rising intensity of natural disasters also impacts the increasing number of people affected by them. While disaster events previously only affected residents living along riverbanks, the scale of natural disasters has now expanded significantly. In 2021, more than 11,000 people in the Mentawai region were affected by floods. Meanwhile, in Tebo Regency, major floods recurred almost every year, and 2024 was recorded as the most severe, with more than 77,000 people affected. The following presents the data regarding the number of people affected by natural disasters in the Mentawai Islands and Tebo Regencies.

Chart 6. Number of Victims Affected by Natural Disasters in the Mentawai Islands and Tebo Regencies



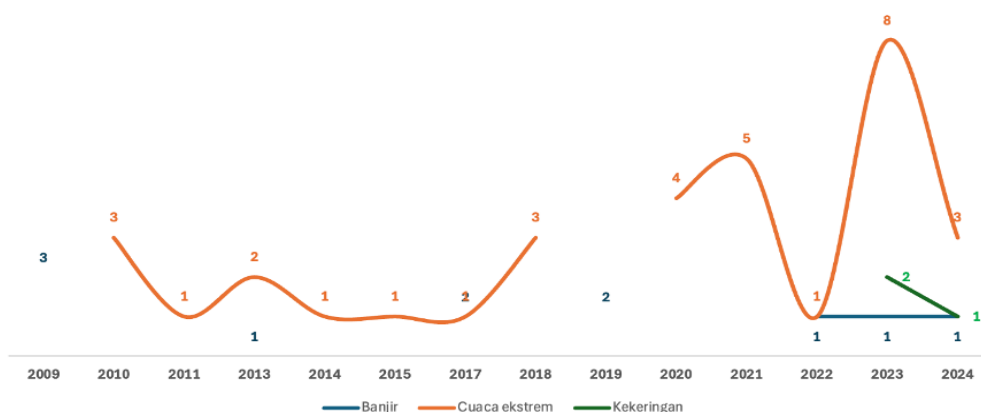


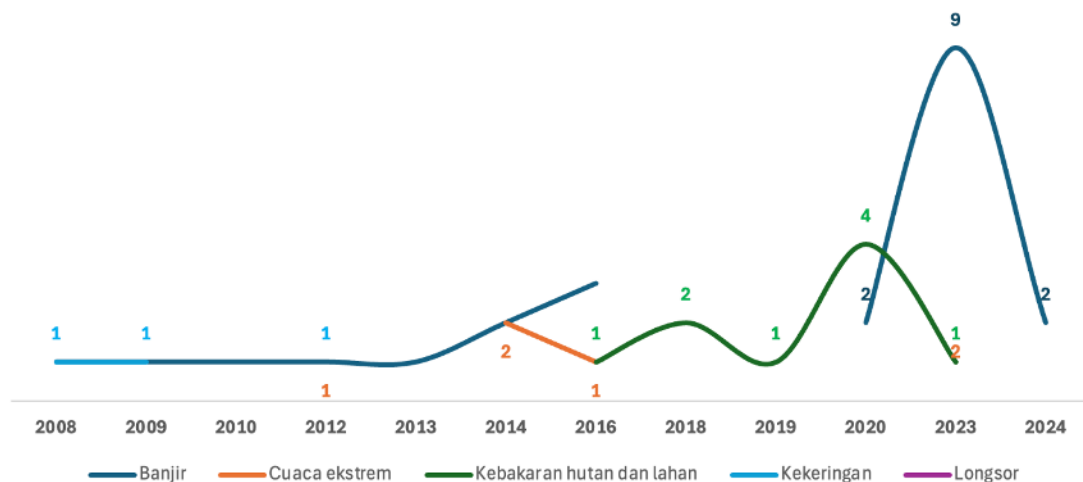
*Data Source: BNPB

2. Worsening Droughts and Fires

In addition to flooding, droughts and forest fires have also become increasingly frequent, particularly in regions such as Tebo and Maros. In Tebo, forest fires frequently occur during prolonged dry seasons, resulting in the loss of agricultural land and the destruction of river ecosystems. BNPB notes that the primary cause of drought is not solely the extended dry season, but also the loss of forest cover and sand mining upstream. For example, the Kemumu River, which once served as a source of clean water, is now experiencing shallowing due to sand sedimentation from deforested areas.

Chart 7. Natural Disaster Events in Maros and Tebo Regencies

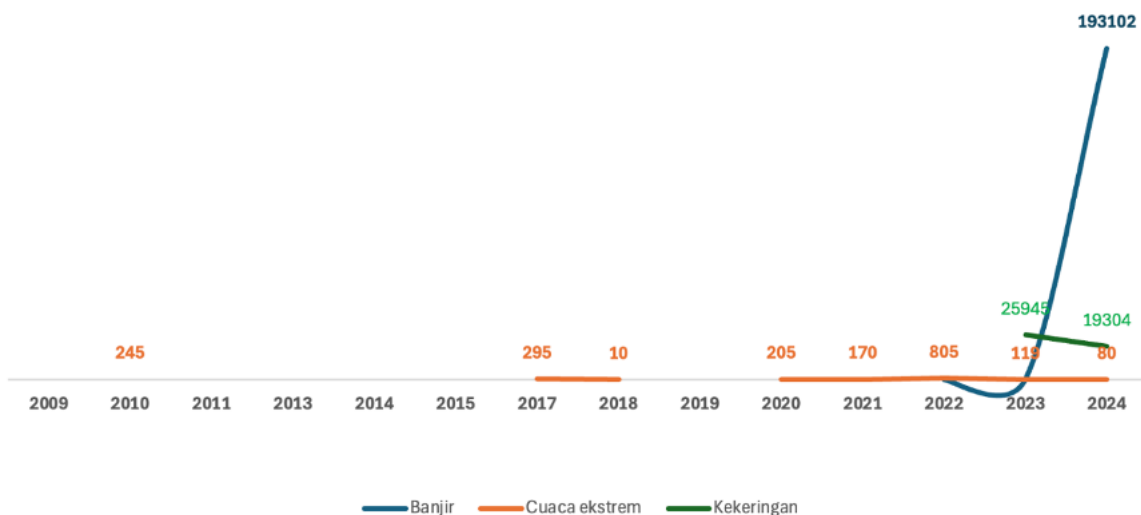




*Data Source: BNPB

Although the number of people affected by natural disasters in Maros remains relatively low from year to year, it can cause severe impacts during specific periods. For instance, the drought disaster recorded in 2023–2024 left approximately 40,000 people affected. Similarly, the flood disaster that occurred in 2023 affected a population reaching up to 192,102 people.

Chart 8. Number of Victims Affected by Natural Disasters in Maros Regency



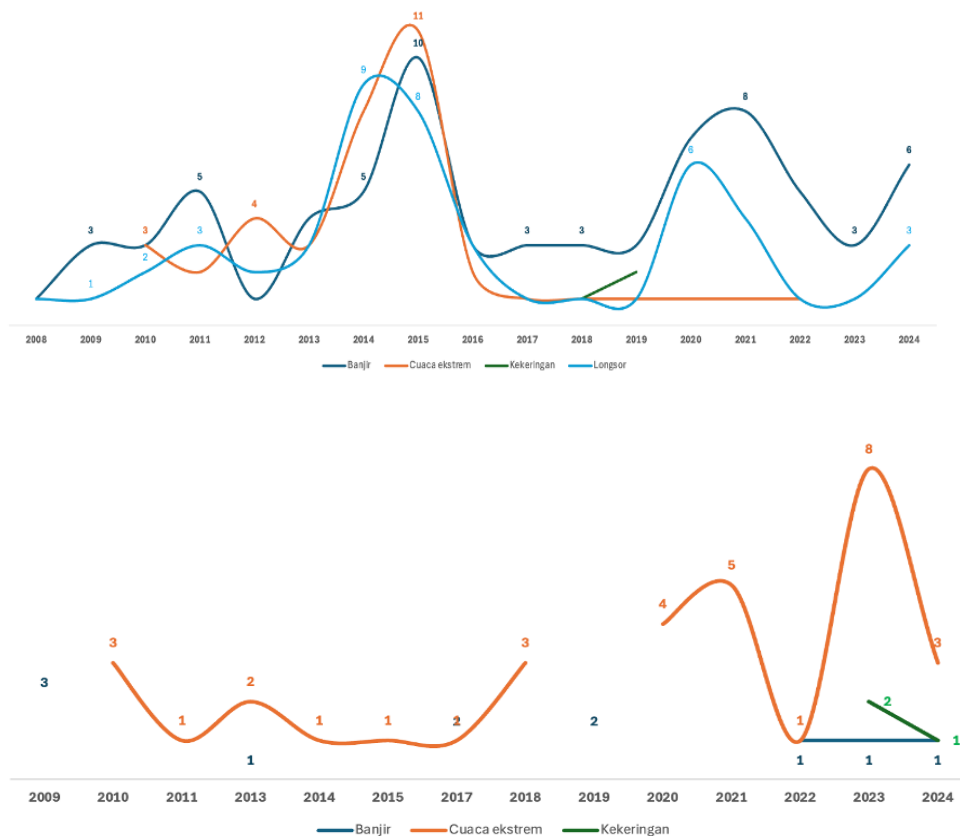
*Data Source: BNPB

3. Extreme Weather and Strong Winds in Mountainous Regions

In mountainous regions such as Bara and Cindakko (Maros) and Lebak (Banten), strong winds and extreme heat have emerged as new challenges. Strong winds do not only damage stilt houses, but also reduce the production of forest honey and palm sugar because many blossoms are shaken loose. In Lebak, a combination of floods, landslides, and droughts occurs almost every year. BNPB data

highlights 2015 and 2021 as the most severe periods for Lebak, during which the intensity of extreme weather and droughts escalated sharply. The following presents the disaster data occurring in Lebak & Maros Regencies.

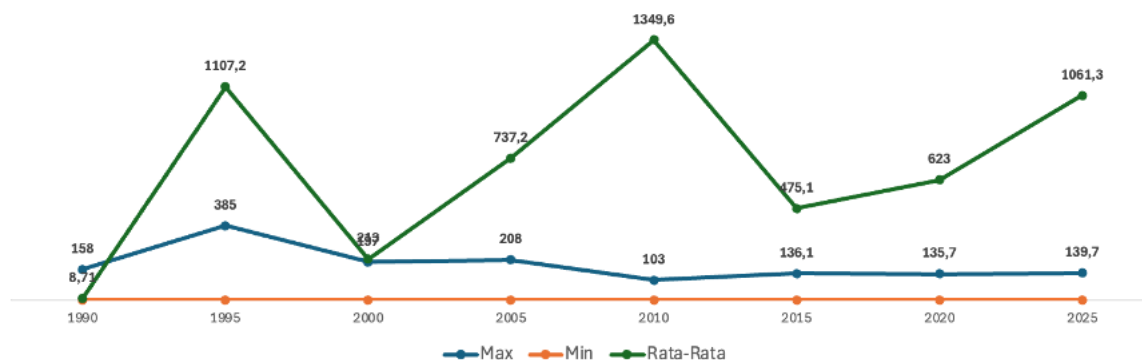
Chart 9. Natural Disaster Events in Lebak and Maros Regencies



*Data Source: BNPB

BNPB and BMKG have recorded an increase in high rainfall and extreme heat across nearly all research areas. In Maros, for example, BMKG data shows annual rainfall exceeding 1,000 mm; in fact, by 2025 (with data only available up to September), the figure had already surpassed the annual average threshold—indicating a wet drought, a condition where rain falls even during the dry season.

Chart 10. Rainfall Intensity in Maros Regency (ml)



**Source: BMKG*

**Note: For the year 2025, data is only available up to September*

This data reinforces what indigenous communities have been recounting: that nature has changed. Planting seasons can no longer rely on natural signs such as wind direction or the sounds of insects. Sudden rainfall can destroy fields, while prolonged droughts cause water sources to dry up.

The data from BNPB and BMKG does not only validate the experiences of indigenous peoples, but also proves that local climate change is real and happening right now. What was once only felt physically through the body—more intense heat, erratic rain, receding water—is now proven through figures and charts. In other words, science and community experience speak the same truth: that the earth is changing, and those who live closest to nature are the very first to feel it.

