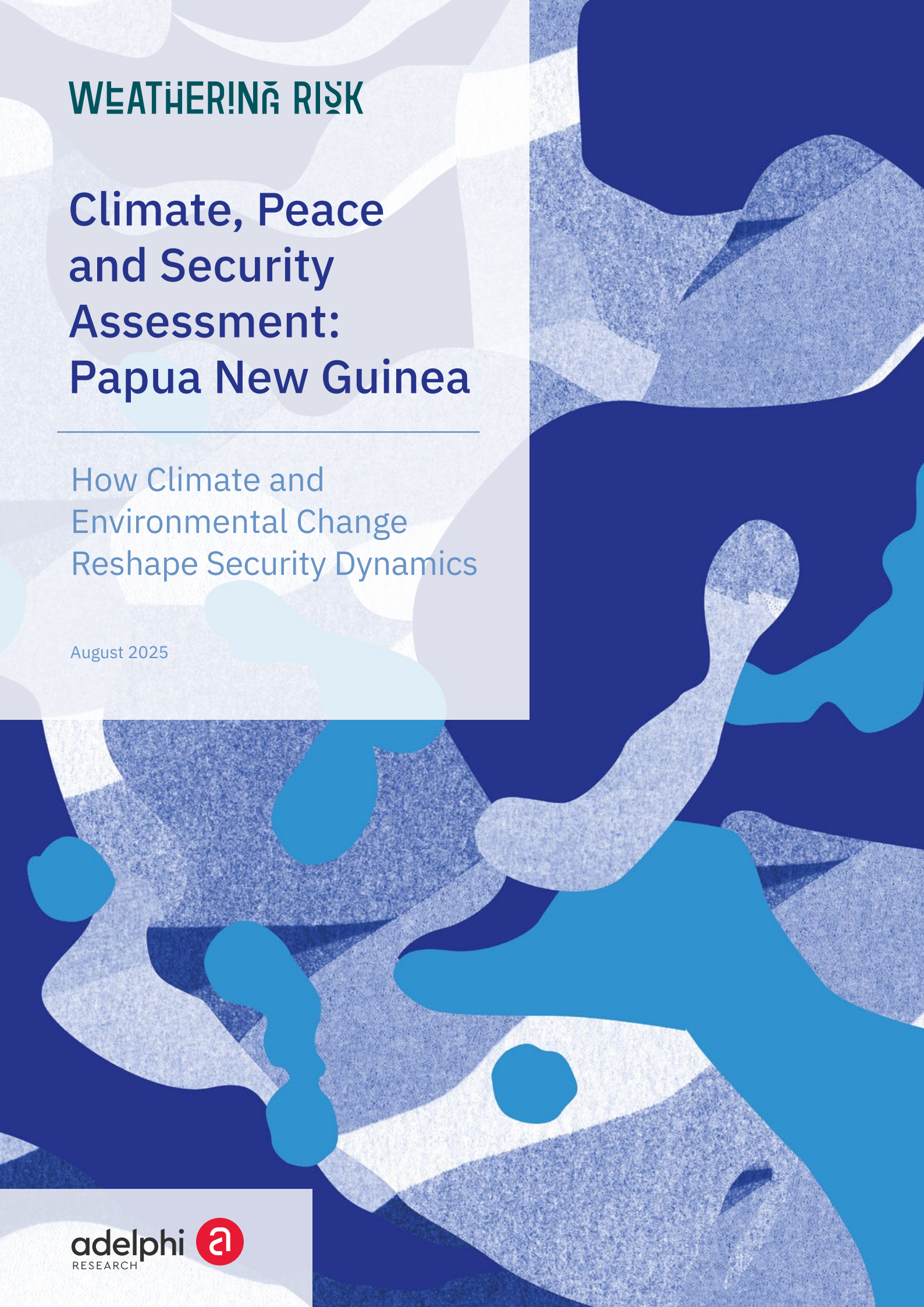
WEATHERING RISK

Climate, Peace and Security Assessment: Papua New Guinea

How Climate and Environmental Change Reshape Security Dynamics

August 2025



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Executive Summary

Papua New Guinea (PNG) is at a pivotal moment, facing the converging threats of climate change, environmental degradation and persistent insecurity. As one of the world's most ecologically and culturally diverse nations, PNG's communities are deeply connected to their environments. Yet this interdependence makes them particularly vulnerable to climate- and environment-related shocks and cascading risks. The Climate, Peace and Security Assessment, led by adelphi in partnership with ADB and UNDP, reveals that climate change is not simply an environmental challenge, but a force that is reshaping the landscape of conflict, vulnerability and development across the country.

CLIMATE AND ENVIRONMENTAL SECURITY PATHWAYS

Our assessment identifies six interconnected pathways through which climate and environmental changes amplify security risks in PNG. These pathways are not isolated; they interact with deep-seated social, economic and governance challenges, often compounding existing vulnerabilities and creating new ones.

Pathway 1: Environmental and climate change impacts contributing to sorcery accusation-related violence: Climate-related and other environmental challenges leading to death, crop failures and unusual weather patterns are increasingly interpreted through sorcery-related beliefs. These events can trigger accusations of sorcery, leading to targeted violence, displacement and deep trauma, especially for women and marginalised groups. A lack of climate awareness, weak law enforcement, the ambiguous roles of churches and village leaders, and the amplification of incidents through (social) media all contribute to the normalisation and increase of sorcery accusation-related violence (SARV) across the country, with climate change expected to further exacerbate such incidents.

Pathway 2: Climate and environmental impacts aggravating conflicts over natural resources: Conflicts over land, forests and fisheries are widespread across PNG and intensifying as climate change accelerates environmental degradation, disrupts traditional management systems and shifts resource availability. Economic pressures, weak governance and demographic change further compound these challenges, leading to new and more frequent disputes. Climate change intensifies these challenges by shifting land fertility, erasing natural boundaries, declining fish stocks, increasing deforestation and forest degradation, and driving displacement. The resulting conflicts and tensions frequently manifest in violent confrontations, particularly affecting communities whose livelihoods and cultural identities are intrinsically linked to these resources.

Pathway 3: Disaster and conflict driving displacement: Displacement in PNG represents a growing security challenge driven by both violent conflict- and climate-related disasters. These displacement events create cascading vulnerabilities, strain host communities and generate new conflicts. Displaced populations face heightened risks of violence, food insecurity and loss of access to basic services, with women and children particularly vulnerable. With limited institutional capacity, complex land ownership systems and increasing climate risks, displacement is becoming one of PNG's most urgent and intractable security challenges.

Pathway 4: Climate change impacts and conflict driving internal migration and security risks in urban areas: Rapid internal migration to urban centres such as Port Moresby (POM) and Lae is reshaping PNG's demographic landscape. Migrants are often driven by a combination of climate-impacted livelihood insecurity, rural violence and the search for better opportunities. However, unplanned urban growth has led to informal settlements with poor infrastructure, high unemployment, heightened exposure to climate risks and increased crime. Youth are especially vulnerable – both as victims

and as potential perpetrators – amid weakening traditional support systems. Urban areas are emerging as climate-security hotspots where environmental and social risks converge.

Pathway 5: Conflicts and tensions around the extractives sector – mining, oil and gas: The extractives sector remains a significant driver of tensions and conflicts in PNG. Large-scale mining, oil and gas projects have historically triggered disputes over environmental impacts, land rights and benefit sharing, often entangled with broader conflict dynamics and continue to do so. Weak oversight and the lack of effective social and environmental safeguards exacerbate these issues. Climate change further amplifies risks by, for example, increasing the likelihood of landslides, flooding and pollution, putting additional strain on relationships between communities, companies and government.

Pathway 6: Response measures intensifying tensions and conflicts: While development, adaptation and disaster-response projects aim to build resilience, they can inadvertently fuel new tensions if not implemented with sensitivity to local conflict dynamics. Unequal aid distribution, land disputes and inadequate community consultations exacerbate grievances, while corruption and favouritism deepen mistrust. Gender dynamics further complicate responses, with women frequently excluded from decision-making processes despite facing disproportionate impacts. However, conflict-sensitive and gender-responsive approaches have shown the potential to address these challenges effectively, highlighting the importance of integrating peacebuilding and climate change adaptation to reduce conflict risks and foster resilience as climate change impacts intensify.

CASE STUDIES: REGIONAL DYNAMICS AND LESSONS

The Highlands region: Hela and Southern Highlands Province (SHP): They represent PNG's most complex environment, where climate impacts, persistent communal violence and weak governance intersect. Severe climate impacts including rising temperatures, landslides and erratic rainfall compound existing challenges like SARV, displacement and extractive conflicts. Together, they create a volatile landscape where insecurity and vulnerability are deepening, and climate change accelerates and intensifies existing security challenges.

Coastal areas: Bougainville: Bougainville is one of PNG's most climate-vulnerable regions, where rising sea levels, intensifying extreme weather and environmental degradation compound the lasting effects of civil war. Communities across Bougainville – including atoll, coastal and inland areas – face severe threats of displacement, resource disputes, livelihood disruption, SARV and persistent tensions around mining activities. As Bougainville navigates its path towards potential independence, the intertwined challenges of climate impacts, disaster vulnerability and unresolved grievances are fundamentally altering the region's security landscape and development trajectory.

Urban Areas: Port Moresby and Lae: These cities emerge as climate-security hotspots where migration, environmental vulnerability and insecurity converge. Both cities are under increasing pressure from rapid urbanisation, fragile governance and the persistent legacy of colonial planning. Climate change – through rising temperatures, flood and drought risks – exacerbates vulnerabilities, particularly in informal settlements. These combined pressures erode social cohesion, intensify competition over land and resources and increase risks of crime and violence, particularly among marginalised youth. The

evolving interplay of climate and social stressors is driving new patterns of risk and instability, making urban resilience a critical priority for PNG's future.