4.4 Living Economy versus Death Economy

Capital penetration into indigenous territories and rural areas often comes with the promise of modernization, development, and economic growth. However, the influx of this external capital not infrequently causes environmental degradation and vulnerability to local climate change. Forests are cleared, mixed gardens are replaced with monocultures, and traditional food systems are disrupted, leaving local communities facing the risk of losing their ecological and social resilience.

Amidst these pressures, community resilience—whether through traditional recovery practices (bouncing back), adaptive innovation (bouncing forward), or efforts to empower marginalized groups (centering the margins)—becomes a critical mechanism for sustaining livelihoods. These practices demonstrate that local communities do not merely survive, but are also capable of reflecting on and renegotiating their relationship with nature and the economy.

From the field findings, indigenous communities are currently confronted with two opposing modes of economy. The death economy pursues rapid accumulation and resource exploitation, frequently disregarding social welfare and ecological health. Within this system, women—who traditionally manage food, mixed gardens, and ecological rituals—are often pushed into marginal positions, losing control over resource access and economic decisions.

Conversely, the living economy emphasizes the interdependent relationship between humans, nature, and the community. Sustainability, socio-ecological values, and regeneration lie at the core of economic practices. Here, women are not merely domestic actors, but also guardians of socio-ecological systems and adaptive innovators. Through local resilience practices—the recovery of tradition (bouncing back),

new innovations (bouncing forward), and the empowerment of marginalized groups (centering the margins)—women play a strategic role in renegotiating the relationship between the economy, society, and nature.

From field observations and the preceding descriptions, it is evident that the lives of women in indigenous communities are always closely linked to the management of shared or collectively enjoyed resources (the commons), food systems, rituals, and social solidarity. The spectrum of resilience shows how women play a strategic role in navigating ecological, social, and economic challenges. This section will focus on the role of women, the management of the commons, collective economics, rituals, and leadership transformation in order to understand the community's capacity to shape a living economy.

In Mentawai, most of the forests have been depleted, leaving the community dependent on mixed gardens, rivers, and the remaining land to sustain daily life. Under these conditions, women become central actors in managing the commons, including sago and mixed gardens that form the basis of household food. They are fully involved in all stages of garden management, from planting and maintenance to harvesting and distribution. This practice demonstrates an adaptive capacity: its primary focus is maintaining survival and food security despite increasingly limited ecological resources. The *punen* ritual, which is still practiced, reaffirms the harmonious relationship between humans and nature, while also marking the eco-spiritual economy dimension that is an inseparable part of local economic activities. Solidarity and the collective economy are clearly visible in the mutual cooperation (*gotong royong*) for harvesting and distributing garden yields among families, serving as a resilience mechanism against economic pressures and disasters. Although regenerative capacity is limited due to ecological conditions, women are beginning to negotiate access to land and the management of rituals, marking the beginning of a new leadership transformation that expands their space within the Mentawai socio-ecological system.

Unlike Mentawai, Talang Mamak still possesses relatively intact lowland forests, rivers, and fields, so the capacity of the living economy appears more diverse. Women are actively involved in managing fields and forest products, preserving local seeds, and applying traditional ecological knowledge, such as crop rotation, regulating planting seasons, and utilizing medicinal plants. These practices allow the community to adjust to environmental changes, affirming the adaptive dimension of the living economy. Solidarity and the collective economy emerge through the sharing of field and forest yields among families, which not only ensures food availability but also builds a social safety net when crises occur. Some women are beginning to lead sustainable field management, demonstrating regenerative potential as well as a new leadership transformation that strengthens the role of women in resource-related decision-making. The ritual of offering field yields to the ancestors affirms the eco-spiritual economy dimension, showing the interconnection between economic production, spirituality, and ecological responsibility.

Through the Rimpahan Palorien Simarintihan Women Farmers Group, they pioneer income diversification by collecting and selling non-timber forest products. Although the path to the market is often literally blocked by herds of elephants whose habitat is shrinking and fragmented, indigenous women persistently carry out this role to ensure their families survive. These adaptive practices are not merely survival strategies, but are a tangible manifestation of a "living economy" that centers on life, rather than profit alone.

In Bara & Cindakko, community life depends on the forest, rivers, and community gardens, all of which form the basis for managing the commons. Women are involved in work rotation, garden management, and the oversight of rituals, ensuring the continuity of ecological and social knowledge. The practice of sharing garden yields and internal support among community members shapes a collective economy

that maintains food and social security. Some women are involved in community decision-making, marking a new leadership transformation that strengthens the interconnection of humans, nature, and the community. Food rituals and offerings affirm the eco-spiritual economy dimension, while simultaneously maintaining the socio-ecological balance at the local level. The living economy spectrum in Bara & Cindakko encompasses adaptive capacity, collective solidarity, and regenerative potential, although the level of capacity varies across different groups.

Kasepuhan Jamrut or Inner Baduy demonstrates a stronger living economy capacity because the forest, rivers, customary land, and mixed gardens are still preserved. Women play a central role in managing gardens, medicinal plants, and water sources, while safeguarding the ecological knowledge that sustains the local food system. Their activities include adapting to climate and environmental change, as well as participating in social solidarity networks and the collective economy, which includes harvest sharing and mutual support among families. Annual rituals and food offerings affirm the interconnection between the economy and spirituality, forming an eco-spiritual economy that is integral to daily life. The transformation of women's leadership is beginning to manifest through their involvement in community projects and resource management, marking a more tangible regenerative capacity. Food systems, forest management, and solidarity practices mutually reinforce each other, underscoring how the living economy in Baduy operates as a complex and interconnected socio-ecological ecosystem.

Table 8. Living Economy and Death Economy Analysis Framework

Aspect of Analysis	Mentawai	Talang Mamak	Bara & Cindakko	Kasepuhan & Baduy
Commons (Roots/sources of life: forests, water, soil, land, seeds, gardens)	Forest is nearly depleted; relying on mixed gardens, sago, rivers, and remaining land	Forest is nearly depleted; relying on fields & rimpahan, rivers undergoing sedimentation processes	Forest, rivers, customary land, local seeds, and community gardens still exist	Conservation forest, rivers, customary land, and mixed gardens remain preserved
Women's Practices in Managing the Commons	Managing mixed gardens, collecting & processing non-timber forest products, harvesting, and distribution; maintaining household	Managing fields and collecting non-timber forest products; preserving local seeds; planting adaptation and utilization of medicinal plants	Involved in work rotation, garden management, seed storage, and ritual oversight	Managing gardens, medicinal plants, and water sources; preserving traditional food systems

Aspect of Analysis	Mentawai	Talang Mamak	Bara & Cindakko	Kasepuhan & Baduy
	food availability			
Ecological Knowledge and Women's Spirituality	Safeguarding the punen ritual and local knowledge related to gardens and sago	Knowledge of crop rotation, planting seasons, and medicinal plants; interconnection of rituals with field yields	Safeguarding ecological and social knowledge; food offering rituals as reinforcers of socio-ecological balance	Safeguarding local ecological knowledge; annual rituals and food offerings
Food Systems and Livelihood Resilience	Focusing on household food security through mixed gardens	Food security through fields, forests, and local seeds	Food security through gardens, paddy fields inside & outside the forest, work rotation, and seed exchange	Traditional food systems that support local resilience
Rituals and Spiritual Economy (Eco-Spiritual Economy)	Punen ritual as a form of eco-spiritual economy	Offerings of field yields to ancestors	Rituals and food offerings affirming economic-spiritual and socio-ecological interconnections	Annual rituals and food offerings
Collective Economy and Solidarity	Mutual cooperation (gotong royong) in harvesting and distributing garden yields among families	Sharing field/forest yields among families; social safety nets	Sharing garden yields, seed exchanges, and internal support among community members	Social solidarity and collective economy through harvest sharing and mutual support among families

Aspect of Analysis	Mentawai	Talang Mamak	Bara & Cindakko	Kasepuhan & Baduy
Resilience against Crises (Ecological & Social)	Adaptation to resource limitations; negotiating land access and rituals, as well as pioneering resistance through social media	Adaptation to environmental changes; some practices are beginning to become regenerative	Adaptation to local conditions; some practices are regenerative; transformation of women's leadership strengthens the socio-ecological system	Adaptation to climate change; tangible regenerative capacity through resource and food system management
Conflict and the Marginalization of Women	Women's capacity is constrained by ecological conditions and social structures	Women are beginning to take on roles, but formal limitations still exist	Women are active in decision-making, but the capacity of each village group varies	Women are beginning to get involved in community projects; higher strategic involvement
Transformation and New Leadership	Women are beginning to negotiate access to land and rituals	Some women lead sustainable field management	Women lead several aspects of community management, strengthening human-nature relationships	Involvement of women in community projects and resource management
Emerging Form of Living Economy	Adaptive and collective solidarity; limited regenerative	Adaptive to beginning to become regenerative; strong collective solidarity	Adaptive, collective solidarity, partially regenerative; transformation of women's leadership is prominent	Adaptive, collective solidarity, and tangibly regenerative

**Data Source: Observation, In-depth Interviews, Group Discussions*

Field analysis shows that the living economy does not emerge as a single practice, but rather as a complex spectrum that affirms the role of women as guardians and innovators of the socio-ecological ecosystem. Women are not merely domestic actors; they mediate the relationship between humans, nature, and the community through the management of the commons, food systems, rituals, and collective solidarity. The spectrum of resilience—the recovery of tradition (bouncing back), adaptive innovation (bouncing forward), and the empowerment of marginalized groups (centering the margins)—demonstrates women's capacity to maintain sustainability while renegotiating an economic order often dominated by the death economy.

The living economy, in this context, emerges across several interconnected dimensions: first, the adaptive capacity of women to maintain food and ecological sustainability amidst external pressures; second, solidarity and the collective economy form social safety nets that reinforce community resilience; third, rituals and the eco-spiritual economy affirm the interconnection between the economy, spirituality, and ecological responsibility; fourth, the transformation of women's leadership opens up space for regenerative practices that challenge the socio-economic structures that place them in marginal positions.

This living economy spectrum also highlights the varying capacities across communities. Under conditions of resource limitations, the living economy persists through adaptive innovation and collective solidarity, despite limited ecological regeneration. On the other hand, communities with greater access to forests, local seeds, and mixed gardens exhibit a more tangible regenerative capacity, with women leading the decision-making that strengthens the socio-ecological ecosystem. This variation confirms that the living economy is not merely a response to external pressures, but a strategic practice by women that asserts a harmonious relationship between humans, nature, and the community, while building a viable alternative to the exploitative death economy.

In other words, the living economy showcases the rich practices of women: they manage the commons, uphold collective solidarity, maintain eco-spiritual rituals, and build regenerative capacity—all functioning to sustain socio-ecological continuity and open up possibilities for structural transformation. This perspective demonstrates that women are not merely passive actors, but the architects of the living economy, navigating the tension between capital accumulation and community sustainability while constructing an economic system that nurtures life.

4.5 Indigenous Women's Resilience Strategies: Reconciling the Past and the Future

The dynamics of local climate change and ecological degradation demonstrate that pressures on the socio-ecological systems of indigenous peoples are becoming increasingly complex. Yet, beneath these conditions, the community's capacity to adapt and reorganize its life emerges. Resilience is the result of the interaction between the community's internal strengths (social capital, cultural values, and local knowledge) and a dynamic external context encompassing policies, economics, and the environment. Thus, the resilience of indigenous peoples against climate change cannot be separated from their ability to navigate external pressures while maintaining their identity and value systems. This is what Atallah (2019) refers to as relational resilience. In other words, relational resilience is the ability to endure through relationships—not just through resources. It connects social, spiritual, and ecological aspects into a single living system.

Indigenous women across the four communities serve as the most visible face of socio-ecological resilience. They directly bear the impacts of forest loss, declining water debit, and diminishing food sources, yet they also stand at the forefront of maintaining life's balance through domestic, spiritual, and communal work. From the experiences of women in Mentawai, Talang Mamak, Bara & Cindakko,

as well as Baduy & Kasepuhan, resilience does not manifest merely as ecological guardianship, but as daily practices that combine recovery, adaptation, and transformation.