BREAKING THE CYCLE: INTEGRATED SOLUTIONS

This assessment reveals that PNG's climate- and environment-related security challenges are deeply interconnected, requiring integrated responses that address root causes rather than symptoms. Eight priority recommendation areas are key:

1. **Integrate Peacebuilding, Climate Adaptation and Development:** Develop holistic approaches that combine climate resilience with conflict prevention and sustainable livelihoods. This includes community-level planning, climate-sensitive infrastructure development and programmes that link environmental awareness with peacebuilding efforts.
2. **Enhance Youth Engagement and Alternative Livelihoods:** Create comprehensive programmes that provide youth with future prospects and diversify livelihood options for climate resilience across all communities. This includes investing in vocational training, leadership development and climate-resilient economic opportunities to reduce youth vulnerability to violence and crime. Focus on both agricultural and non-agricultural sectors while addressing underlying social issues and marginalisation.
3. **Address Sorcery Accusation-Related Violence:** Develop multi-sectoral interventions that tackle the links between environmental change and SARV. This includes integrating climate and SARV education within schools, strengthening victim-protection mechanisms and engaging traditional leaders and community organisations in prevention efforts.
4. **Strengthen Disaster Risk Management and Displacement Response:** Build robust systems for disaster preparedness and displacement management that prevent conflict and maintain social stability. This includes establishing comprehensive data collection on displacement, making disaster preparedness and response conflict sensitive, and developing durable resettlement solutions with meaningful community participation.
5. **Build Urban Resilience:** Develop inclusive urban development strategies that address the convergence of climate change vulnerability and insecurity in cities. This includes conflict-sensitive urban planning, upgrading informal settlements with climate-resilient infrastructure and creating violence prevention programmes that engage youth and marginalised communities.
6. **Improve Sustainable Natural Resource Management:** Develop integrated approaches to managing PNG's natural resources that balance economic development with environmental conservation and conflict prevention. This includes supporting community-based management initiatives with built-in conflict resolution mechanisms, strengthening land rights and governance systems, ensuring extractive industries adhere to environmental and social safeguards with equitable benefit-sharing, and empowering women's participation and leadership in resource management decisions.
7. **Improve Governance, Law Enforcement and Data Systems:** Strengthen institutional capacity for managing climate- and environment-related security risks through better governance and evidence-based decision-making. This includes enhancing local conflict resolution mechanisms, improving resource management systems and building comprehensive monitoring and analysis capabilities.
8. **Enhance Data Collection and Analysis for Evidence-Based Interventions:** Establish robust systems for collecting and analysing climate and environmental security data to enable more targeted and effective interventions. This includes developing comprehensive monitoring of displacement, SARV incidents, and climate- and environment-related conflicts, conducting regular local-level assessments, and building capacity of local institutions to explore climate-conflict dynamics and share lessons learned regionally.

PNG's ability to navigate the challenges of climate change and insecurity will depend on coordinated, inclusive and context-sensitive action. By bridging climate adaptation, peacebuilding and development, decision-makers can turn risks into opportunities – building a more resilient, peaceful and equitable future for all Papua New Guineans.

Contents

List of Acronyms

ABG	Autonomous Bougainville Government
AROB	Autonomous Region of Bougainville
BCL	Bougainville Copper Limited
BPA	Bougainville Peace Agreement
BRA	Bougainville Revolutionary Army
BSDS	Benefit Sharing Distribution System
DDA	District Development Authority
DRM	Disaster Risk Management
DYDC	District Youth Development Council
ENSO	El Niño-Southern Oscillation
GPPF	Gulf of Papua Prawn Fishery
GRM	Grievances Redress Mechanism
HGCP	Hides Gas Conditioning Plant
ILG	Incorporated Land Groups
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
IPV	Intimate Partner Violence
ITCZ	Intertropical Convergence Zone
IUU	Illegal, unreported, and unregulated
KMS	Kanaka Management Services
LEDL	Log Export Development Levy
LLG	Local Level Governments
LNG	Liquified Natural Gas
MDB	Multilateral Development Bank
MTDP	Medium Term Development Plan
NDC	Nationally Determined Contributions
NFA	National Fisheries Authority
NGO	Non-Governmental Organisation
ODA	Official Development Assistance
PDI	Peace Dividends Initiative
POM	Port Moresby
PNG	Papua New Guinea
PNGDF	Papua New Guinea Defence Forces
SARV	Sorcery Accusation-Related Violence
SGBV	Sexual and Gender-Based Violence
SHP	Southern Highlands Province
SIDS	Small Island Developing States
SPCZ	South Pacific Convergence Zone

List of Figures

List of Tables

Glossary

Climate-related hazards: Adverse events directly or indirectly caused by climate variability and change, posing risks to human health, ecosystems, infrastructure and economies. These hazards include sudden-onset events like hurricanes, floods and heatwaves, as well as slow-onset processes such as sea-level rise, desertification and glacial retreat (IPCC 2022).

Climate impacts: Climate impacts on natural and human systems result from the complex interaction between climate-related hazards (such as extreme weather and climate events), exposure and vulnerability. These impacts encompass effects on lives, livelihoods, health and well-being, ecosystems and biodiversity, economic, social and cultural assets, as well as services – including ecosystem services – and infrastructure. In this report, climate impacts (also referred to as consequences or outcomes) may be either positive or negative (IPCC 2018).

Weather, climate, geological and water-related or -induced disasters: This phrase inclusively denotes the origins and impacts of hazards most relevant to PNG. According to the UN General Assembly, a hazard is "a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation." A hazardous event may produce a disaster or serious disruption by interacting with conditions of exposure, vulnerability and capacity. Hazards with geological origin include earthquakes, volcanoes, near-surface erosion and mass movement. Meteorological (weather-induced or -related) and hydrological (water-related) hazards result from atmospheric processes and their interactions with land and ocean systems, influencing the distribution of water resources. These hazards include tropical cyclones, droughts, riverine floods and heatwaves. A location's average weather conditions over an extended time period (usually 30 years) comprise its climate, and persistent changes in climate act as underlying drivers of disaster risk that reflect a combination of natural processes and phenomena, as well as human activities and choices (UNDRR 2020).

Cultural identity: Cultural identity is a complex combination of ethnic backgrounds, socioeconomic conditions, linguistic elements and historical influences, each contributing uniquely to the formation of individual and collective identities.

Intergroup (communal) violence: A type of communal violence where group identity, traditional familial ties, clans and tribes serve as significant motivating factors. This term encompasses conflicts between various social groups. In PNG, a lot of intergroup and communal violence is described as "tribal" violence. However, there are several challenges with this terminology, including assumptions about the nature, motivations and forms of this type of violence that are not necessarily appropriate for the context in PNG, as well as the "othering" typically linked to the term (Forsyth et al. 2024).

Natural hazards: These include earthquakes, floods or landslides. They interact with exposure and vulnerability to produce disasters in communities that are not adequately protected (UNDRR 2023).

Settlers: This term is used in PNG's urban context to describe internal migrants moving from rural areas to urban settings, residing illegally in peri-urban settlements that are often on state and sometimes on customary land.

Transactional sex: The exchange of sex for material goods or financial resources that often takes place in a context where women lack alternative choices to fulfil the need for survival or consumption (Formson & Hilhorst 2016).

Interview partners: In this report, the term is used to describe all individuals who participated in interviews as part of this assessment. Their identity is not disclosed for confidentiality and security reasons. This includes community members, local leaders, government officials, civil society representatives and other relevant stakeholders.

Introduction

Background

PNG is a country of extraordinary cultural and ecological diversity, home to over 800 languages and remarkable traditions that have evolved alongside abundant natural resources for millennia. Rural communities represent 85 per cent of the population, and they are deeply connected to the forests, land and sea (Greenpeace 2010). PNG thus offers both great opportunities and mounting risks in our changing climate.

The country is home to the world's third largest tropical rainforest and exceptional marine biodiversity within the Coral Triangle, placing it at the heart of global environmental concerns. Yet this same geography – spanning the volatile Pacific Ring of Fire[1] – exposes PNG to some of the planet's most severe natural hazards, ranking it among the top 10 per cent of countries most vulnerable to climate impacts (ND-GAIN 2022). This vulnerability is particularly acute given that traditional livelihoods, from subsistence agriculture to coastal fishing, depend directly on stable environmental conditions.

What makes PNG's situation particularly urgent is how environmental pressures amplify existing tensions and conflicts, undermining peace. Climate impacts don't occur in isolation – they intersect with histories of conflict, violence and grievance, governance gaps and competition over natural resources. The devastating May 2024 landslide in Enga province, which displaced nearly 2,000 people and affected over 10,000 more, exemplifies how extreme weather events can trigger cascading humanitarian and security crises (Rognon 2024; IOM 2024a). The resulting displacement overwhelmed local capacity, heightened risks of disease and protection concerns, and fueled tensions among communities already affected by longstanding disputes.

Aim and Structure

Against this backdrop, adelphi, in collaboration with the ADB and UNDP, have developed this comprehensive Climate, Peace and Security Assessment for PNG. This report begins by outlining key historical, demographic, socioeconomic and peace and security trends in PNG. An overview of current and future climate change risks provided under possible climate and socioeconomic scenarios follows. Together, these elements provide a foundation for understanding the risks posed by climate change and their far-reaching implications for human security, including food, water and livelihood security, human health and displacement. Third, the assessment investigates climate- and environment-related security risks by analysing the main pathways through which climate change impacts and other environmental challenges translate into specific security risks. A crucial aspect of this analysis is understanding how environmental challenges are perceived by communities and how these perceptions interact with PNG's unique and diverse cultural contexts. This helps in identifying specific vulnerabilities and potential flashpoints for violence and conflict, as well as opportunities for building resilience. Finally, three case studies are presented that cover the diversity of PNG's geographies and communities and show important differences and similarities in terms of how climate- and environment-related security risks emerge across the country. The case studies focus on the Highlands region (Hela and SHP), coastal regions (Bougainville) and urban centres (POM and Lae).

Based on these findings and analyses, a set of actionable recommendations and entry points are put forward to better address climate- and environment-related security risks. These recommendations are meant to inform local communities, government agencies, non-governmental organisations (NGOs), multilateral development banks (MDBs) and international partners. The comprehensive approach used for this assessment aims to ensure that these strategies and recommendations are well-informed, culturally appropriate and effectively address the needs and concerns of all stakeholders concerned.

Methodology and Approach

The assessment follows the approach outlined in the Pacific Climate Security Assessment Guide endorsed by the Pacific Islands Forum, employing a mixed-methods approach, combining quantitative and qualitative data collection and analysis, and incorporating a gender-sensitive lens (UNDP and

1 The Pacific Ring of Fire is a volatile seismic strip of volcanoes characterised by frequent volcanic eruptions, earthquakes and tsunamis.

PIFS 2023). This approach and methodology were developed based on two years of field testing through over 12 assessments as part of the Weathering Risk initiative.[2] It combines state-of-the-art quantitative and qualitative methods in an innovative way. The approach builds upon other assessment methodologies and data sets, particularly those used for climate impact, vulnerability and resilience assessments, as well as peace and conflict analysis.[3] The analysis covers the following elements (see Figure 1):

- **Climate and environmental stressors** and their direct impacts, including temperature rise and its impacts on agriculture, flooding and infrastructure, as well as other non-climate related environmental issues such as pollution.
- **Peace and security context**, which comprises the history and state of economic, social and political (in) stability, past and ongoing security risks and conflict dynamics, the drivers and causes of insecurity, and the main actors that have an impact on security and stability.
- **Climate and environmental security pathways** that link certain climatic impacts and environmental challenges with specific security risks and conflicts, showing how security risks affect resilience, the environment and climate risks.
- **Context factors** shaping vulnerability and resilience to climate and security risks, including a variety of factors like gender equality and social inclusion. These context factors normally play a decisive role in all pathways and are at the centre of the analysis.

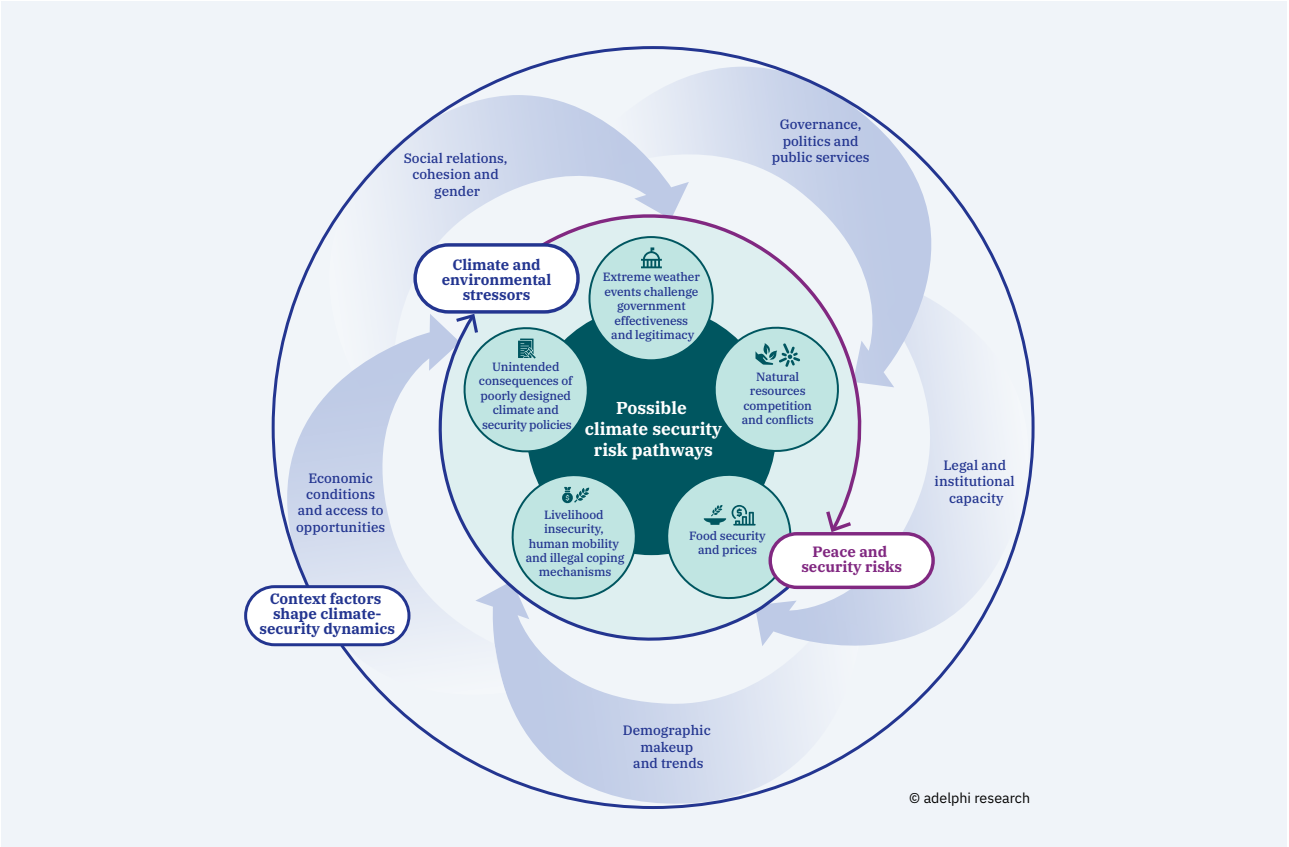

Figure 1: Elements of Weathering Risk Climate Security Risk Assessment Methodology (elaborated by adelphi). Weathering Risk climate security assessment approach (© adelphi).

2 Weathering Risk is a multilateral initiative that offers tailored analysis and tools to understand the linkages between climate and environmental changes and human insecurity to build sustainable peace. For more information, see https://weatheringrisk.org/
3 For more information, see https://weatheringrisk.org/en/methodology.

To ensure conflict sensitivity and a deep contextual understanding, local experts were involved from the beginning of the project. The assessment draws on a comprehensive review of the existing literature and evidence as of March 2025, alongside primary research conducted by a joint team of local and adelphi experts in cooperation with the Asian Development Bank (ADB) and UNDP. This research was carried out during a three-week mission in October and November 2024. To capture a broad spectrum of PNG's diverse geographies and communities, the team conducted more then 70 interviews and focus group discussions across SHP, Hela province, Western Highlands, East Sepik, Bougainville, Morobe and National Capital District (figure 2). For Bougainville, the assessment was built on prior climate-security work by Conciliation Resources who facilitated access to their network of partners and experts. In this report, "interview partners" refers to all individuals who participated in interviews as part of this assessment. Depending on context and confidentiality requirements, this includes community members, local leaders, government officials, civil society representatives and other relevant stakeholders. For reasons of privacy and security, we do not specify the identity or affiliation of individual interview partners.

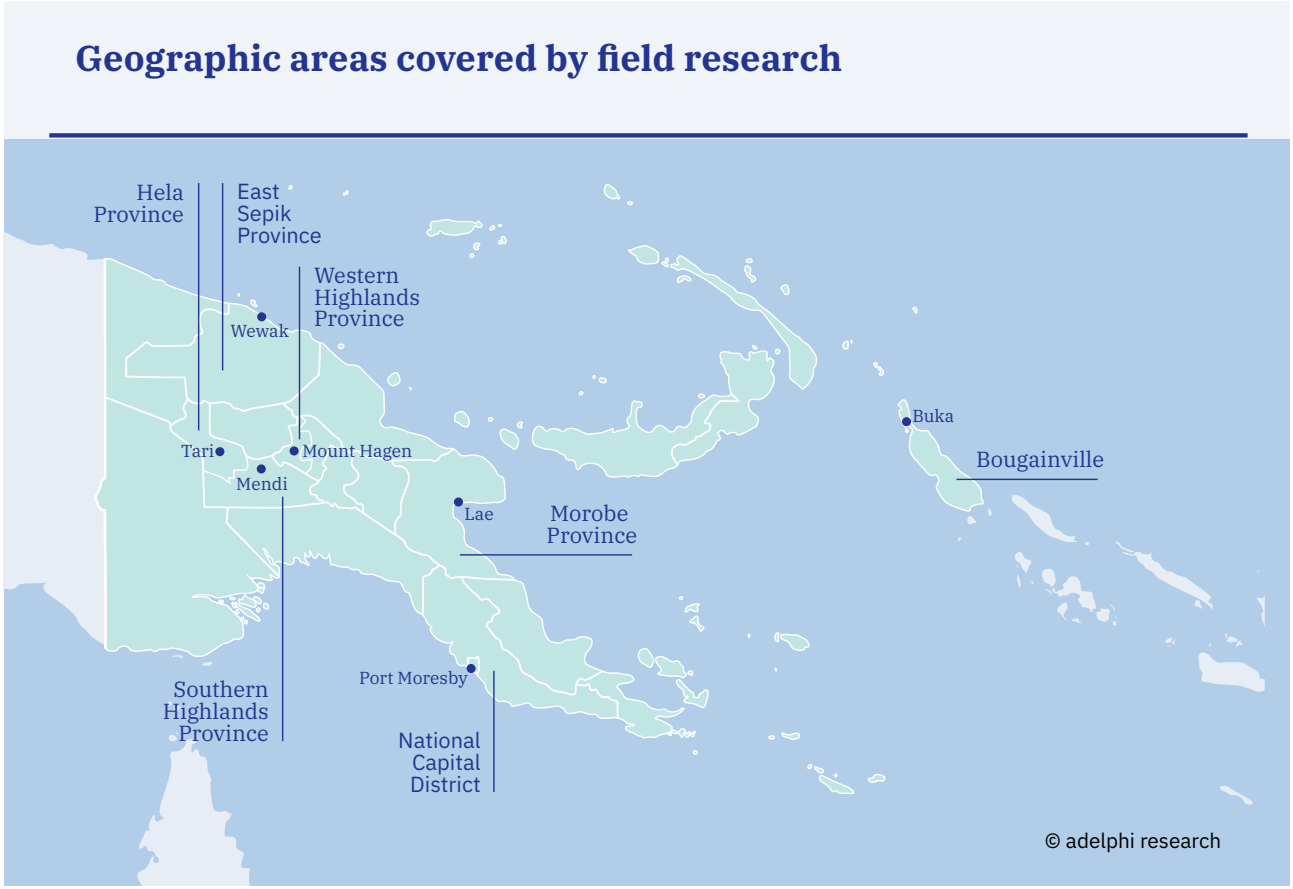

Figure 2: Geographic areas covered by field research (elaborated by adelphi).

Context Factors

PNG's fragmented political history

PNG's history is marked by divisions and political fragmentation, rooted in its extraordinary cultural and geographic complexity. Prior to the European settlement of PNG, the island was dominated by dispersed and isolated local communities, often ruled by traditional elders and engaged in taro crop production, fishing and hunting. In 1884, the island was divided between German and British control, with the northern part becoming German New Guinea – including New Britain, New Ireland and Bougainville – and the southern part, known as Papua, coming under British control.

During this colonial period, indigenous socioeconomic and cultural practices were systematically undermined. In the Wampar community for instance, power structures vested in traditional leaders through initiation practices diminished, and new forms of governance such as informal village councils were established by colonial administrators, eroding traditional structures (Church 2019). After the First World War, German New Guinea and the British Papua were merged and came under Australian administration until PNG gained its independence in 1975. The strive for independence began almost 10 years before, driven by international pressures and local motivations for self-determination.

Today, the colonial legacy continues to shape PNG's environmental, social, economic and geopolitical landscape. Its effects are evident in challenges such as land ownership disputes, economic dependency and political instability, which persist as significant risks (Church 2019; Suter 1981).

Geographical diversity: climate, resources and ecosystems

PNG encompasses the eastern half of the New,Guinean Island, the four islands of Manus, New Ireland, New Britain and the Autonomous Region of Bougainville (AROB), as well as 600 smaller atolls (World Bank 2021). It is also the largest island country in the Pacific region, distinguished by its mountainous topography and rugged terrains (UNDP 2023).