Mentawai: A Revolution Starting from the Kitchen to the Digital World

In Mentawai, women have become the guardians of life amidst massive changes that began with the introduction of resettlement programs and HPH (Forest Concession Rights) in the late 1960s. The loss of the forest shook the social, traditional, and spiritual systems centered around the *uma* (customary house) and the values of Arat Sabulungan. However, amidst this upheaval, indigenous women stepped forward as the primary pillars sustaining the continuity of life.

In the context of social and ecological change, while many men were driven to work in the timber industry sector or migrated to the mainland of Sumatra island, indigenous women took on strategic roles that transcended conventional domestic functions. Braving the depths of the forest (which in older perspectives was regarded as the "dark world" due to its perils), they strived to secure household food diversity by catching fish, gathering marsh clams (*lokan*) and woodworms (*toek*), tending to livestock, and collecting non-timber forest products. Activities such as foraging for sago in the remaining forests, planting bananas and taro in new plots, and preserving food processing rituals did not merely restore the food supply chain, but also reorganized the social space of the *uma* and maintained customary rituals. It is worth noting that all these recovery efforts were born out of loyalty to customs and local wisdom, rather than external interventions, thereby demonstrating an authentic and sustainable cultural resilience amidst the pressures of change.

In the context of economic shifts, women also adapted by adjusting to new systems without losing their cultural roots. Some young women began to engage in informal economic activities, such as handicrafts and care services, while continuing to carry customary symbols into their daily lives. They learned to negotiate with the new world, yet steadfastly asserted that their identity remains anchored in a spiritual relationship with nature.

At a time when the Arat Sabulungan value system is weakening in the public sphere, women act as the custodians of custom—reviving the meaning of balance through spiritual practices and social solidarity. In small rituals or traditional healing practices still conducted within the *uma*, they nurture not only the human body but also the body of nature. The resilience of Mentawai women is not just an ability to survive, but a form of gentle resistance against cultural and ecological dislocation. They serve as a bridge between a wounded past and a future that must be reinvented.

Within the patrilineal social system of Mentawai, men are the inheritors of land, fields, and the *uma*—the customary house that serves as the center of social-spiritual life. Women formally hold no inheritance rights, and upon marriage, they relocate to the *uma* of the husband's family. Yet behind these structural limitations, women are by no means entirely passive. They hold vital roles in maintaining the sustainability of daily life: managing food, regulating water, and sustaining social networks between *uma*. Through domestic work that is inherently ecological and social, women build new spaces for negotiation outside the formal structures of custom. These spaces form the foundation of women's leadership on a micro-scale—a leadership characterized not by titles, but by the capacity to maintain life's balance amidst crisis.

Mentawai women demonstrate survival strategies by utilizing the family economy as their arena. In Saureinu and Malancan villages, mothers process garden yields into marketable products such as *jengkol* crackers, dried bananas, and ready-to-sell areca nuts. They also cultivate *toek* (*Tubifex* sp.), a high-protein water worm that serves as both a food source and a source of supplementary income. These activities are not driven by external actors, but by local creativity responding to the family's basic needs.

This practice demonstrates that the household economy is not merely a domestic activity, but a space for adaptive leadership that sustains community resilience amidst ecological uncertainty.

The climate crisis imposes layered burdens on Mentawai women: they must search for water during droughts and replant when floods devastate their fields. Yet amidst these pressures, an ecological intelligence rooted in local knowledge emerges. They cultivate local weather-resistant crops such as taro, sweet potatoes, and bananas that do not depend on chemical fertilizers. This mixed cropping pattern is not just an agrarian strategy, but a form of socio-ecological adaptation that safeguards land and food sustainability. In this context, women do not merely survive, but also lead the process of ecological transformation based on indigenous knowledge.

When policies and markets fail to protect the community, Mentawai women build forms of social solidarity rooted in empathy and mutual cooperation. In Saureinu, small groups of women take turns managing gardens and cultivating *toek*, with the yields distributed based on need rather than labor contribution. This solidarity functions as a community of care—a nurturing network that strengthens the position of women as guardians of social stability amidst crisis. Through collective work, they reinforce ties between *uma* and create alternative food distribution systems outside formal market mechanisms. This practice highlights the collaborative leadership of women born out of the values of *muturuk* (cooperation) and *sailale* (mutual assistance), two social ethics that have long sustained Mentawai life.

The younger generation of Mentawai is now articulating their leadership through digital spaces. In Sirilanggai and Saureinu, teenage girls create videos about floods and forest destruction caused by logging, then disseminate them on social media using widely circulated hashtags to make them easily discoverable by search engines, such as: #SelamatkanMentawai (#SaveMentawai), #MentawaiBukanPulauKosong (#MentawaiIsNotAnEmptyIsland), #HutanMentawai (#MentawaiForest), #SaveHutanSiberut (#SaveSiberutForest), and #SaveSipora. They transform customary narratives into public ecological messages, connecting local issues with global awareness. This digital activism represents a form of the politics of empathy—a new way for women to negotiate their voices within the public arena without abandoning their cultural roots. They do not only carry forward ancient customary values regarding nature protection, but also modernize them into environmental advocacy grounded in lived experience and solidarity.

From an outside perspective, the work of Mentawai women is often deemed domestic and apolitical. However, in the context of climate change and ecological vulnerability, domestic work becomes a tangible form of socio-ecological leadership. Planting, processing garden yields, safeguarding water, and performing micro-rituals in the *uma* are daily political acts that sustain community continuity. As stated by RS, a female Sikerei (shaman/healer) in Malancan, “We might not sit in meetings, but we know how to keep this house alive.” This sentence encapsulates a women's leadership that relies not on power, but on knowledge, care, and responsibility toward life. Through their hands, the socio-ecological resilience of Mentawai keeps beating—teaching us that true leadership is born from the work of nurturing, not commanding.

The description of indigenous Mentawai women shows that resilience springs from their ability to negotiate living spaces amidst ecological crises and social change. While customary structures and development policies relegate women to subordinate positions, they utilize the domestic sphere as an arena for ecological leadership—regulating food, safeguarding water, and creating micro-economic innovations like *toek* cultivation. In situations where nature is no longer stable and markets increasingly dictate life, women act as regulators of the balance between household needs and ecosystem sustainability.

They do not merely survive, but also adapt creatively through solidarity networks, crop rotation of extreme-weather-resistant local plants, and even digital transformation. From kitchens and gardens to cyberspace, Mentawai women construct a hybrid form of culture—merging customary values, ecological spirituality, and modern technology to safeguard life. In this context, women's resilience is not just an ability to endure, but a form of grassroots leadership that asserts the role of women as the primary anchors of Mentawai's social and ecological sustainability.

Talang Mamak: Between Dependency and Loyalty to Custom

Talang Mamak women live amidst two powerful, opposing forces that equally restrict their living space: corporate plantation expansion and state-corporate conservation. Plantations convert forests into industrial estates, while conservation cuts off access to ancestral lands. In this situation, women bear the heaviest burden—they lose sources of food, water, and ritual spaces that form the core of their social system.

A fundamental shift has also occurred within the cultural realm, where the ecological value system that serves as the soul of the Talang Mamak society is being reduced to mere symbolic identity. Their cultural foundation, which views humans as an inseparable part of nature, is increasingly losing its footing alongside local climate change triggered by deforestation. This is revealed through the grievance of Ibu K, a housewife and farmer, who shared, "Now the seasons are unpredictable; nature itself seems confused," illustrating how traditional ecological knowledge—such as reading wind directions and lunar phases to determine planting times—is becoming increasingly difficult to apply. This is compounded by challenges from the state, which bans traditional practices, and the demands of meeting economic needs that can no longer be sufficiently fulfilled by and from nature. The Basolang ritual (mutual cooperation for land clearing) has nearly vanished due to bans on land burning and the depletion of forest areas.

"In the past, burning made it easy for us to farm huma (rainfed fields). Now it's difficult; we are afraid of being arrested when we burn. In the past, we didn't spend money, but now we must have money to buy our family's food needs," remarked one customary leader.

Yet, amidst these pressures, women remain the primary drivers in restoring the domestic sphere of life. They plant in cramped plots, cultivate traditional food crops such as field paddy, sweet potatoes, cassava, and bananas, and safeguard local seeds from vanishing. These actions demonstrate a form of recovery born out of a steadfast commitment to maintaining customary values as a life guide, even within an increasingly restricted space.

Talang Mamak women also demonstrate climate resilience by transforming their traditional knowledge. When medicinal plants in the forest become difficult to find due to fires or temperature shifts, they begin cultivating them in their home yards. When rainfall patterns alter, they experiment with crop varieties and document new planting cycles. These adaptive actions are a tangible manifestation of *kawin batin* (spiritual marriage)—a reunification of ancestral knowledge with new ecological realities—initiated by women to ensure the survival of their community. In every pandan weave, in every stored seed, and in every replanted medicinal herb, lies a narrative of resilience that refuses to go extinct.

As economic structures shift, women adapt. They begin to think about processing forest products, cultivating food crops in gardens, increasing their knowledge capacity through farmers' groups, and simultaneously maintaining micro-rituals like planting and harvesting prayers so their meanings are not lost. Women become the link between two worlds: the modern world that demands productivity and

the customary world that honors balance. This is a form of adaptation without surrender, where ecological values serve as a moral guide in new economic activities.

Furthermore, within the social dynamics that marginalize customary authority, women play a role in altering inequalities. They engage in indigenous women's groups, serve as a moral voice in community meetings, and even negotiate with corporate entities and conservation institutions. In a gentle manner, they assert that land and forests are not merely economic assets, but living spaces that possess a soul. Through their dual roles as caregivers, food managers, and guardians of values, Talang Mamak women exhibit a relational resilience—reconnecting relationships that have been severed by external forces.

Bara & Cindakko: Indigenous Women Leaders and Spiritual Negotiation

For the Bara and Cindakko communities in the mountainous region of South Sulawesi, the primary pressure comes not from extractive industries, but from state conservation policies through the establishment of the Babul National Park. The designation of this area excludes the community from their traditional management space, restricting access to water sources and forest products. However, indigenous women here do not remain silent; they become the guardians of spiritual and social balance amidst the constraints of state policy.

In daily life, women play a vital role in managing water and food—the two elements most severely impacted by conservation. When access to the forest is restricted, they cultivate resilient crops around their homes and along riverbanks, ensuring the family's basic needs are met. This action reflects a form of recovery born out of adaptive strategies rooted in spiritual values and local ecological knowledge.

However, the resilience of these indigenous women does not stop at recovery. They go further by adjusting to the new system without entirely submitting to it. They learn to read the policy language of the national park and find loopholes to continue practicing rituals and managing water within boundaries acceptable to authorities. In this context, women practice strategic adaptation, preserving values while negotiating boundaries.

The most powerful symbol of transformational resilience in Bara & Cindakko is embodied in customary leaders such as the galarang and totua adat, where women are directly involved as spiritual guardians of water, nurturing natural resources through customary rituals. Through rituals, prayers, and water source preservation practices, they build a space for dialogue between the customary world and the state. These female customary leaders do not resist openly; instead, they shift the logic of power: from the dominance over space to the nurturing of life. This is a manifestation of the margins becoming the center of ecological knowledge and morality. The resilience of these women is a form of subtle resistance against displacement, carried out through the language of values rather than confrontation.

Kasepuhan & Baduy: Women Amidst Customary Bureaucracy and Cultural Commodification

In the Inner Baduy society, women hold an essential role in household food security. They are directly involved in farming, collecting non-timber forest products such as honey, catching fish, and managing household food logistics. Their role does not end in the domestic sphere; the weaving tradition practiced by young women serves as a rite of passage, signifying their readiness to enter married life. Every piece of woven cloth preserves intergenerational knowledge of motifs, techniques, and natural dyes, while simultaneously reaffirming adherence to the pikukuh (customary tenets). Their readiness for marriage is regulated through the kawin batin system.

In the Baduy community, kawin batin (spiritual marriage) refers to a lifelong marriage performed before the puun with only one partner, where divorce can only occur through death. This marriage is determined through a matchmaking process initiated by the mother's side, meaning that the choice of

partner is not merely an individual decision. The word *batin* indicates that the marriage is not just an alliance of individuals, but a binding connection of customary-based kinship, economic, social, and spiritual networks. The married couple must shoulder economic and domestic responsibilities independently yet in balance: the groom brings kitchen utensils and the dowry (*mas kawin*) earned through his own hard work, and both must be capable of fulfilling household needs together.