Figure 3: Physical map of Papua New Guinea (Ecosostenibile 2023).

As a Pacific island, PNG has a tropical climate characterised by its hot and humid nature all year-round, with an average temperature between 19°C to 29°C (UNDP 2023).

The wet season runs from December to March and is considered one of the wettest climates in the world, with an annual rainfall exceeding 3,074.85 mm. However, year-to-year climate variability is heavily influenced by the El Niño and La Niña conditions in the southeast Pacific, which brings an overall dryer climate to PNG (World Bank 2021). Situated in the Pacific Ring of Fire, PNG is exposed to frequent and intense natural hazards such as earthquakes and volcanoes (UN-PNG 2023).

PNG boasts abundant natural and mineral resources, including significant deposits of copper, gold, oil and natural gas. The country's mineral wealth is complemented by its vast biodiversity and extensive forest cover. Recognised as one of the most biodiverse countries in the world, PNG boasts extraordinary diversity across species, landscapes and ecosystems. Its vast tropical rainforests – the third largest globally, after the Amazon and the Congo Basin – are particularly notable, hosting an estimated 5 per cent of the world's total biodiversity (BioDB n.d.). PNG's forests serve as crucial carbon sink due to their large above-ground biomass. They also play a vital role in the livelihoods of local communities, providing resources for both household use and export (World Bank 2021)

PNG is also part of the Coral Triangle, renowned for its exceptional marine biodiversity, which includes some of the world's largest and most diverse coral reefs (BioDB n.d.). PNG's ecosystem landscapes range from highland valleys and grasslands to ancient swamps and mangroves.

Despite this considerable natural wealth, PNG is facing significant risks to biodiversity protection and conservation, mainly due to habitat loss from agriculture, logging, unsustainable practices and mining (BioDB n.d., World Bank 2021). Overfishing and destructive fishing practices are also putting PNG's marine ecosystem at risk.

A natural resource-dependent economy

Natural resources are the cornerstone of PNG's economy, which has grown more than threefold since the country gained independence in 1975 (World Bank 2021). Due to its high dependence on international commodity prices, PNG's real GDP per capita has grown at a modest annual rate of just 0.9 per cent. In 2022, the mining and quarrying sector dominated the economy, contributing more than 30 per cent of GDP. The extractive sector has been particularly volatile over the past years, with the closure and reopening of mines causing wide-felt disruptions. Despite this, the extractive sector continues to be the biggest driver of PNG's economy (Baker 2023). Together with agriculture, forestry and fishing, which accounted for nearly 20 per cent of the GDP, these two sectors make around half of PNG's economy (UN-PNG 2023). Additionally, the devastating earthquake in Hela province in 2018, as well as the impacts of the COVID-19 pandemic, set the country in a recession that significantly disrupted its economic growth (Baker 2023).

The agricultural sector is the primary source of employment for most of PNG's population, with subsistence farming and cash cropping serving as the main livelihood for 70 per cent of households (Fleishmann 2022). Subsistence agriculture is also crucial for ensuring food security across the country, notably in Hela and SHP provinces, where protracted violence and customary land tenure systems impede the development of agricultural value chains, leading to worse food and nutrition security outcomes (UNDP 2023). Forestry is another important source of livelihoods, providing employment through logging and other related activities (ADB 2023).

Despite these rich economic opportunities, poverty remains widespread, with rates estimated at 30 to 40 per cent. Adult literacy stands at just 50 per cent, placing PNG among the lowest 30 countries in the Human Development Index (World Bank 2021). While the unemployment rate was reported as low as 2.70 per cent in 2023 (Trading Economics 2023), this does not reflect the contextual realities of the economy, as many people are employed in subsistence farming and other informal economic sectors (Turia 2024).

Classified as a Small Island Developing State (SIDS) in a fragile and conflict-affected situation by ADB, PNG received a total of $4.7 billion in the form of 271 public sector loans, grants and technical assistance as of 31 December 2023, rendering ADB its largest financial partner. Currently, ongoing large-scale investment by ADB includes a $1 billion programme for the rehabilitation and sustainable maintenance of a highway in the Highlands region to support the country's transport and energy sectors (ADB 2024). These loans and grants constitute a significant proportion of PNG's budgetary income and play a critical role in shaping its development strategies. Next to ADB, the Australian government is PNG's second biggest donor, with an estimated Official Development Assistance (ODA) of $637.4 million in 2024-2025. Australian ODA is heavily directed towards investment in economic growth, education, health, law and justice, infrastructure, gender and subnational priorities (Australian High Commission n.d.). The World Bank is also a significant donor to PNG, although there are limited comparable data on investment sizes and timelines (PNG National Information Center 2024; JICA 2024; World Bank n.d).

Shifting demographic and social trends

In 2021, PNG was estimated to have a population of over 11 million – 47.8 per cent of which are female (NSO 2021).[4] This is a big difference from the 2011 numbers, which reported the total population of the country at 7,375,324 (NSO 2011). The annual population growth has been steadily increasing from 2.2 per cent in the 1980s to 3.1 per cent in 2011.[5] The largest number of inhabitants reside in the Highlands region, totalling 4.57 million people, followed by the Momase region, with a population of 3.04 million, which includes the Morobe province, recognised as the most densely populated area in the country (NSO 2021). The national capital, POM, is located in the National Capital District (NDC) and has a population of 513,918, according to the 2021 census (NSO 2021). A majority of people in PNG are young, with the best estimates putting the youth population aged 15 to 24 at 21.6 per cent and the youth population below 15 years at 40 per cent (NSO 2021; CCDA 2020; Ige 2024).

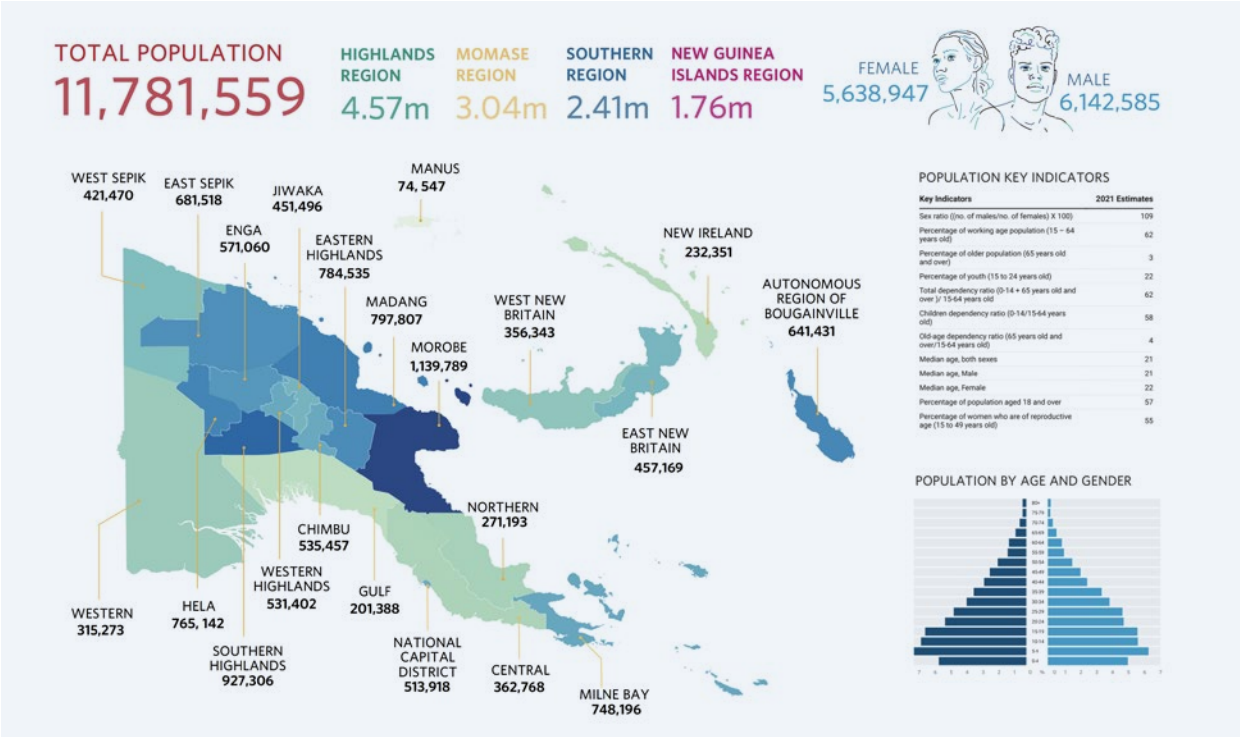

Figure 4: National population census for PNG (NSO 2021).

4 The country's demographic census takes place every 10 years. The estimated censuses of 2011 and 2021 are not entirely reliable due to discrepancies in implementation and methodology (Laveil 2023; CCDA 2020).
5 Annual population growth numbers were not available in the 2021 national census.

PNG stands out as one of the world's most culturally and linguistically diverse countries in the world, a characteristic that profoundly shapes its societal fabric and national identity (UN-PNG 2023). The country's population, predominantly of Melanesian origin, speaks an array of over 800 distinct languages, making PNG home to roughly 12 per cent of the world's total languages (Minority Rights Group 2018). This linguistic diversity reflects the country's complex and rugged geographies, as well as the historical isolation of many communities.

Despite this linguistic landscape, PNG has adopted English, Tok Pisin (an English-based creole) and Hiri Motu as its official languages (Minority Rights 2018). These lingua francas serve as bridges across the country's diverse communal and linguistic groups. Identity distinctions are also significant across the different regions, as a product of fragmented terrains, history, culture and language. Each communal identity has its own distinct traditions, social structures and cultural practices, contributing to a rich and complex national tapestry. Christianity plays a crucial role in PNG's cultural landscape. The introduction of Christianity by European missionaries during the colonial period has had a profound impact, with the overwhelming majority of the population now identifying as Christian (Aritonang & Steenbrink 2008). As a result, the church has become deeply integrated into the social, cultural and developmental dimensions of PNG societies, often serving as a unifying force across diverse groups (Minority Rights Group 2018).

An essential part of PNG's social and cultural fabric is the Wantok system: a traditional social system in which people from the same identity groups support and protect each other. It emphasises relation building and mutual support between members of the community, and it largely influences political allegiance, which almost always aligns with communal identities (Huettmann 2023). The Wantok system significantly shapes PNG's democratic processes, as political allegiances often follow kinship and communal ties rather than policy platforms, giving communal leaders considerable power in PNG's political system. This is evident in the way elected officials allocate resources exclusively to the constituents who voted for them. As a result, roads may abruptly end at the boundaries of these constituents' lands (Higgins et al. 2022). Strong regional and provincial identities in PNG mean that governance and development policies must gain approval from traditional authorities before they can be officially adopted or effectively implemented (Jorgensen 2007).

Patterns of insecurity, violence and conflict

PNG is ranked in the bottom 10 countries on the Global Peace Index as one of the most violent and least peaceful countries in the world (IEP 2024). Several structural conflict drivers, including weak governance and institutions, colonial and historical legacies, inequality and exclusion, societal and ethnic divisions, environmental and climate pressures, and demographic challenges, combine and manifest in different forms of violence and conflict. These include, but are not limited to, intergroup violence, SARV, electoral violence, and sexual and gender-based violence (SGBV). Among these, intergroup violence and SARV are the most prevalent, according to media and national court reports (Forsyth et al. 2024; Laki 2022). This violence contributes to rising annual fatality rates, intensifies intergenerational trauma and weakens social cohesion. The geographic location of violent incidents also varies. Enga province reports the highest number of violent incidents, while the lowest is reported in the NDC. However, this disparity may reflect the concentration of journalists in certain areas, suggesting an increased likelihood of documentation rather than an actual difference in incident frequency (see Table 1).

While intergroup violence is most prevalent in the Highlands region, it is not confined to it. These conflicts are often rooted in disputes over land access and ownership, frequently escalating into large-scale violence. For instance, in February 2024, intergroup violence resulted in the killing of 49 people in a major escalation in Enga province (Swanston 2024). As for SARV, sorcery accusations have and continue to be a major driver of violence in PNG, with up to 6,000 violent incidents involving more than 3,000 deaths between 2000 and 2021 (Forsyth et al. 2021). Electoral violence is also common. During the last national elections in 2022, almost 25 cases of election-related violence were reported, with almost 18 killings in Enga province alone (Forsyth & Peake 2022).

PROVINCE	NUMBER OF VIOLENT INCIDENT	PERCENTAGE
Enga	79	28.2
Westen Highlands	53	18.9
Hela	50	1.8
Jiwaka	32	11.4
Southern Highlands	31	11
Eastern Highlands	25	8.9
Chimbu	10	3.6
National Capital District	1	0.4
Total	**281**	**100.0**

Table 1: Location of intergroup violent incidents in PNG (Forsyth et al. 2024).

Women and girls are particularly affected by violence. In particular, SARV is experienced by women at significantly higher rates than men, with some regional variations (see Pathway 1 for more information). The high rates of SARV against women reflect embedded assumptions about women engaging in sorcery, subjecting them to physical violence, social exclusion and psychological trauma as a result (Forsyth et al. 2019; Forsyth et al. 2024). In addition, SGBV is an endemic challenge in PNG. Between 2016 and 2018, 56 per cent of women aged 15-49 in PNG reported experiencing physical violence since age 15, and 28 per cent have experienced sexual violence (NSO n.d.; UN-PNG 2023). These specific types of violence are often rooted in the patriarchal and patrilineal nature of many communities. Women-led peacebuilding efforts are driving positive change and becoming more effective in reducing violence in PNG (Forsyth et al. 2024; UNSDG 2020). Youth are often both victims and perpetrators of violence and criminal behaviour. Many migrate to large cities such as POM or Lae in search of better livelihood opportunities. However, this migration often disconnects them from their communities and traditional leaders, leaving them vulnerable to reside in informal settlements notorious for crime and violence. High rates of youth unemployment and illiteracy further contribute to their marginalisation and engagement in criminal activities (McLachlan 2018).

Urban and peri-urban areas are often hotspots for crime and violence, with POM notably ranking among the world's top 50 cities for highest homicide rates (Ivaschenko et al., 2017). Urban spaces are becoming riskier partly due to the unplanned influx of internal migrants, especially from rural areas. These migrants often reside in inadequate settlements without reliable infrastructure or services and face challenges in finding suitable employment, resulting in increased criminal behaviour. For instance, existing tensions erupted during a POM police strike in January 2024, which led to looting and rioting, eventually killing 15 people and five in Lae (SBS 2024; ACLED 2024).

Finally, the repercussions of the Bougainville civil war are still felt across the country. The war negatively impacted PNG's development, delaying progress on education, healthcare and infrastructural development (Reilly 2004). After almost a decade of fighting (from 1988 to 1998) which claimed the lives of more than 20,000 people in the region (PBF n.d.), the conflict ended through the signing of the Bougainville Peace Agreement (BPA) in Arawa in 2001. The BPA granted Bougainville a state of autonomy, with the first Autonomous Bougainville Government (ABG) introduced in 2005. A referendum took place in 2019 and achieved almost a 98 per cent endorsement, paving the way for an independent Bougainville (Conciliation Resources n.d.).

Climate Risks: Current and Projected Climate Changes

This section provides an overview of observed and projected climate changes for the near-term (2020-2039) and medium-term (2040-2059).

It uses available data from the World Bank's Climate Change Knowledge Portal,[6] as well as impacts across different sectors.[7]

CLIMATE HAZARD / TREND	KEY CLIMATE IMPACTS / OBSERVED CHANGE
HISTORICAL CHANGE (1970–2020)	**Warming and Wetting:** • Over the past 50 years, PNG has become both warmer (0.2°C per decade) and wetter (153 mm more rain per decade). • Policymakers should note that gaps exist in PNG's historical and ongoing climatological monitoring, limiting a comprehensive understanding of long-term climate dynamics.
TEMPERATURE INCREASE	**Progressive Warming Across Regions:** • PNG faces significant warming under all scenarios, with temperatures rising 0.58°C by 2039 and up to 1.17°C by 2059 under a high-emission scenario. • The Highlands will warm more during winter and spring than coastal and island areas. **Dramatic Increase in Extreme Heat:** • Warm days will increase dramatically (up to 44 more days >25°C in Hela and 108 more days >30°C in POM by 2059), as well as warm nights (up to 61 more tropical nights in Southern Highlands). • This will threaten health, sleep quality and shifting habitable zones in Highland areas.
PRECIPITATION	**Wetter Future with High Uncertainty:** • PNG's rainfall is projected to increase by 76 mm (near-term) to 161 mm (mid-century) under a high-emission scenario, with wide possible ranges (-146 mm to +419 mm). • The greatest increases will be in the Highlands (>200 mm) and the smallest changes in POM (62 mm). **Continued Climate Variability:** • Despite the overall wetter trend, El Niño-driven dry periods will persist alongside more frequent and intense extreme rainfall events, with current once-in-a-century events occurring twice as often nationally and 2.3 times more frequently in the Highlands by mid-century.
INLAND FLOODING	**Intensifying Riverine Flood Risk:** • Riverine flood risks will intensify by mid-century, with increased flooding depths (>1 m) projected for major river systems in Western, Gulf, East Sepik, Sandaun and Madang provinces, threatening settlements, infrastructure and agricultural lands.
LANDSLIDES	**Elevated Landslide Hazards:** • Increasing monsoon rainfall (>100 mm) will elevate landslide risks across the Highlands and Momase regions, with Western Highlands, Jiwaka and Morobe facing the greatest risk, especially in areas also exposed to earthquake hazards.
DROUGHT	**Persistent and Intensifying Drought:** • Despite PNG's wet climate, drought risks will persist due to El Niño events, which are projected to become more frequent (17-20 per cent increase) and intense by mid-century. • The Southern region faces the highest drought risk during the southeast monsoon season, with Central province (around POM) projected to experience the greatest precipitation deficits, threatening water-intensive crops, hydropower and water systems.

6 For more information about the portal, see https://climateknowledgeportal.worldbank.org/.

7 Projected trends rely on two Intergovernmental Panel on Climate Change (IPCC) climate change scenarios compared to 1995-2014 baseline conditions – a low-emission SSP1-2.6 scenario and high-emission SSP3-7.0 scenario presented at 0.25° x 0.25° resolution. Best estimates refer to median (50th percentile) multi-model ensemble projections, while possible estimates in parentheses denote 10th percentile and 90th percentile ranges. Observed temperature and precipitation records (CRU TS4.07 and ERA5 data) originate from ground instruments and satellites for the periods 1971-2020 and 1991-2020. For further details regarding climate scenarios, data sources, presentation and uncertainty, see the "Supplemental Information" in the Annex.

COASTAL AND MARINE RISKS	**Rising Sea Levels and Compounding Marine Impacts:** • Sea levels are projected to rise approximately 20 cm by mid-century and up to 66 cm by 2100, with low-lying islands in Manus, New Ireland and Milne Bay provinces facing the greatest risks. • Rising sea surface temperatures (0.7-1.1°C by mid-century) will compound coastal threats through coral bleaching and reef degradation, endangering marine biodiversity, food security and coastal livelihoods.

Table 2: Climate hazards/ trends and their key climate impacts & observed changes.

Observed Climate

PNG's climate is shaped by five key factors that create its diverse weather patterns:

- **Varied landscapes** – from low-lying islands to highlands over 4,000 metres high
- **Geographic position** – spanning 1-12 degrees south of the equator
- **Wind-driven monsoon seasons** – northwesterly during December-March, southeasterly during May-October
- **Key atmospheric features** – the movements of the Intertropical Convergence Zone (ITCZ) and Southern Pacific Convergence Zone (SPCZ)
- **El Niño-Southern Oscillation (ENSO)** – a natural climate cycle that causes alternating wet and dry periods

PNG has consistently warm temperatures year-round. The national average ranges from about 19.5°C (minimum) to 30°C (maximum). Coastal and lowland areas are warmest, with Manus Island reaching 27.4°C during January (summer). Mainland lowland provinces like Western, Gulf and East Sepik average around 26°C.[8] Temperature decreases with elevation – for every 200 metres higher, temperatures drop by about 1°C (Michael 2019). The Highland provinces experience the coolest temperatures, with Hela province averaging 21.4°C annually and dropping to 20.6°C in July (winter).[9]

As one of the world's wettest countries in the world, PNG receives over 3,000 mm of rainfall annually, though timing and amounts vary significantly by region. Rainfall patterns are influenced by the movement of the ITCZ – a band of heavy rainfall that shifts north and south seasonally. From December to March, this system moves southward, bringing moist northwesterly winds and the "wet" monsoon season (Australian Bureau of Meteorology and CSIRO 2011). From May to October, the ITCZ shifts northward, resulting in southeasterly winds and a relatively drier season.[10] Regional rainfall patterns vary significantly across PNG due to geography and seasonal weather systems:

- **Islands Region:** The eastern islands (New Britain and Bougainville) experience a unique rainfall pattern influenced by the SPCZ. This creates two distinct wet periods annually – a primary peak during winter (June-August) and a secondary peak during summer (December-March). All island provinces receive substantial rainfall exceeding 3,000 mm yearly, with New Britain as the wettest at over 4,000 mm annually (Australian Bureau of Meteorology and CSIRO).