Unlike other cultures where monogamy is generally understood only as a prohibition against having other partners, an exclusivity of relationship, or a legal status, in Baduy, monogamy regulates the entire dynamic of relationships, responsibilities, and connections between men and women within the customary framework. Women as the determiners of *kawin batin* underscore the negotiating power and leadership of women within the family and community.

In the Kasepuhan community, women play an important role in community resilience through economic and natural resource management. They are not merely implementers; they also develop new strategies toward the environment, for example, in the design of handicraft products and the processing of forest products like *sambal honje* (torch ginger chili paste), demonstrating local-based creativity and initiative. Various women's group training sessions reinforce their capacity to manage the potential of customary forests and participate in economic activities.

In Kasepuhan, women often assume critical roles in managing customary forests. The Sundanese proverb “*Lisung nu jadi indung, nyiru nu jadi guru*” (meaning: the mortar becomes the mother, the winnowing basket becomes the teacher) provides a social foundation for this stance: the mortar, as a symbol of the mother, affirms women's practices as community nurturers, while the winnowing basket as a teacher shows their capacity to accommodate and facilitate.

Behind the cultural recognition of women as guardians of tradition and knowledge, there lies a structural inequality that systemically restricts their space. Although the customary philosophy of Baduy and Kasepuhan emphasizes complementarity between men and women, formal practices remain dominated by patriarchy, particularly regarding inheritance rights and land ownership. Baduy women can inherit family land or property, but they only receive half of a man's share; formal access to land also depends on their relationship with a husband or father. In cases of divorce or the death of a husband, women often lose control over land they have managed for years. Data shows that less than 10% of land certificates issued under the name of indigenous peoples in Lebak are owned by women.

This inequality is also evident in customary decision-making. Although women are allowed to attend assemblies (*musyawarah*), their voices are often not given equal weight to those of men. Formal positions such as *Jaro*, Customary Elders, or *Pu'un* are almost exclusively held by men, while women with deep ecological knowledge—about medicinal plants, agricultural systems, and forest resource management—are rarely involved in strategic decisions. This paradox creates a situation where women are symbolically revered but lack formal power to determine the future of the territories and knowledge they safeguard. Symbolic recognition does not necessarily translate into real access to resources or decision-making.

In this context, women develop social practices as alternative spaces for negotiation and leadership. They perform a dual role: bearing domestic and production responsibilities, while simultaneously preserving and transforming customary knowledge. It is these social practices that enable women to influence community management, despite their formal limitations.

Witnessing the *Seren Taun* celebration in Kasepuhan Jamrut, amidst the rituals, women take on primary roles: singing traditional songs, dancing, and pounding rice in the *nutu lisung* stage. All these activities

are performed to honor Dewi Sri (Nyi Pohaci), the goddess of fertility believed to govern life, harvest yields, and food security.

The role of women in rituals shows that they are the guardians of life and ecological knowledge. They know how to plant rice, protect the forest, and preserve local seeds—practices that ensure the community's food sustainability. In rituals, women appear honored and occupy the center of attention. Yet, behind this symbolism, women frequently face inequality and marginalization.

They rarely have access to key decisions regarding land or natural resources. Inheritance rights and land ownership remain dominated by men, meaning their knowledge and experience in managing nature are not always recognized within customary institutions. This condition places women in a marginal position: though symbolically the center of life, they are limited in their actual influence over the resources they manage.

The myth of Dewi Sri, who passed away and whose body transformed into rice and spices, can be viewed as the emotional dimension of women's marginal experience. Her body gives life to the community, yet real-life women often bear a double burden: preserving tradition, managing food, caring for the family, and still playing a part in rituals—without holding full control over land or customary policies. Emotions such as exhaustion, heavy responsibility, and a sense of limitation reflected in the performance signify a tangible marginal experience in daily life.

Nevertheless, this myth also holds potential for transformation and strength. Indigenous Baduy and Kasepuhan women demonstrate high resilience in facing climate change and pressures from extractive industries. Their knowledge of agriculture, forests, and local seeds becomes an asset for survival and adaptation. The story of Dewi Sri in the Seren Taun ritual is not merely a symbol of fertility, but also a narrative containing women's cultural citizenship, structural inequality, and the emotions of marginal experience to understand daily life as well as a framework for action.

In that context, women are also the guardians of customary and environmental values that ensure community sustainability. In many ways, customary social systems recognize the role of women and place them in an honored position. Gender equality here manifests as a balance of responsibilities between men and women, though it is not entirely equal in terms of resource control. Structurally, severe limitations remain that restrict women from owning land, participating in customary decision-making, and accessing economic resources on a broader scale.

However, contemporary social dynamics reveal the emergence of new spaces for indigenous women to strengthen their roles. Economic training programs, the recognition of customary forests, and the involvement of women in natural resource management forums indicate a transformation toward a more inclusive gender justice. In several communities, women are also beginning to initiate creative activities such as developing local products, weaving businesses, or community-based environmental preservation. Nonetheless, this process of change moves slowly and depends heavily on the local context—specifically, on the extent to which customary norms can adjust to new realities and on the openness of customary leaders to support women's active participation in the public sphere.

In the Kasepuhan and Baduy regions, pressures on customary life come through the bureaucratization of custom and cultural tourism. The state and tourism actors view custom as something to be preserved, but also regulated and commercialized. In this process, the spiritual and ecological meaning of custom gradually shifts into an identity symbol and a cultural commodity.

In this situation, women play a crucial role in maintaining the balance between preservation and adjustment. They become the guardians of the leuit (rice barn) and leuweung larangan (forbidden

forest), ensuring that food systems and ecological rules continue to be practiced even though custom has now entered the administrative calendar. Through domestic work and micro-rituals at home, women restore the continuity of custom outside formal bureaucratic structures—a form of recovery born out of spiritual and cultural awareness.

Women also become the drivers of new social adaptation. They are active in tourism economic activities, handicraft production, and the management of cultural events organized by local governments. Although involved in the modern economy, they continue to carry customary principles into every practice—maintaining a balance between openness and boundaries. Their resilience here is visible in their ability to negotiate their roles within two worlds, bridging custom and modernity.

Yet, the most subtle power emerges when women negotiate the meaning of custom amidst commodification. They recognize that custom has now become a spectacle, but they continue to ensure that the spiritual values within it are not lost and remain a guide for life. They teach children the meaning of the leuit, instruct them in prayers and pamali (taboos), ensuring that custom remains alive in daily experience. This is the resilience of indigenous women: they do not merely protect custom, but redefine its authenticity under the logic of tourism. They ensure that custom is not merely “preserved,” but continues to live as a way of thinking and a way of feeling.

Table 9. Indigenous Communities' Resilience Analysis Framework

Resilience Strategy	Mentawai	Talang Mamak	Bara & Cindakko	Kasepuhan & Baduy
Bouncing Back	Women return to managing sago & gardens; punen ritual is revived	Returning to manage gardens & fields; simplified customary practices are maintained	Local production practices & community solidarity are restored	Rituals & ancient systems are maintained; traditional food production
Bouncing Forward	Integration of light modern techniques into mixed gardens	Modification of fields & cropping patterns; food innovation	Adoption of new agricultural methods; socio-ecological experimentation	Utilization of forests & ritual innovation
Centering the Margins	Women & vulnerable groups are more actively involved in rituals & the economy	Involvement of minority groups in field-related decision-making	Empowering members who typically play lesser roles; socio-ecological inclusion	Strengthening the role of women & young members in rituals & resource management

**Data Source: Observation, In-depth Interviews, Group Discussions*

The resilience framework in the table above utilizes the approach formulated by Atallah (2016), where resilience is understood not as a process moving linearly from recovery to transformation, but rather as a spectrum of capacities that can emerge simultaneously within a community. This means that bouncing back, bouncing forward, and centering the margins are not successive stages, but rather strategies that can be implemented in parallel, depending on the dynamic situation and socio-ecological capacity faced by the community.

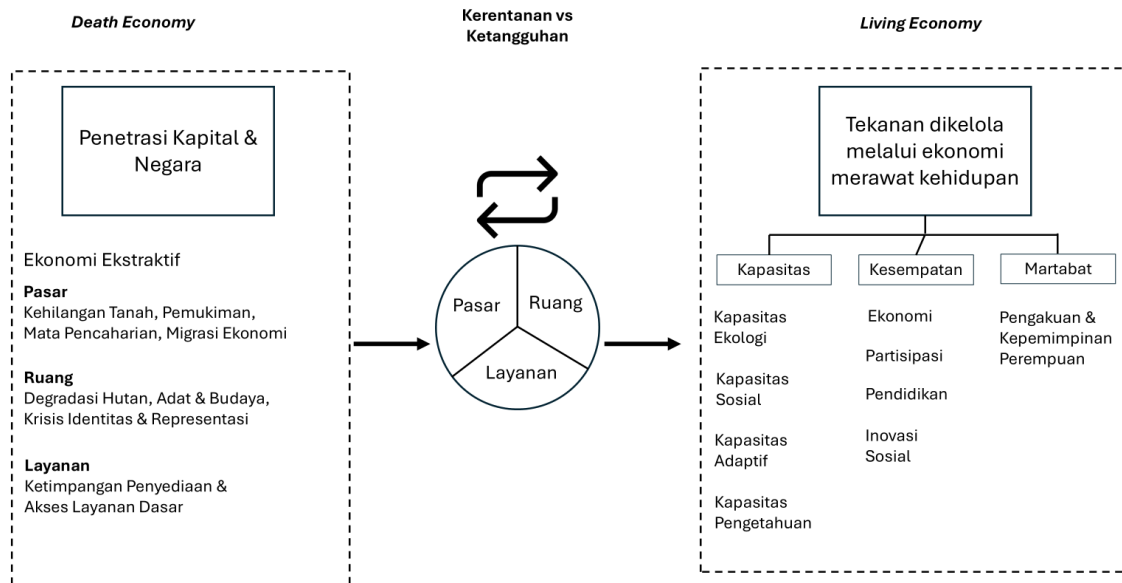
Under certain conditions, a community can exhibit recovery resilience (bouncing back) when they repair damage caused by disasters or restore basic life functions. Concurrently, some community members can demonstrate adaptive resilience (bouncing forward) by adjusting their cropping patterns, water systems, or social practices to cope with new climate variations. Meanwhile, other groups—such as customary leaders, women, or youth—can simultaneously drive transformational resilience (centering the margins) through political negotiations, institutional innovations, or initiatives to reclaim control over customary living spaces.

Thus, resilience must be understood as a complex and layered social dynamic. Indigenous communities do not merely survive in a uniform manner; rather, they respond to crises through a combination of recovery, adaptation, and transformation strategies arising from their collective experience. This approach reaffirms that the strength of indigenous peoples lies not in the ability to "return to exactly how things were," but in their capacity to manage change while safeguarding the continuity of values and socio-ecological relationships that underpin their life together.

This reflection demonstrates that women's resilience is not merely an ability to endure; it is a critical and emancipatory practice that challenges structures of inequality and opens up space for constructing fairer economic and social frameworks. Women serve as central actors bridging ecological, social, and economic sustainability, while simultaneously asserting the strategic value of local knowledge in confronting global challenges.

The comprehensive analysis demonstrates that the turning point of change within indigenous communities, the penetration of capital and the state, ecological degradation, the struggle between the living economy and the death economy, and the resilience strategies of indigenous women are not isolated phenomena. Instead, they are tightly intertwined as a singular, complex landscape of socio-ecological transformation. Indigenous women stand at the center of this vortex of change—being the party most severely impacted by market exclusion, lack of basic services, and political marginalization, yet simultaneously emerging as the key authors who nurture life through local knowledge, communal solidarity, and adaptive innovation. Through a blend of ecological capacity, socio-economic opportunity, and the restoration of cultural dignity, indigenous women construct resilience strategies that do not only address contemporary pressures, but also reconcile the past and the future of their communities. From this, it becomes clear that the path toward future sustainability is highly determined by the extent to which the state and society recognize, protect, and strengthen the leadership of indigenous women in safeguarding life.