- **Northern Regions:** The ITCZ has greater year-round influence in the north (Momase region, Manu, and Bismarck Archipelago). Islands closest to the equator (Manus, New Ireland) receive nearly uniform rainfall throughout the year, especially during spring (September-November) and fall (March-May) when the ITCZ hovers closer to the equator.

8 However, PNG's largest islands – New Britain, New Ireland and Bougainville – maintain slightly lower mean temperatures due to their higher topography.
9 Observed temperature and precipitation records (CRU TS4.07 and ERA5 data) originate from ground instruments and satellites for the periods 1971-2020 and 1991-2020. See "Supplemental Information" in Annex for more details.
10 While regions across the monsoonal Pacific experience "wet" and "dry" monsoon phases, the "dry" monsoon season in PNG principally denotes the change in southeasterly wind direction, which delivers less precipitation in relative terms compared to the northwest monsoon, but still exceeds global thresholds associated with moist tropical rainforest climates. The most distinct wet and dry periods occur in parts of the Southern region, where a tropical monsoon climate prevails according to the Köppen-Geiger classification system. The dry monsoon also plays a large climatic role in the Western province, where savanna, scrubland and dry seasonal forest dominate areas furthest south. For further details, see Australian Bureau of Meteorology & CSIRO, 2011.

- **Highlands Region:** The Southern Highlands and Hela province receive surprisingly high rainfall during the southeasterly monsoon (May-October) despite this being the "drier" season elsewhere (Standish & Jackson 2025).

- **Southern Region:** POM experiences much drier conditions during winter months (June-August) due to its location in the rain shadow of the Papuan Peninsula. This geographic position magnifies the effects of the dry monsoon season during austral winters.

- **Seasonal Variations:** The northwest monsoon typically peaks at different times across the country – earlier in eastern Momase and later in both western Momase and Highland provinces. Similarly, the southeasterly monsoon season varies in length, lasting only about three months in northernmost Manus but extending to roughly seven months in southernmost Milne Bay.

PNG's climate is also strongly affected by the ENSO cycle. During La Niña phases, the Highlands and Southern region typically experience heavier rainfall, especially when paired with a negative Indian Ocean Dipole (IOD) phase, which brings the largest observed increases in Western, Madang and Morobe provinces (Aitkenhead et al. 2023). By contrast, during El Niño phases, most of PNG faces delayed monsoons and drier conditions, further amplified during positive IOD phases.[11] This natural variability leads to both extreme floods and landslides (typically during La Niña for most provinces) and droughts and high-altitude frosts (typically during El Niño for most provinces).

Records from the past 50 years (1971-2020) show PNG becoming both warmer and wetter. However, policymakers should note that gaps exist in PNG's historical and ongoing climatological monitoring, which limit a comprehensive understanding of long-term climate dynamics (Australian Bureau of Meteorology and CSIRO 2011; Kuleshov et al. 2019).

Average temperatures have increased by 0.2°C per decade nationwide, with Sandaun province warming the most (0.35°C per decade) and East New Britain the least (0.12°C per decade). Both maximum and minimum temperatures have increased by 0.23°C per decade. Notably, the number of warm tropical nights (minimum temperature above 20°C) has increased by nearly five nights per decade nationally. Rainfall has increased by about 153 mm per decade nationally, with the largest increases in Morobe province (346 mm per decade) and West New Britain (305 mm per decade). The greatest seasonal rainfall increases have occurred during spring months (September-November), particularly in Morobe, with increases of 132 mm per decade. These warming and wetting trends are projected to continue under both high- and low-emission scenarios.

Air Temperature

PNG will experience significant warming in the coming decades under both high-emission (SSP3-7.0) and low-emission (SSP1-2.6) scenarios.[12] While both scenarios show similar warming in the near-term (2020-2039), they diverge more noticeably by mid-century (2040-2059). Under the high-emission scenario, average annual temperatures are projected to rise by 0.58°C (possible range: 0.33°C to 0.89°C) in the near-term and by 1.17°C (possible range: 0.79°C to 1.70°C) by mid-century. The low-emission scenario shows similar warming in the near-term but less warming by mid-century (see Figure 4).

Temperature increases will not be uniform across PNG's regions and seasons. By mid-century, the Highlands region will experience greater warming during winter (June-August) and spring (September-November) compared to the Islands and mainland coastal areas under both scenarios. For example, winter temperatures in Hela province are projected to rise by 1.27°C (possible range: 0.83°C to 1.92°C), while Bougainville may see a lower increase of 1.09°C (possible range: 0.77°C to 1.53°C) during

11 Except in East New Britain, New Ireland and Bougainville, droughts tend to correlate with La Niña phases (Aitkenhead et al. 2023). Changes in the SPCZ exert greater influence over these typically moist areas. During La Niña, the SPCZ generally shifts southward, while during El Niño, the SPCZ shifts northward (Lorrey et al. 2012). During concurrent El Niño and positive IOD events, the northernmost Momase coast and islands remain less susceptible to observed droughts (Aitkenhead et al. 2023). The ITCZ exerts greater influence over these typically moist areas.

12 In short, the SSP1-2.6 scenario refers to a future global trajectory of up to 2ºC warming by 2100 that presumes low mitigation challenges and low adaptation challenges, realizing net-zero CO2 emissions after mid-century. The SSP3-7.0 scenario represents a future global trajectory with high mitigation and high adaptation challenges (including resurgent nationalism, regional conflict and insecurity), where by 2100 CO2 emissions double and warming exceeds 3ºC.

the same season. As temperatures rise, climate zones will shift upward in elevation across the Highlands, potentially affecting where people can live and grow crops.[13]

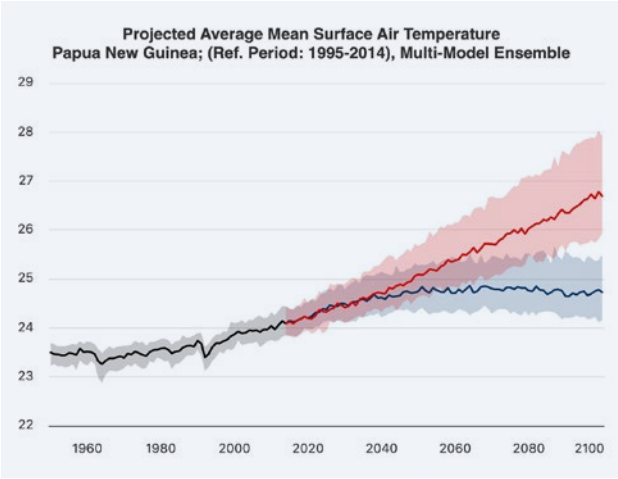

Figure 5: Projected average mean temperature in Celsius (Ref. Period 1995-2014) in PNG under SSP1-2.6 and SSP3-7.0 through 2100.[14] Note divergence between low-emission (blue) and high-emission (red) projected scenarios around mid-century. Shaded boundaries indicate 10th to 90th percentile values.

The number of warm days will increase significantly. However, both scenarios show a wide upper range of warm days:

- **In Hela province,** days with temperatures above 25°C will increase by 44 days annually (possible range: 25 to 75 days) by mid-century under the high-emission scenario and by 33 days (possible range: 16 to 52 days) under the low-emission scenario.

- **In POM,** days exceeding 30°C will increase dramatically – by 108 days annually (possible range: 58 to 202 days) under the high-emission scenario and by 79 days (possible range: 36 to 148 days) under the low-emission scenario.

- The highest heat index values (above 35°C, accounting for humidity) will pose the greatest risks in the less populated lowland areas of the **Southern and Momase regions.**[15]

Nighttime temperatures will also rise significantly across PNG:

- **SHP** will see the greatest increase in warm nights (above 20°C) in the Highlands region – 61 more nights annually (possible range: 35 to 93 nights) under the high-emission scenario and 43 more nights (possible range: 21 to 68 nights) under the low-emission scenario. These increases will be most pronounced during winter months.

- **Coastal provinces with mixed elevations** will experience large increases in even warmer nights (above 23°C), particularly in the Momase region (except Morobe province). [16]

- **Lowland Southern provinces** including POM **and larger mountainous islands** like Bougainville will also see substantial increases in warm nights.[17]

- The most extreme increases will occur on **lowland islands** including Milne Bay, which could experience more than six additional months of very warm nights (above 26°C) during summer and fall by mid-century under both scenarios.

These rising temperatures pose significant health risks, especially for vulnerable groups like the elderly, pregnant women, children and people with pre-existing health conditions. All regions of PNG will experience warmer conditions than in the past, with both hotter days and warmer nights. The extent of these temperature increases will ultimately depend on whether global emissions follow a high or low pathway.

13 This trend also extends to provinces with high elevations such as Morobe (Momase region), which displays the largest projected best estimate mid-century increase in summer days under the higher emission scenario by 56 days (39 days and 93 days possible) and under the lower emission scenario by 43 days (25 days and 70 days possible).
14 Data and visual produced using: World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.
15 For example, the largest best estimate increase in heat index days (maximum >35°C) of 49 days (11 days and 139 days possible) by mid-century under the high-emission scenario and 24 days (4 days and 77 days possible) under the low-emission scenario occurs in East Sepik province.
16 Under the high-emission scenario by mid-century, Sandaun province experiences an annual increase of 90 nights (53 nights and 138 nights possible) and under low-emission scenario an increase of 63 nights (33 nights and 108 nights possible).
17 Annual tropical nights in POM above the indicated threshold increase 75 nights (61 nights and 94 nights possible) under the high-emission scenario and 62 nights (42 nights and 81 nights possible) under the low-emission scenario by mid-century. In Bougainville, they increase 64 nights (46 nights and 96 nights possible) and 47 nights (27 nights and 72 nights possible), respectively.

Precipitation

PNG's rainfall is projected to increase annually nationwide, particularly during the northwest monsoon season, but significant year-to-year variability and varying levels of certainty in climate projections create a complex picture of changes across the country in the near- and medium-term:

- **Under the high-emission scenario,** annual rainfall is projected to increase by 76 mm nationally in the near-term (2020-2039) to 3,825 mm total (possible range: -146 mm and +259 mm) and by 161 mm by mid-century (2040-2059) (possible range: -67 mm and +419 mm possible).