Figure 4. Integrative Analysis of Indigenous Women's Resilience Strategies



Based on the findings and reflections across various locations, this study highlights the following patterns and critical points:

1. Climate change exacerbates existing gender inequalities. For indigenous women working in the agricultural sector—which is highly vulnerable to weather variability and price shocks—climate change worsens pre-existing gender inequalities due to women's minimal access to capital, assets, information, and decision-making processes. Impacts such as extreme weather, food and water crises, as well as male migration have increased women's domestic workload and caregiving responsibilities, while simultaneously reducing their educational and employment opportunities. Despite these conditions, indigenous women demonstrate extraordinary strength and resilience in facing the impacts of climate change that affect their daily lives. Amidst challenges such as extreme weather, food and water crises, as well as shifting work patterns, indigenous women do not merely survive; they also adapt by relying on local knowledge and community solidarity. They develop more climate-resilient agricultural strategies, safeguard the sustainability of food sources, and ensure that families and communities maintain access to basic needs. The active role of women in decision-making, natural resource management, and disaster risk reduction demonstrates that they are not mere recipients of impacts, but key actors in building community resilience. Therefore, the recognition and inclusion of women in climate adaptation policies form a vital step toward realizing equitable and sustainable climate justice.

2. Climate change causes layered vulnerabilities and burdens for indigenous women. Indigenous women face multi-layered challenges in the climate crisis, not only due to overlapping domestic and agricultural roles, but also as a result of structural inequalities in resource access. In Mentawai and Talang Mamak, for instance, 95% of the labor required to fetch clean water is borne by women, who must walk long distances of 2–5 km during the dry season. They must also reorganize household affairs when floods destroy fields and harvests, ensuring that their families do not suffer from starvation.

3. The adverse impacts of climate change are already experienced by indigenous peoples, yet their adaptive capacity remains limited. Indigenous communities perceive and experience firsthand how natural signs (observing rainfall patterns, astrology) and traditional calculation systems—which have long served as their guidelines for farming—have altered and no longer align with the seasonal references they rely on. This not only causes losses for indigenous communities, but also threatens the

resilience of food systems that have been practiced for generations. For example, within the Talang Mamak indigenous community, it has become difficult to determine the right time to slash and burn land in preparation for planting rice.

4. Climate change causes health disruptions and food insecurity. The impacts of climate change on indigenous peoples do not only disrupt food production systems, but also worsen the community's health conditions. In Mentawai, the shift in consumption from local food staples like sago and taro to rice increases household living costs, forcing women—as the managers of consumption—to adjust family dietary patterns amidst declining incomes. Furthermore, extreme climate variations trigger new health threats. High temperatures, floods, and droughts elevate the risk of airborne, waterborne, and vector-borne infectious diseases, such as malaria, diarrhea, and acute respiratory infections.

5. Climate change increases the intensity and destructive power of natural disasters. Indigenous peoples have lived and adjusted to the natural conditions of the environments where they reside and depend for their livelihoods, including adapting to the natural disasters that occur around them. The architectural design of indigenous houses, built as stilt houses using natural materials, actually serves as a marker of their adaptation to hot and cold weather shifts, as well as an adaptive measure against sudden flood hazards. However, the architecture and building materials of these stilt houses are not durable and degrade rapidly when subjected to continuous floodwaters or persistent strong winds. While floods were merely seasonal events in the past, today they can occur at any time with an unprecedented frequency and devastating destructive power. For example, in the Mentawai indigenous community, residents are accustomed to facing floods and coastal abrasion because their villages are located along riverbanks or coastlines; however, floods can now happen at any time, and the water level can submerge their homes. Another example is found in the Cindakko indigenous community, where houses frequently shake and face the risk of collapsing due to strong winds and high rainfall in the highland area.

6. The disruption and severance of traditional ecological knowledge among indigenous peoples. Every indigenous community possesses traditions and knowledge for utilizing natural resources sustainably, as well as for adapting to changes in their environment. The performance of customary rituals in agricultural activities is one example of how this knowledge and tradition are passed down between generations. However, in several indigenous communities, state development policies regarding natural resource exploitation have brought negative impacts to indigenous lives, not only concerning their sources of livelihood but also uprooting their relationship with nature. For instance, in the Mentawai indigenous communities of North Siberut and South Sipora, they no longer have the *uma* as a community center to regulate and manage natural resources. As a consequence, many of the younger indigenous generation are no longer acquainted with the traditions and culture that have historically defined their identity.

7. The emergence of new perspectives among the indigenous youth. Increasing awareness within indigenous communities regarding education has shifted the perspectives of the younger indigenous generation toward tradition, culture, and customary worldviews. The expanding access of the indigenous youth to the internet, particularly social media, also influences how they view themselves and interpret desired progress. Many young indigenous people choose to work outside rather than stay within their indigenous communities. For instance, in Kasepuhan Jamrut, many young men and women prefer to migrate to the Jabodetabek (Greater Jakarta) area to work in the informal sector. They prefer working in the city with wages and environmental qualities that are relatively no better, rather than staying in the village. There are also young generations of Talang Mamak who aspire to plant oil palm rather than cultivate the agricultural commodities traditionally managed by their parents.

8. Development policies are not yet climate-responsive and do not favor indigenous peoples. State development policies that exploit natural resources do not only cause ecological disasters—which are increasingly worsened by climate change—but also erase the identity and traditions of indigenous peoples. Examples include state policies granting concessions to companies for logging or monoculture plantations, as well as policies establishing national parks that deny the existence and restrict the access of indigenous communities that have inhabited the locations long beforehand.

9. Indigenous peoples require more adequate climate adaptation mechanisms. Climate change cannot be treated as a seasonal phenomenon, but as a long-term shift that demands structural adaptation. This condition is directly felt by indigenous peoples through the decline in agricultural yields, the reduced availability of non-timber forest products, and its impact on health conditions. Traditions or methods historically used as adaptation mechanisms to nature now require new adaptation patterns. For example, in the Talang Mamak as well as the Bara and Cindakko indigenous communities, residents complain about rising heat temperatures that prevent them from working longer in the rice fields and farms, along with a lack of awareness regarding heat strokes that afflict citizens while working outdoors.

Chapter 5 Conclusion and Recommendation

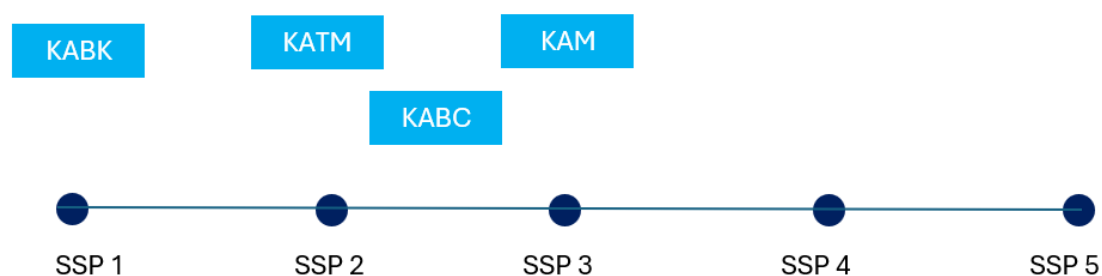
5.1 Conclusion

Climate change has been tangibly experienced by indigenous peoples in their daily lives, manifested through shifting weather patterns, declining agricultural yields, outbreaks of diseases, and the increasing intensity of natural disasters. Unpredictable weather has rendered the traditional agricultural systems passed down through generations unreliable, thereby disrupting the food security and socio-economic stability of indigenous communities. On the other hand, development policies that remain ecologically insensitive exacerbate environmental degradation and erode the relationship between indigenous peoples, nature, and their traditions.

To understand the capacity of indigenous communities to confront ecological, social, and economic pressures, this study places the field findings within the Shared Socioeconomic Pathways (SSP) framework, which has been modified into the Indigenous Shared Socioeconomic Pathways. This research adapts five global scenarios to make them relevant for indigenous communities, aimed at assessing climate risks and adaptation challenges contextually for future policy and planning. The SSPs are modified global scenarios that link socio-economic development pathways with the dynamics of climate change, environmental degradation, and community resilience. By employing the SSP perspective, we can observe how the degree of resource degradation, external pressures, and adaptive capacity affect the ability of indigenous communities to maintain sustainability, while simultaneously asserting the role of women as strategic actors within the living economy.

This approach enables an analysis that is not only descriptive but also reflective, anchoring local conditions within a global context to reveal the spectrum of resilience and regenerative capacity in each community. Through the SSP framework, we can compare Mentawai, Talang Mamak, Bara & Cindakko, and Baduy & Kasepuhan, and understand how the interaction between environmental degradation, social structures, and the role of women shapes diverse living economy pathways—ranging from emancipatory and transformative to adaptive and conservative. The following presents the results of the SSP analysis on indigenous communities, concluded based on the field findings.

Figure 4. Conclusion of SSP Analysis of Indigenous Communities at the Research Sites



**Note: KABK = Komunitas Adat Baduy & Kasepuhan; KAM = Komunitas Adat Mentawai; KABC = Komunitas Adat Bara & Cindakko; KATM = Komunitas Adat Talang Mamak.*

This study reveals a highly diverse spectrum of vulnerability and resilience across each community, with women acting as central actors.

1) Mentawai Indigenous Community – SSP3, fragmented: Confronting high vulnerability and low adaptation capacity, driven by tidal floods, coastal abrasion, the decline of non-timber forest products, and a shift from local food staples (sago) to rice since the agarwood (gaharu) boom and resettlement programs. Yet uniquely, they demonstrate a moderate, emancipatory resilience through the Pumonean agroforestry system, the management of women's 'autonomous territories' in aquatic areas, food source diversification, and social solidarity. Their key role is evident in processing shelf-stable foodstuffs, which serve as a buffer for the family economy amidst uncertainty.

2) Talang Mamak Indigenous Community – SSP2: Facing high vulnerability and moderate adaptation capacity caused by state and capital penetration that diminishes living spaces, accompanied by deforestation and the degradation of soil and water quality. Indigenous women bear a double burden: managing fields and households with restricted access to land, education, and decision-making. Their resilience is spiritual-ecological, manifested through customary forest restoration rituals, the conservation of seeds and medicinal plants, and the formation of women farmer groups for household and community-scale food security.

3) Bara & Cindakko Indigenous Community – SSP2-3: Confronting moderate-to-high pressures due to the expansion of the Babul National Park area, which carries implications for limited arable land. While their capacity for adaptation and social innovation is quite high, external pressures and state interventions create structural uncertainties. Women serve as mediators between custom and the village government, safeguarding water rituals and food systems, and shaping a living economy anchored in the care economy and water resources. Although leadership transformation remains partial, regenerative practices and collective solidarity underscore a potential transition toward SSP2 if socio-ecological capacity is further reinforced.

4) Inner Baduy & Kasepuhan Indigenous Communities – SSP1: The Inner Baduy community exhibits low vulnerability and high resilience. A strict customary system, prohibitions against forest exploitation (leuweung tutupan and titipan), and communal rice barns (leuit) guarantee food security. Inner Baduy indigenous women play a significant role as food guardians, seed breeders, and custodians of customs—primarily as the determiners of kawin batin (spiritual marriage) that dictates the community's continuity. Meanwhile, the Kasepuhan indigenous women face moderate vulnerability due to shifting rainfall patterns and pests, yet possess high socio-cultural resilience. This is seen in the revitalization of the Seren Taun ritual, where women play a highly central role in reinforcing collective identity; they are the "queens of the kitchen" who dictate the production, consumption, and distribution of community food.

Placing indigenous communities within the SSP framework helps clarify the relationship between environmental degradation, socio-ecological capacity, and the living economy. Mentawai sits within SSP3 with high fragmentation, yet women's resilience asserts an emancipatory living economy. Talang Mamak in SSP2 demonstrates a middle path, combining innovation and tradition. Baduy in SSP1 maintains a conservative sustainability, while Bara & Cindakko sit in an SSP2–3 transition, displaying an adaptive living economy but with structural limitations. This analysis reinforces that women's living economy is a strategic mechanism for confronting differing global socio-economic scenarios, while bridging local capacities with the challenges of climate change and capital penetration.

This study finds that climate change exacerbates existing gender inequalities, particularly for indigenous women working in the agricultural and household sectors. Minimal access to capital,

information, and decision-making forces them to bear a double burden: maintaining household food security while simultaneously confronting environmental impacts. In Mentawai and Talang Mamak, for example, women must walk 2–5 kilometers to fetch clean water during the dry season. Their workload and health risks increase as temperatures rise and the quality of water resources declines.

Beyond economic and health aspects, climate change also causes the loss of local knowledge. Many indigenous communities can no longer utilize traditional calendars to determine planting seasons, as observed in the Talang Mamak and Kasepuhan Jamrut indigenous communities. This does not only threaten food systems, but also their cultural heritage and spirituality toward nature.

The indigenous youth, both women and men, demonstrate new perspectives regarding tradition and the future. Access to education and digital media brings both opportunities and challenges: on one hand, it opens spaces for innovation and advocacy; on the other hand, it can alienate them from the customary values that have long underpinned ecological harmony.

Despite facing multi-layered challenges, indigenous women are not passive. They have developed various adaptation strategies rooted in cultural values and social solidarity—ranging from crop diversification and nature-balancing rituals to the establishment of women farmer groups to preserve local food. These practices demonstrate that adaptation is not merely technical, but also ethical and relational: it is about how humans care for the earth and for one another.

This study concludes that the path toward climate justice in Indonesia cannot be achieved without positioning indigenous communities—and specifically indigenous women—as primary actors in every adaptation policy and sustainable development initiative. They have proven that sustainability is not just a matter of technology or economics, but about nurturing life in all its forms: people, land, water, and culture.

By making care for the commons a foundational principle of public policy, Indonesia will not only strengthen its resilience against climate change, but also reaffirm its identity as a civilized and ecologically just nation. Indonesia's green future will be born from the roots—from communities that nurture, not from the desire to conquer the universe that serves as the source of human life.

Ultimately, the core message of this research is that the resilience of indigenous peoples, especially indigenous women, constitutes a vital foundation in confronting climate change. Indigenous women are not merely affected victims or the most vulnerable parties in the climate crisis; rather, they are sources of inspiration for resilience with the potential to lead climate mitigation and adaptation actions. Indigenous women are capable of connecting traditional ecological knowledge with modern scientific innovation, while also bridging the past and the future, and fluidly reaching across generations. Moving forward, Indonesia's climate policy needs to shift toward development planning that favors indigenous communities, is gender-just, and is rooted in an environmental ethic of care.

5.2 Recommendations

Looking at the situation and the impacts of climate change experienced by indigenous peoples, the efforts made must not only encourage indigenous peoples to mitigate and adapt, but also focus on how stakeholders such as the central government, local governments, civil society organizations, the private sector, and customary institutions respond and collaborate to resolve this intricate problem. Therefore, this study provides several recommendations addressed specifically to each stakeholder that possesses the role, responsibility, and authority to resolve these issues, as follows:

For the Central Government & Local Governments

1. Promoting Gender-Responsive Climate Action

Considerations: Climate change carries differing impacts for indigenous men and women. Indigenous women bear an increased reproductive and productive workload, such as walking further to fetch clean water during droughts, saving harvests during floods, and ensuring family sanitation and reproductive health are maintained. This situation further reduces their rest time, social access, and economic opportunities. The vulnerability of indigenous women is also exacerbated by the lack of access to early warning information, safety training, and decision-making spaces, despite the fact that they stand on the frontline in facing climate risks alongside children and the elderly. The 2024 National Action Plan on Gender and Climate Change (RAN GPI) has recognized indigenous peoples as a vulnerable group, but its implementation at the regional and community levels remains weak.

Recommended Actions:

- Policy Implementation at the Regional Level
 - Local governments must formulate Regional Action Plans on Gender and Climate Change (RAD GPI) that specifically encompass the needs and challenges of indigenous women in climate adaptation and mitigation.
 - Technical regional government agencies (OPD) need to mandate gender-responsive indicators across all climate action programs.
- Strengthening Data and Information
 - Develop sex-disaggregated gender–climate data at the village/indigenous community level, including access to clean water, domestic workload, reproductive health risks, and access to early warnings.
 - Ensure that this data serves as the foundation for gender-responsive planning and budget allocation.
- Strengthening Indigenous Women's Participation
 - Promote a meaningful quota for the representation of indigenous women (avoiding tokenism—which refers to formal or cosmetic representation where unjust power structures are maintained and their voices are not genuinely integrated) in village planning forums, development planning consultations (musrenbang), farmer/forest groups, and regional climate task forces.
 - Ensure indigenous women's access to training (including evacuation and survival drills), disaster early warning information, and climate change education as part of the community's resilience strategy.
 - Encourage local initiatives led by indigenous women, such as clean water management, food and alternative livelihood diversification, as well as conservation based on local wisdom to enhance the economic and ecological resilience of indigenous communities.

2. Promoting the Recognition and Restoration of Indigenous Territories

Considerations: The ecological damage experienced by indigenous communities stems from two directions: 1) exploitative development policies—primarily based on natural resource extraction that destroys the living spaces and sources of livelihood of indigenous peoples; and 2) restrictions on spatial utilization through the designation of conservation areas that do not yet fully recognize customary rights. This condition results in the loss of livelihoods, declining adaptive capacity toward climate change, and an increasing dependency on government assistance. In fact, Law No. 32/2009 has reaffirmed that development planning must be oriented toward economic welfare as well as ecological

preservation. In reality, however, regional apparatuses in customary territories still lack adequate planning documents, technical capacity, and climate risk information systems to anticipate environmental degradation and climate disasters.

Recommended Actions:

- **Strengthening Regional Planning Documents and Instruments**
 - Local governments need to accelerate the formulation of Environmental Protection and Management Plans (RPPLH) that guarantee the ecological protection of customary territories.
 - Mainstream cross-sectoral climate change adaptation and mitigation into the Regional Long-Term/Medium-Term Development Plans (RPJMD), Regional Spatial Plans (RTRW), and other sectoral plans.
 - Every development project must undergo a Climate Risk Assessment (CRA) to ensure it does not increase the vulnerability of indigenous communities and ecosystems.
- **Recognition and Protection of Customary Rights as an Adaptation Strategy**
 - Expedite participatory mapping of customary territories for integration into the RTRW and RPPLH.
 - Utilize legal instruments such as Decrees (SK) on the Recognition of Customary Law Communities and the designation of Customary Forests (Hutan Adat) as steps to strengthen both the ecological and economic resilience of indigenous peoples.
- **Strengthening Climate Risk Information Systems**
 - The central and local governments should build a verified spatial database of customary territories connected to disaster systems and climate change monitoring.
 - Develop early warning systems and climate risk monitoring in customary villages—such as rainfall, flood, and drought data—that are easily accessible to all community groups, including vulnerable groups.
- **Capacity Building for Regional Apparatuses**
 - Organize technical training on formulating climate policies and ecosystem-based and customary rights-based natural resource management for all relevant regional government agencies (OPD) such as Bappeda, DLH, Dishut, and other technical departments as a step to reinforce the implementation of climate-adaptive policies in customary territories.

3. Protecting Biodiversity as a Foundation for Climate Adaptation in Customary Territories

Considerations: Indigenous peoples possess traditional knowledge that preserves local food varieties and medicinal plants passed down across generations. Local varieties—such as traditional rice and native horticultural seeds of the region—have proven to be more pest-resistant and adaptive to climate change. However, agricultural policies that prioritize high-yielding varieties have displaced local seeds from cultivated lands. Concurrently, deforestation and forest degradation eliminate medicinal plants and species vital to cultural identity and customary rituals, thereby threatening food security, health, and the sustainability of customary knowledge. To this end, the government needs to protect biodiversity and ensure its benefits return to indigenous communities through innovations based on science and local wisdom.

Recommended Actions:

- **Protection and Revitalization of Local Varieties**
 - Include climate-resilient and low-agricultural-input local varieties in government assistance schemes and food security programs.

- Encourage the establishment and strengthening of local seed banks managed by indigenous communities to safeguard community-based food security.
- Partnership-Based Research and Development
 - The central and local governments should collaborate with universities and research institutions to conduct seed breeding, climate resilience testing, and productivity enhancement of local varieties, while ensuring that the research results are utilized back by indigenous peoples.
- Biodiversity-Based Conservation and Economy
 - Develop conservation zones for customary plants, including medicinal plants and species crucial for customary rituals, to support the cultural sustainability and health of indigenous peoples.
 - Promote the sustainable and equitable utilization of local biodiversity as a source of income for indigenous communities, while maintaining ecosystem preservation.

For Civil Society Organizations and the Private Sector

1. Capacity Building and Leadership of Indigenous Women

Considerations: The experiences of indigenous women in facing the climate crisis vary, influenced by age, social position, as well as their access to resources and community recognition. Indigenous women play an essential role in safeguarding local food systems, and their relationship with nature serves as a pillar of community resilience. Even so, this role is frequently unrecognized in policies and within patriarchal social structures. Strengthening the capacity of indigenous women is a strategic step to enhance household food and economic security, as well as to reinforce the community's capacity in facing climate risks.

Recommended Actions:

- Capacity Development and Climate Education
 - Organize periodic training sessions for indigenous women encompassing, but not limited to, adaptive and eco-friendly agriculture; climate risk mitigation at the household and community levels; sustainable local food processing and value-addition; knowledge on indigenous women's rights and leadership in village governance and climate justice.
- Economic Empowerment Based on Local Food
 - Develop local food business units managed by indigenous women, including access to processing technology, marketing, and product certification.
 - Provide dedicated support funds for indigenous women groups driving community food security.
- Policy Affirmation and Leadership Strengthening
 - Promote affirmative policies that reinforce indigenous women's access to productive resources, early warning information, and decision-making forums related to the village and climate.
 - Develop leadership mentoring programs for indigenous women in village planning and the formulation of climate change adaptation policies.

2. Revitalizing Local Knowledge and Traditional Ecology

Considerations: Indigenous peoples typically store and pass down their knowledge orally, as well as through daily practices and rituals. Several civil society organizations have begun documenting the

local knowledge and traditional ecology held by indigenous peoples and engaging the indigenous youth to study the meanings behind this knowledge. These efforts can serve as a foundation for indigenous peoples to pass down knowledge and develop intergenerational learning related to climate change mitigation and adaptation efforts.

Recommended Actions:

- Support the development of community-based climate field schools or integrate the traditional ecological knowledge content of indigenous communities into formal/informal learning curricula/modules in formal schools, family education, or customary institutions.
- Document the traditional ecological knowledge of indigenous communities through media and languages that are comprehensible and appealing to the indigenous youth.
- Develop and promote knowledge exchanges across indigenous communities and between indigenous and non-indigenous communities, particularly targeting women and the indigenous youth, to enhance public awareness about such indigenous knowledge.

3. Developing an Economy Based on Local Resources

Considerations: Climate change impacts the livelihoods of indigenous communities that depend on natural resource utilization. Therefore, besides encouraging indigenous communities to care for increasingly limited natural resources, their capacity must be enhanced to process these resources so that they possess added value for the life and welfare of the indigenous community.

Recommended Actions:

- Strengthening Production and Processing Capacity
 - Organize training sessions on processing local food (e.g., sago, tubers, jengkol, forest products) using simple and eco-friendly technologies.
 - Enhance product diversification skills based on local natural resources that are adaptive to climate change.
- Developing Inclusive Local Value Chains
 - Promote community-based value chain models that reinforce the ownership of indigenous women throughout the production-to-distribution process.
 - Connect indigenous community products with niche market segments (e.g., organic markets, educational tourism, premium ethnic products).
- Business Support and Market Access
 - Provide micro-business incubation programs and business assistance for customary business groups centered on food and non-timber forest products.
 - Facilitate branding, certification, and digital marketing to enhance the competitiveness of customary food products in the broader market.

For Indigenous Community Leaders, Indigenous Women & Indigenous Youth

1. Strengthening Indigenous Women's Leadership in Local Food Systems

Considerations: Climate change erodes traditional food systems, impacts nutritional diversity, and weakens ecological independence. To strengthen food security and sovereignty, local food systems need to be revived through agroecological approaches that support adaptive farming and traditional harvesting methods. Indigenous women, who hold vital knowledge regarding production, processing, preservation, and biodiversity conservation, must play a leading role so that food systems remain diverse, sovereign, resilient, and culturally relevant.