- **Under the low-emission scenario,** annual rainfall is projected to increase by 100 mm nationally in the near-term (2020-2039) (possible range: -90 mm and +280 mm) and by 115 mm by mid-century (2040-2059) to 3,865 mm total (possible range: -91 mm and +326 mm).

This illustrates that most models agree annual precipitation will increase under both scenarios and timeframes, though some models also project notable annual reductions.

While the overall trend points to a wetter future, PNG will continue to experience significant year-to-year variability:

- **Regional variations:** The Highlands region will see the largest increases (>200 mm annually), with Southern Highlands province receiving an additional 257 mm by mid-century under the high-emission scenario. In contrast, POM will see minimal increases (62 mm annually) due to its rain shadow location.

- **Seasonal patterns:** Most regions will experience wetter wet seasons, with rainfall increases concentrated during the northwest monsoon period (December-March). Under the high-emission scenario, the ITCZ, SPCZ and monsoonal peaks all intensify nationally by mid-century

- **Climate variability:** Despite the wetting trend, El Niño events will continue to bring delayed monsoon onset and precipitation deficits across mainland PNG. More frequent and intense El Niño phases are possible under high-emission scenarios, meaning dry years will still occur periodically.

- **Extreme rainfall:** Heavy rainfall events will become more intense and frequent. The largest five-day rainfall totals will increase by up to 30 mm in the Southern Highlands by mid-century. What are currently considered once-in-a-century rainfall events could occur approximately twice as often nationally, and up to 2.3 times more frequently in the Highlands.

These projections highlight the need for decision-makers in PNG and partners to prepare for both more rainfall on average and more extreme rainfall events, while still maintaining readiness for periodic dry years, particularly during El Niño phases.

Riverine Flooding

PNG faces high riverine flood risk across most of the country due to its steep terrain, low-lying areas and heavy rainfall patterns:

- **Extreme flood risks** currently exist in (WRI 2023):
  - The Momase region, including most of the Sepik and Ramu River watersheds
  - The Bismarck Archipelago
  - The Southern region, including the Kikori and Upper Purari River watersheds that originate in the Southern Highlands

- **High flood risk** also affects the Fly-Strickland River watershed in Western province and the Markham River watershed in Morobe province (WRI 2023).

Climate projections indicate these flooding risks will intensify. By mid-century under a "middle-of-the-road" scenario, areas experiencing severe flooding (over one metre depth during 100-year flood events) are expected to increase in several major river systems (WRI 2023):[18]

18 Best-estimate riverine flood inundation risks decrease in some areas over the same time period, such as in the Brown-Vanapa River watershed (Central), subject to interannual and seasonal monsoon deficits and greater rain shadow effects. Similar ensemble projections occur under higher emission scenarios.

- The Fly-Strickland River system in Western province
- The Purari River system in Gulf Province
- The Sepik River system in Sandaun and East Sepik provinces
- The Ramu River system in Madang province

These projections align with the expected increases in extreme precipitation across the Highlands region, where these river systems originate. The most significant increases in flood risk will likely occur at the end of both monsoon seasons. Increased flooding threatens water, sanitation and hygiene systems in settled areas and raises the risk of vector-borne and waterborne diseases. Floods can also damage crops sensitive to excess moisture, such as sweet potato, and facilitate the spread of agricultural pests.

While these projections contain uncertainty similar to the precipitation forecasts, the overall trend points to increased flood risk with some location-specific decreases in flooding possible, depending on flood recurrence interval and future changes in ENSO variability and intensity. Decision-makers should prepare for more extreme flooding during La Niña or ENSO-neutral years, while hydrological droughts remain a risk during El Niño years.

Landslides

The projected increases in rainfall, especially during the northwest monsoon season, will raise landslide risks in mountainous provinces with high population density and erosion-prone terrain. Provinces with the largest clusters of historical landslide events include (Robbins 2014):

- Western province
- Sandaun province
- Western Highlands province
- Chimbu province
- Morobe province

Projected increases in monsoon rainfall will significantly elevate landslide risks across several provinces:

- **Highlands region:** Cumulative precipitation during the northwest monsoon season (December-April) is projected to increase by more than 100 mm across the Highlands under both emission scenarios, with Western Highlands and Jiwaka provinces facing the greatest increases in seasonal rainfall and landslide risk.

- **Momase region:** Under the high-emission scenario, monsoon rainfall will increase by more than 100 mm, with Morobe province facing the greatest increase. Under the low-emission scenario, Sandaun province will see the largest increases.

- **Island provinces:** East New Britain and New Ireland provinces, which have experienced landslides historically, are projected to see rainfall increases of approximately 100 mm under the low-emission scenario.

Historical patterns show that most landslides occur during La Niña phases and wet northwest monsoon periods (Robbins and Petterson 2015). **This suggests greater near-term landslide risk under the low-emission scenario,** but greater medium-term risk under the high-emission scenario. Large monthly rainfall increases during the southeasterly monsoon season, particularly under the high-emission scenario, would also raise the risk of landslides during what is traditionally the "dry" season.

While heavy rainfall is the primary trigger for landslides, earthquakes significantly increase the risk. Areas with elevated combined risk from both rainfall and earthquakes include Western, Sandaun and Morobe provinces, as well as the mountainous areas of Hela, Southern Highlands, Madang and the Bismarck Archipelago (GEM 2021). Settlements, critical infrastructure and agricultural land located on slopes in these high-risk areas face the greatest future threats from landslides.

Droughts

Despite PNG's generally wet climate, the country faces significant drought risks that will continue to impact food and water security in the future. Droughts particularly affect water-intensive crops (Michael 2019), hydropower energy supplies and water, sanitation and hygiene systems. These risks are primarily driven by the ENSO cycle.

Drought patterns in PNG show strong correlation with ENSO phases:

- **El Niño connection:** Most of PNG experiences drought during El Niño events, which typically bring delayed northwest monsoon onset and drier southeast monsoon conditions (Aitkenhead et al. 2023; PCCSP 2011).[19]
- **Regional exception:** East New Britain, New Ireland and Bougainville experience drought during La Niña phases rather than El Niño (Aitkenhead et al. 2023; PCCSP 2011).
- **Highland frost risk:** El Niño phases reduce cloud cover over the Highlands, leading to cooler night temperatures and increased frost risk (UNDP 2023).

Future drought conditions will be heavily influenced by how climate change affects ENSO patterns:

- **Severe drought frequency:** While average drought length may decrease, severe drought frequency associated with El Niño events may increase by mid-century in the Highlands under both emission scenarios (UNDP 2023).
- **Extreme drought intensity:** The frequency and intensity of the most extreme droughts nationwide may increase by mid-century under a high-emission scenario, though moderate droughts may not change significantly (Iese et al. 2021).
- **El Niño projections:** Most climate models project a 17-20 per cent increase in El Niño event occurrence between the late 20th and projected 21st centuries (Lopez et al. 2022), though significant uncertainty remains about how climate change will influence ENSO cycles (World Bank 2021).
- **Changing El Niño patterns:** Greater evidence suggests that El Niño forming over the Central Pacific will become more frequent, while patterns forming over the Eastern Pacific will intensify, affecting the timing and severity of drought impacts across PNG (Shin et al. 2022; As-syakur et al. 2016).

Drought risks will vary significantly by region and season:

- **Southern region:** More intense precipitation deficits are projected during the southeast monsoon season, especially in the Southern region. Central province around POM shows the greatest season-wide deficits: -12 mm under the high-emission scenario in the near-term and -8 mm under the low-emission scenario by mid-century.
- **Gulf province:** Under the high-emission scenario in the near-term, Gulf province could experience precipitation deficits of -29 mm during the first half of the southeast monsoon season (austral winter), though with high variation possible (-117 mm to +98 mm).
- **Morobe province:** Under the low-emission scenario by mid-century, Morobe could see precipitation deficits of -19 mm during austral winters, with similarly high variations possible (-125 mm to +64 mm).
- **Water resource variability:** Medium-high interannual water resource variability due to ENSO is projected to persist under both scenarios across most of the Islands and Southern regions (WRI 2023). The low-emission scenario projects high interannual variability in Milne Bay and Western province by mid-century.

Overall, projections suggest modestly higher meteorological drought risk during the southeast monsoon season across the Southern region and Morobe, especially under the high-emission scenario by mid-century. However, **given model uncertainty over future ENSO patterns, decision-makers should prepare for more frequent and intense extreme droughts nationwide** during whichever ENSO phase historically correlates with local drought impacts.

19 Observed drought intensity during El Niño years also strengthens during positive IOD phases (except on the northernmost Momase coast and Islands region).

Coastal and Marine Risks

PNG's extensive coastline faces significant risks from coastal flooding, sea level rise and increasing sea surface temperatures, with impacts varying across different coastal regions.

Sea level rise will affect PNG's coastlines with varying severity across regions and timeframes:

- **National trends:** Major cities like POM and Lae will experience sea level rise of approximately 20 cm (at least 11 cm likely) by mid-century under both scenarios, increasing to 66 cm (at least 46 cm likely) by 2100 under the high-emission scenario.
- **Most vulnerable areas:** Small and low-lying islands face the greatest risk, particularly in the northern Bismarck Sea (Manus province), north and east of New Ireland and in the southern Solomon Sea (Milne Bay province).
- **Extreme case:** The Louisiade Archipelago could see sea level rise of 23 cm (range: 14-33 cm) by mid-century under the high-emission scenario, increasing to 72 cm (range: 48-103 cm) by 2100.
- **Compounding factors:** Interannual sea level increases associated with La Niña events will further exacerbate the impacts of long-term sea level rise, storm surge and king tides (Red Cross Red Crescent 2024).

Baseline coastal flood risks vary significantly across PNG's diverse coastline:

- **Extremely high risk:** Low-lying archipelagos (Manus, Milne Bay Island chains) and much of the Southern Coral Sea coast (Western, Gulf) face the greatest baseline coastal flood risks.
- **High risk:** The northernmost Momase coast (Sandaun, East Sepik) and easternmost Islands (New Ireland, Bougainville) have high coastal flood risk.
- **Medium risk:** Much of the Papuan Peninsula, including POM, faces medium baseline coastal flood risk (WRI 2023).

Rising sea surface temperatures will compound coastal threats, particularly to marine ecosystems:

- **Temperature increases:** Coastal areas with the highest rates of sea level rise across the Southern region and Islands also face the greatest projected increases in sea surface temperature.
- **Warming projections:** By mid-century, sea surface temperatures are projected to increase by about 0.70°C under the low-emission scenario and about 1.10°C under the high-emission scenario (EU 2024).
- **Ecosystem threats:** These warming conditions increase risks of coral bleaching, ocean acidification and reef degradation, potentially preventing marine ecosystems from rebuilding biomass from current (2010-2014) levels.
- **Human impacts:** Degradation of marine ecosystems threatens biodiversity, food security and economic livelihoods dependent on coastal resources (Cheung et al. 2022).