Recommended Actions:

- Strengthen indigenous communities' food barns.
- Revitalize traditional agroecology and adopt relevant modern knowledge to develop traditional knowledge systems.
- Enhance skills regarding customary gastronomy to maintain traditions and reinforce food security and nutritional diversity among indigenous peoples
- Develop women-based customary food cooperatives.

2. Reviving Customary Institutions as a Pillar of Climate Governance

Considerations: In the past, customary institutions held an important role in various aspects of indigenous life. Today, their position has weakened because governance functions have been taken over by villages and sub-villages (dusun), leaving customary institutions to mostly manage culture and rituals. Customary traditions and cultures are still practiced, but they lack meaningful interpretation for the younger generation. As a result, many young indigenous people are severed from ancestral values and traditions. Strengthening customary institutions is vital to ensure that nature protection practices, local knowledge, and social structures remain the foundation in confronting climate change. This encompasses institutional structures, decision-making spaces, as well as the revitalization of values and traditions that safeguard ecosystem balance.

Recommended Actions:

- Revitalizing Customary Practices and Rules
 - Document customary governance and institutions that have proven effective in safeguarding natural resources, including customary sanctions and wisdom regarding spatial use.
 - Revive customary rituals that embody nature protection values as instruments for education and reinforcing community identity.
- Strengthening Institutions and Representation
 - Establish a Customary Climate Council involving customary elders, indigenous women, and youth to design and oversee the implementation of customary-based climate change adaptation.
 - Ensure the formal involvement of customary institutions in village planning and musrenbang, including in the designation of customary management territories and the protection of traditions.

3. Interpreting New Roles for the Indigenous Youth

Considerations: Indigenous communities do not live in a vacuum; they dynamically interact with and are influenced by the outside society. The indigenous youth are now growing up in an era of information technology. Their access to various information sources can broaden horizons and drive innovation to strengthen indigenous lives, but it also possesses the potential to erode customary values and practices. Therefore, customary institutions need to play a role in interpreting these changes within the framework of culture and tradition, ensuring that customary values remain relevant for the younger generation in every era.

Recommended Actions:

- Intergenerational Knowledge Transfer

- Develop dialogue and intergenerational learning forums between customary elders and the indigenous youth regarding the meaning of traditions, culture, and rituals in the context of climate change.
- Organize mentorship programs between customary elders and the indigenous youth to reinforce traditional ecological knowledge and the understanding of natural resource governance.
- Enhancing Digital and Technological Capacities
 - Provide digital, visual, and financial literacy training for the indigenous youth to support cultural preservation and community economic innovation.
 - Develop cultural digitalization skills (photography, video, digital archiving) to document and disseminate customary knowledge safely and ethically.
- Youth Involvement in Climate Action
 - Involve the indigenous youth in monitoring climate change using technology and simple, appropriate applications (e.g., monitoring rainfall, temperature, forest fires, wildlife, rare trees/medicines, etc.).
 - Form and strengthen Indigenous Youth Forums as spaces for climate and cultural innovation, as well as vehicles to consolidate aspirations in village development.

5.3 Policy Implications: National and Regional Strategic Directions

The findings of this study demonstrate that climate change affects not only the physical ecosystem, but also reorganizes the social, cultural, and economic structures within indigenous communities. In the Indonesian context, the greatest challenge is not merely how to reduce emissions, but how to ensure that climate adaptation and mitigation processes are just and inclusive, particularly for vulnerable groups such as indigenous women.

The analysis carried out in the preceding chapters shows that the resilience of indigenous communities grows out of daily practices—care, social solidarity, food innovation, and ecological wisdom—that are frequently unaccommodated within national policy frameworks. Therefore, this section formulates policy directions and recommendations capable of bridging these local practices with the national climate governance system. The objective is to steer Indonesia's transition toward the SSP1 (Sustainability) pathway: a development framework that is climate-just, rooted in local values, and stands in favor of indigenous women as the guardians of life.

a. Recognition of Customary Rights and Land Ownership

The most severe vulnerability identified in this study stems from weak protections for customary land rights. Deforestation, large-scale investment projects, and resettlement force communities to lose their living spaces and erode their capacity to read natural signs. The government needs to prioritize the deliberation and ratification of regulations protecting the rights of indigenous peoples, ensure that the interests and climate justice for indigenous peoples are accommodated within climate regulations, and strengthen cross-sectoral coordination among the ministries that oversee indigenous affairs (specifically the Ministry of Forestry, Ministry of Environment, Ministry of Agrarian Affairs and Spatial Planning/National Land Agency, Ministry of Home Affairs, Ministry of Social Affairs, and the Ministry of National Development Planning/Bappenas). Furthermore, customary territory data needs to be integrated into national climate policy systems, such as the National Action Plan for Climate Change Adaptation (RAN-API) and Indonesia's NDC. This formal recognition will serve as the foundation for rights-based, inclusive, and participatory adaptation development.

b. Integrating Gender into Climate Policy

Indigenous women have consistently been the vanguard of climate adaptation, yet public policies have not yet taken their specific experiences into account. Consequently, every climate mitigation and adaptation policy—at both the national and regional levels—needs to incorporate gender-sensitive and gender-responsive performance indicators, encompassing women's participation in the planning, implementation, and evaluation of policies and programs related to climate change. The central government (the Ministry of Women Empowerment and Child Protection along with the Ministry of Forestry, Ministry of Environment, and the Ministry of National Development Planning/Bappenas) and local governments need to promote the roles and leadership of indigenous women in national climate forums and regional climate task forces. The approach is not merely a matter of representation, but concerns epistemic justice: recognizing that women possess valuable ecological knowledge for public policy.

c. The Living Economy Approach as a Local Green Economy Model

Research findings indicate that the economy of indigenous communities operates under a different logic than capitalistic markets. Activities such as food sharing, mutual cooperation (*gotong royong*), and rotating savings clubs (*arisan*) constitute a form of living economy—an economy anchored in care, rather than capital accumulation. The state needs to recognize this economic value as part of a green development strategy that supports conservation. Concrete policies could include: the establishment of a Community Green Fund to support adaptation initiatives, micro-financing for indigenous women's enterprises, and conservation driven by local food staples. Beyond supporting economic independence, this approach reinforces local food security and culture, which have proven to be more adaptive to climate change.

d. Cultural Documentation/Digitalization and Social Innovation

The digital transformation occurring within indigenous communities—such as cultural preservation via social media or online promotion of local food yields—demonstrates that technology can serve as a new medium for sustainability. However, digital infrastructure in many customary territories remains limited. Therefore, the government needs to develop ecological digital literacy programs and expand internet access to customary villages. This support will not only enhance economic independence but also strengthen cultural identity and environmental advocacy networks, particularly among young indigenous women.

Table 10. Programmatic Recommendations Based on Policy-Making Level

Level	Intervention Focus	Concrete Action Plan	Stakeholders (Actors/Sectors)
National Government	Mainstreaming gender-sensitive & gender-responsive climate change policies for vulnerable/marginalized groups	o Formulation of regulations concerning the recognition and protection of indigenous peoples.	Bappenas, Ministry of Environment (KLH), Ministry of Forestry, Ministry of Women Empowerment and Child Protection (KemenPPPA), Ministry of Agrarian Affairs and Spatial Planning/National Land

Level	Intervention Focus	Concrete Action Plan	Stakeholders (Actors/Sectors)
		- o Mainstreaming gender-sensitive climate change issues into development policies & programs. - o Fiscal incentives for indigenous peoples' initiatives in territorial conservation.	Agency (ATR/BPN), Ministry of Agriculture, Ministry of Home Affairs (Kemendagri), Ministry of Finance-BPDLH.
Local Government	Recognition & protection of indigenous peoples, particularly concerning traditional ecological knowledge and their living spaces	- o Identification & development of local seed breeding. - o Policies for the protection & preservation of indigenous livelihood zones. - o Relief & technical assistance for the development of local community food security.	Provincial Government, Regency Government, Bappeda, Environmental Agency (DLH), Forest Management Units (KPH), Social Agency, Health Agency, Women Empowerment & Child Protection Agency, Food Security Agency, Village Community Development Agency (DPMD), Regional Disaster Management Agency (BPBD), etc.

Level	Intervention Focus	Concrete Action Plan	Stakeholders (Actors/Sectors)
Indigenous Community	Enhancing knowledge capacity & skills in adapting to climate change	- o Enhancing culture-based adaptation knowledge capacity & skills (field schools). - o Empowerment of women & communities in natural resource management. - o Documenting & developing intergenerational traditional ecological knowledge related to climate change.	National & local Civil Society Organizations (CSOs), universities, the business community, and other strategic stakeholders.

Closing

This study reaffirms that climate change is not merely an environmental crisis, but also a social, cultural, and moral crisis. The resilience of indigenous communities, particularly indigenous women, highlights that the sustainability of life depends on the capacity to care, share, and adapt. By anchoring public policy in indigenous knowledge and an ethic of care, Indonesia can tread a development path that is more equitable, ecologically sovereign, and in favor of life. The future of the nation's sustainability will be born from communities that nurture the earth with love—just as indigenous women do across all corners of the Archipelago.

References

- Alfian, Andi. 2023. *Eco Relational Citizenship: Perspective from Bara & Cindakko Indigenous Communities of Sulawesi*. Yogyakarta: CRCS-UGM.
- Apriyani, Via, Mukhlis J. M. Holle, Christian Silangen, Fitria T. Oktalira, and Sonny Mumbunan. 2021. What evidence exists on the relationship between agricultural production and biodiversity in tropical rainforest areas? A systematic map protocol. *Environmental Evidence*. doi.org/10.1186/s13750-021-00233-z.
- Adger, W. N., J. M. Pulhin, J. Barnett, G. D. Dabelko, G. K. Hovelsrud, M. Levy, Ú. Oswald Spring, and C. H. Vogel. 2014. Human Security. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 755–791.
- Agarwal, Bina. 2010. *Gender and Green Governance: The Political Economy of Women's Presence Within and Beyond Community Forestry*. Oxford University Press.
- Anas, Y., et al. 2024. Characteristics and potential of the extreme poor in the Mentawai Islands Regency, West Sumatra Province. *ISAR Journal of Economics and Business Management*, 2(5), 7–18.
- Arham. 2024. *Kapasitas Adaptif Petani Kopi Berbasis Lanskap Desa Kahayya Bulukumba Sulawesi Selatan*. Doctoral dissertation, Universitas Hasanuddin.
- Arif, Ahmad. 2024. Ketimpangan Emisi dan Maladaptasi: Tantangan Bagi Keadilan Iklim di Indonesia. *Prisma*, 43(3).
- Arif, Ahmad. 2021. *Masyarakat Adat & Kedaulatan Pangan*. Jakarta: KPG & Kemitraan.
- Atallah, Devin G., Gonzalo Bacigalupe, and Paula Repetto. 2021. Centering at the Margins: Critical Community Resilience Praxis. *Journal of Humanistic Psychology*, 61(6), 875–905.
- Bauer, T. N., W. De Jong, and V. Ingram. 2022. Perception matters: an Indigenous perspective on climate change and its effects on forest-based livelihoods in the Amazon. *Ecology and Society*, 27(1):17. doi.org/10.5751/ES-12891-270117.
- Bhargawa, Ruma, and Megha Bhargava. 2023. “The climate crisis disproportionately hits the poor. How can we protect them?” *World Economic Forum*.
- Boserup, Ester. 1970. *Woman's Role in Economic Development*. London: Allen & Unwin.
- BNPB. *Geoportal Kebencanaan Indonesia | Portal Satu Data Bencana Indonesia*.
- Burrows, Leah. 2016. *Smoke from 2015 Indonesian fires may have caused 100,000 premature deaths*. Harvard John A. Paulson School of Engineering and Applied Sciences.

Campbell, Bruce M. et al. 2016. Reducing risks to food security from climate change. *Global Food Security*, 11, 34–43. doi.org/10.1016/j.gfs.2016.06.002.

Climate Action Tracker-IESR. 2022. *Indonesia Assessment 2022*.

Climate Central. 2025. *Climate change increases pregnancy risks around the world due to extreme heat. A Climate Central analysis of the past five years (2020-2024)*.

Copage, Michael, Robert Glasser, and Isabelle Bond. 2025. *Indonesia in 2035 - Climate risks to security in the Indo-Pacific*. ASPI's Climate and Security Policy Centre.

Copernicus Climate Change Service. 2025. *Global Climate Highlights 2024 Report*.

Darmanto and Abidah Setyowati. 2012. *Berebut Hutan Siberut: Orang Mentawai, Kekuasaan dan Ekologi Politik*. Jakarta: Kepustakaan Populer Gramedia.

Dankelman, Irene, and Joan Davidson. 1988. *Women and Environment in the Third World: Alliance for the Future*. London: Earthscan.

Dharmawan, A. H. 2007. Dinamika Sosio-Ekologi Pedesaan: Perspektif dan Pertautan Keilmuan Ekologi Manusia, Sosiologi Lingkungan dan Ekologi Politik. *Sodality: Jurnal Sosiologi Pedesaan*, 1(1).

De Pryck, Kari, and Mike Hulme. 2022. *A Critical Assessment of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Denton, Fatma. 2002. Climate Change Vulnerability, Impacts, and Adaptation: Why Does Gender Matter? In: *Gender, Development, and Climate Change*. Oxford: Oxfam GB.

Dudley, J. 2010. *Research Methods for Social Work: Being Producer & Consumer of Research*. 2nd ed. Boston, MA: Pearson Education.

Dwiputra, D. F. K., Maryani, E., & Heryanto, F. N. 2024. From Tradition to Future: Sundanese Indigenous Laws as the Vanguard of Environmental Conservation and Disaster Mitigation. *The Journal of Indonesia Sustainable Development Planning*, 5(2), 134–145. doi.org/10.46456/jisdep.v5i2.559.

FAO, IFAD, UNICEF, WFP, and WHO. 2024. *The State of Food Security and Nutrition in the World 2024 – Financing to end hunger, food insecurity and malnutrition in all its forms*. Rome: FAO.

FAO. 2015. *Climate Change and Food Security: Risks and Responses*. Rome: FAO.

Febriyanti, Siti. 2017. *Perlawanan Masyarakat Adat Talang Mamak terhadap Program Restorasi Ekosistem PT ABT: Studi Kasus Perebutan Akses & Legitimasi Properti dalam Pelaksanaan Program REDD+ di Hutan Ranti*. Master's thesis, Graduate Program in Anthropology, UGM, Yogyakarta.

Garai, Joydeb. 2025. Impacts of Climate Change and Environmental Degradation on Indigenous People in Bangladesh: An Ethnographic Study. *Wild*, 2, 13. doi.org/10.3390/wild2020013.

Hart, Elis N. 2021. *Inklusi Sosial – Sepuluh Kisah Peduli Masyarakat Adat dan Lokal Terpencil Nusantara*. Jakarta: Kemitraan. [loc.gov/item/2021306752/](https://doi.org/10.24127/loc.gov/item/2021306752/).

Hutabarat, Rainy Maryke, Siti Aminah Tardi, and Hariati Sinaga, eds. 2024. *Lenting dalam Kegentingan: Krisis Iklim dan Dampaknya Terhadap Kerentanan Perempuan*. Jakarta: Komisi Nasional Anti Kekerasan Terhadap Perempuan.

IPCC. 2013. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

IPCC. 2018. *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways...* Geneva: IPCC.

IPCC. 2019a. *Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Geneva: IPCC.

IPCC. 2019b. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Geneva: IPCC.

IPCC. 2021. *The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

IPCC. 2022. *Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Mamo, Dwayne, ed. 2023. *The Indigenous World 2023*. International Work Group for Indigenous Affairs (IWGIA).

Mbow, C., et al. 2019. Food Security (Chapter 5). In: *Climate Change and Land: An IPCC Special Report...* Edited by P. R. Shukla et al. Geneva: IPCC.

Mariadi, Ocha, Hikmatul Fadila, and Gerson M. Saleleubaja. 2020. *Pumonean: Jawaban Pelestarian Hutan dari Mentawai*. Padang: Penerbit Yayasan Citra Mandiri Mentawai.

Masika, Rachel, ed. 2002. *Gender, Development, & Climate Change*. Oxford: Oxfam GB.

Mayastuti, Anti, and Hari Purwadi. 2025. Legal protection for indigenous women as a basis for climate resilience of indigenous peoples in Indonesia. *IOP Conf. Ser.: Earth Environ. Sci.*, 1462, 012057.

Merchant, Carolyn. 1980. *The Death of Nature: Women, Ecology, and the Scientific Revolution*. San Francisco: Harper & Row.

Mies, Maria, and Vandana Shiva. 1993. *Ecofeminism*. Halifax, Nova Scotia: Fernwood Publications.

Muflih, Miftah K. 2024. *Disclosing Intersectionality Based Gender Discrimination among the Indigenous People of Talang Mamak Simarantihan*. Yogyakarta: CRCS-UGM.

Munawaroh, Iis. 2023. *Context Based Women Empowerment: A Case Study of Baduy Indigenous People*. Yogyakarta: CRCS-UGM.

Naik, Netra. 2023. *Indonesia's Agriculture Sector Contributed 2.4% of Global Agricultural Emissions in 2021*. Climate Scorecard.

Nurhidayah, L. 2021. Sea Level Rise and Its Implication on Human Security & Human Rights In Indonesia: A Legal Analysis. In: *Climate Change Research, Policy & Actions in Indonesia*. Switzerland: Springer.

Ortner, Sherry. 1974. Is Female to Male as Nature is to Culture? In: M. Z. Rosaldo and L. Lamphere, eds., *Woman, Culture, and Society*. Stanford, CA: Stanford University Press.

Pasaribu, Tracy Yoanna, Widya Anggraini, and Melya Findi Astuti, eds. 2024. *Hasil Riset: Kekerasan Seksual di Masyarakat Adat dan Etnis Minoritas*. Jakarta: Kemitraan.

Pane, Beby, Rayhan Dudayev, R. Yando Zakaria, Dieri Tarau, and Galih Nur Fitriyani. Merawat Pesisir Lestari: Peluang Partisipasi Komunitas Nelayan Kecil Melalui Penguatan Kewenangan Desa Berdasarkan Asas Rekognisi dan Asas Subsidiaritas. In: Dedi Adhuri et al., eds., *Merampas Laut Merampas Hidup Nelayan: Coastal and Marine Grabbing in Indonesia and the Philippines*. Penerbit Palmerah Syndicate.

Persoon, Gerard A., and Tessa Minter. 2020. Knowledge and Practices of Indigenous Peoples in the Context of Resource Management in Relation to Climate Change in Southeast Asia.

Prior, Tahnee Lisa, and Leena Heinämäki. 2017. The Rights and Role of Indigenous Women in the Climate Change Regime. *Arctic Review on Law and Politics*, 8, 193–221.

Quinten, M., et al. 2014. Knowledge, attitudes and practices of local people on Siberut Island (West-Sumatra, Indonesia) towards primate hunting and conservation. *Journal of Threatened Taxa*, 6(11), 6389–6398.

Santisteban, Rocío Silva, ed. 2020. *Indigenous Women and Climate Change*. International Work Group for Indigenous Affairs (IWGIA).

Savelli, A., et al. 2021. *Climate-Smart Agriculture in Indonesia*. CSA Country Profiles for Asia Series. Hanoi: The Alliance of Biodiversity and CIAT; The World Bank Group.

Schefold, Reimar. 2014. *Aku dan Orang Sakuddei: Menjaga Jiwa di Rimba Mentawai*. Jakarta: Penerbit Buku Kompas & KITLV (translated and edited by Mulyawan Karim and Indira Ismail from *Wees goed voor je ziel. Mijn jaren bij de Sakuddei*).

Sen, Amartya. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. New York: Oxford University Press.

Siscawati, Mia. 2014. Masyarakat Adat dan Perebutan Penguasaan Hutan. *Wacana Jurnal Transformasi Sosial*, 16(33).

Syafrizaldi. 2020. *Talang Mamak di Tepi Zaman*. AsM Law Office and Rights & Resources Initiative.

Tulius, Juniator. 2018. Review of "Reimar Schefold, Toys for the souls; Life and art on the Mentawai Islands." *Wacana, Journal of the Humanities of Indonesia*, 19(2), Article 8.

Tulius, Juniator. 2012. Stranded people: Mythical narratives about the first inhabitants of Mentawai Islands. *Wacana*, 14(2), 215–240.

United Nations. 2023. *Advancing Indonesia's Food Systems Transformation: A Stocktaking Moment*.

United Nations. 2016. *Human Security Handbook*. New York: UN.

United Nations Development Programme. 1994. *Human Development Report 1994: New Dimensions of Human Security*. New York: Oxford University Press.

Van De Sande, A., and K. Schwartz. 2017. *Research for Social Justice: A Community Based Participatory Approach*. 2nd ed. Canada: Fernwood Publishing.

Vinyeta, Kirsten, Kyle Powys Whyte, and Kathy Lynn. 2015. *Climate change through an intersectional lens: gendered vulnerability and resilience in indigenous communities in the United States*. Gen. Tech. Rep. PNW-GTR-923. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Whyte, K. 2018. What Do Indigenous Knowledges Do for Indigenous Peoples? (Chapter 4). In: M. K. Nelson and D. Shilling, eds., *Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability*. Cambridge: Cambridge University Press, pp. 57–82.

The World Bank Group and Asian Development Bank. 2021. *Climate Risk Country Profile: Indonesia*. Washington, DC: The World Bank Group.

The World Bank Group. 2016. *The Cost of Fire: An Economic Analysis of Indonesia's 2015 Fire Crisis*. Washington, DC: The World Bank Group.

Wani, Khursheed Ahmad, and Lutfah Ariana. 2018. Impact of Climate Change on Indigenous People and Adaptive Capacity of Bajo Tribe, Indonesia. *Environmental Claims Journal*.

Wihardja, Maria Monica, Bustanul Arifin, and Mukhammad Faisol Amir. 2023. *Towards More Sustainable Agro-food Systems in Indonesia*. Jakarta: Center for Indonesian Policy Studies.

World Meteorological Organization. 2024. *State of The Climate 2024 Update for COP-29*. WMO.

Newspaper and Media Articles

Antara News. March 11, 2014. Mentawai Kejar Target Swasembada Pangan. Accessed August 20, 2025, via <https://sumbar.antaranews.com/berita/88207/mentawai-kejar-target-swasembada-pangan>.

- Arif, Ahmad. February 12, 2025. Makna Perjanjian Paris bagi Indonesia. *Harian Kompas*.
- Arif, Ahmad. February 11, 2025. Mencairnya Kutub Utara Percepat Pemanasan Global, Tantangan dalam Beradaptasi. *Harian Kompas*.
- Arif, Ahmad, et al. 2023. *Colonial Legacy Behind the Marginalization of Local Food Culture*. Rainforest Journalism Fund.
- Arif, Ahmad, et al. 2023. *Food Independence Emergency in the Islands*. Rainforest Journalism Fund.
- Diana, Elviza. 2019. *Orang Talang Mamak, Bertahan Hidup di Hutan Tersisa*. Story Grants 2019, Internews' Earth Journalism Network.
- Fajriansyah, Adrian. August 11, 2025. Kala Laut Tak Lagi Bersahabat dengan Suku Laut. *Harian Kompas*.
- Febrianti. May 2025. *Terancamnya budi daya toek milik perempuan Mentawai* (English version: In Mentawai, a Local Delicacy Traditionally Harvested by Women is at Risk). Earth Journalism Network.
- Project Multatuli. February 28, 2023. Serial Masyarakat Adat: Suara dari Penjaga Terakhir Bumi.
- Rahayu, Kurnia Yunita. June 11, 2025. Tuter Pau Nene Perempuan Kallupini yang Menjaga Adat. *Harian Kompas*.
- Sari, Agus. February 6, 2025. Persetujuan Paris, AS, dan Kita. *Harian Kompas*.
- Wulansari, Ica. September 12, 2024. Pertanian tak berkelanjutan menghambat petani beradaptasi dengan perubahan iklim. *The Conversation*.