Decision-makers should prepare for worsening extreme sea level events in the near-term, especially in the Islands and POM. The extent of medium-term coastal impacts along the Southern Coral Sea coast, northernmost Momase coast and Islands will partly depend on future global emissions. **These combined coastal impacts on food, water and livelihood security threaten to displace low-lying settlements and resources even before the full effects of sea level rise are realised by the end of the century.**

Climate and Environmental Security Pathways

As PNG confronts intensifying climate change, its impacts are increasingly manifesting as complex security risks threatening stability, social cohesion, livelihoods and human well-being. This section examines six key pathways through which climate and environmental changes are interacting with existing social, economic and political dynamics exacerbating security challenges in PNG (Figure 6). These pathways reveal how climate and environmental change deepen and transform existing vulnerabilities within PNG's unique cultural and geographical context, contributing to different forms of conflict and violence.

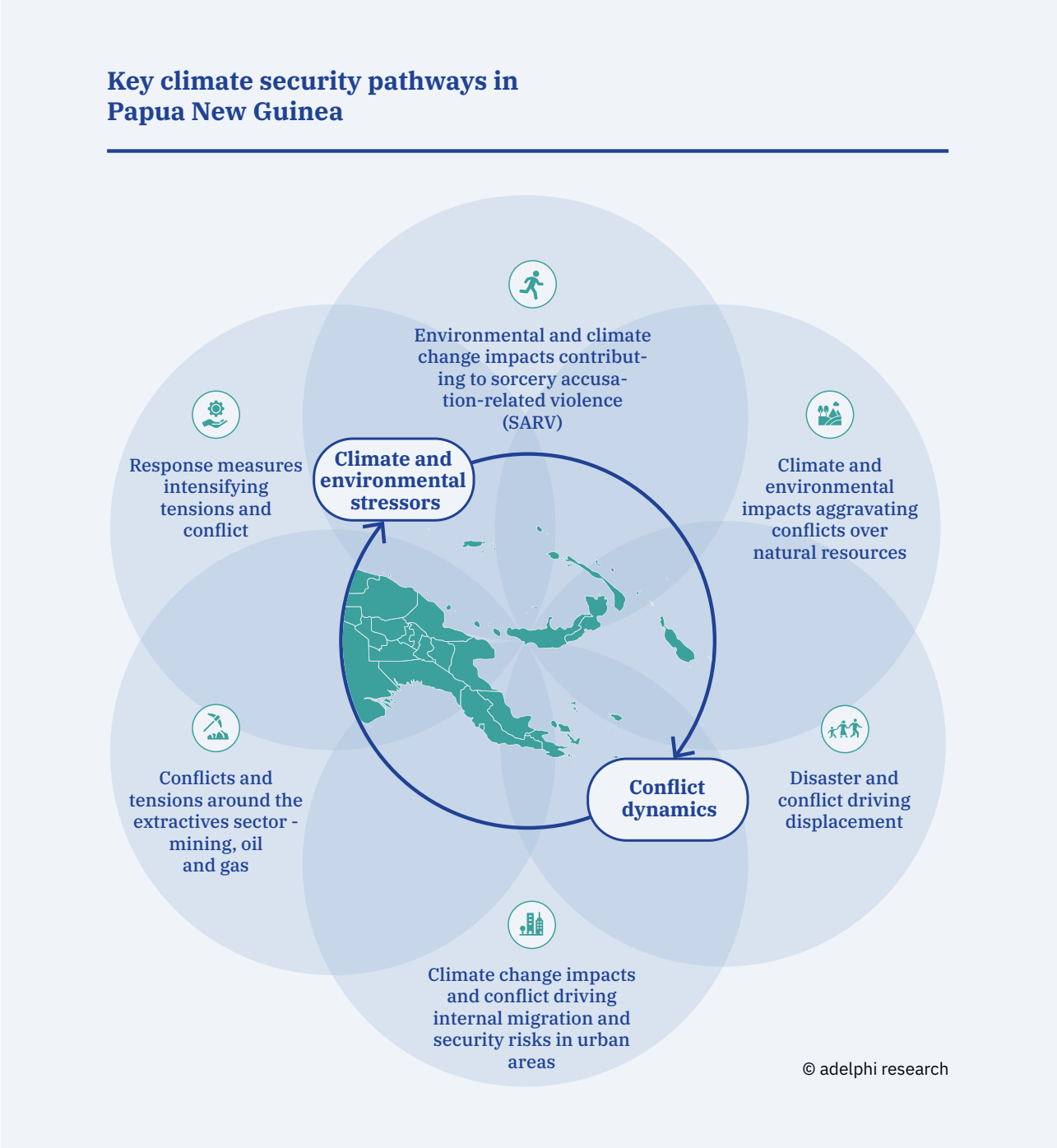

Figure 6: Key climate security pathways in Papua New Guinea (elaborated by adelphi).

Pathway 1: Environmental and climate change impacts contributing to sorcery accusation-related violence

Environmental and climate change impacts are increasingly contributing to SARV, a pervasive form of violence rooted in cultural beliefs. Disasters, crop failures and unusual weather patterns are often interpreted through the lens of sorcery-related beliefs or attributed to spiritual causes, disproportionately targeting women and exacerbating existing vulnerabilities in communities.

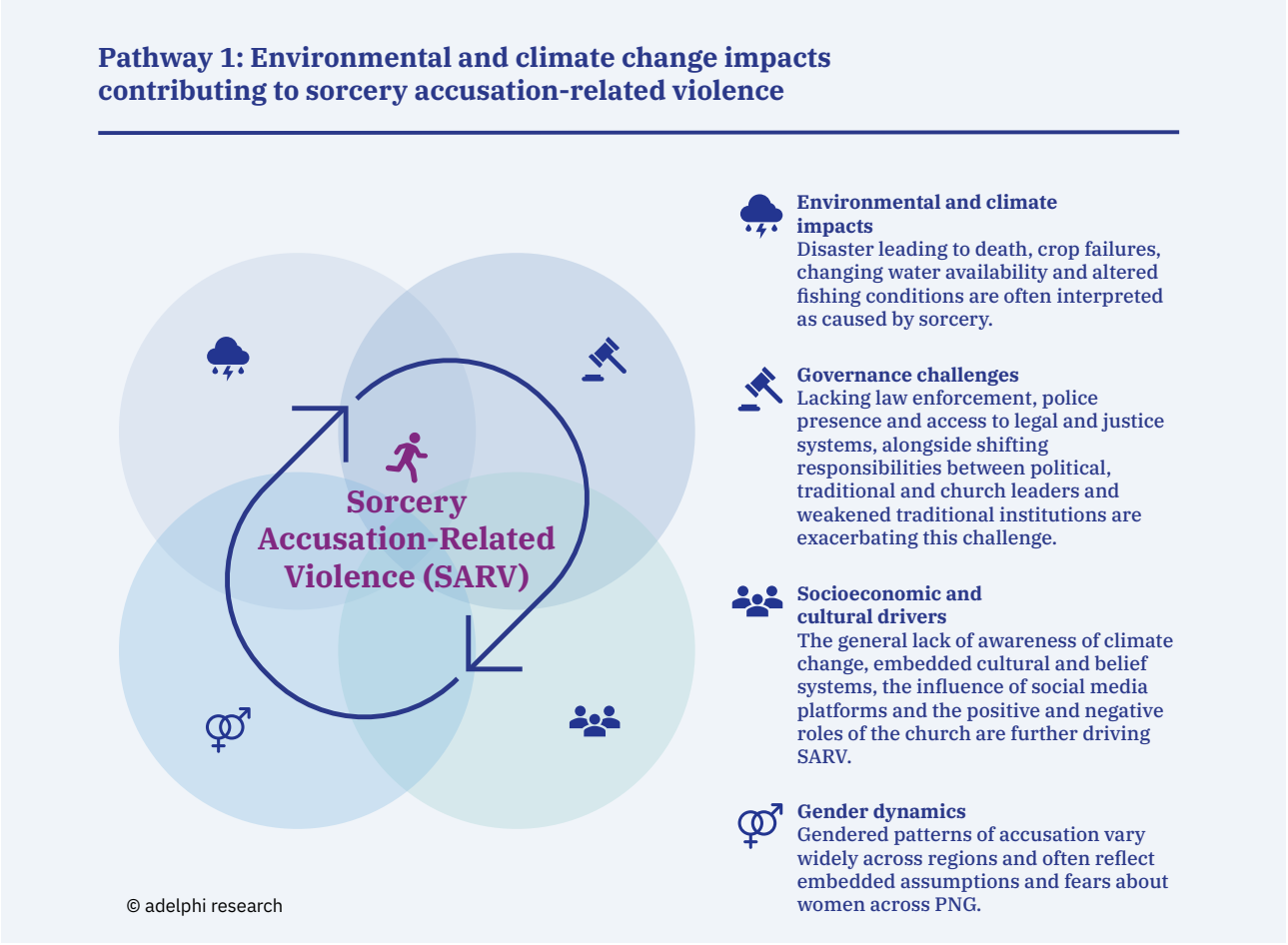

Figure 7: Environmental and climate change impacts contributing to sorcery accusation-related violence (elaborated by adelphi).

SARV is a distinct form of violence against individuals believed to have knowledge of or association with sorcery practices, in particular the power to cause death, harm or illness to a family or community through spiritual means (Witne et al. 2023). In PNG, it is a way of interpreting events such as drought, business failure or death, by blaming a "sorcerer" for this misfortune (Forsyth et al. 2019). These beliefs are deeply embedded in traditional sociocultural explanations of misfortune and death as caused by someone who possesses spiritual powers. In many cases, community members turn to glasman or glasmeri – spiritual intermediaries believed to possess the ability to identify witches or sorcerers who solidify vague suspicions into targeted accusations. These beliefs vary across PNG's diverse cultural landscape but share the fundamental understanding that serious illness, unexpected deaths and community misfortunes are rarely seen as random events (Forsyth et al. 2019; Forsyth et al. 2021).

SARV is a significant and increasing challenge across PNG (UN-PNG 2023). Comprehensive statistics on SARV are not available for PNG. However, experts have tried to estimate the scale of the problem based on national media and national court reporting. Between 2000 and 2021, the best available estimates put violent incidents attributed to SARV in PNG at more than 6,000 and involving more than 3,000 deaths (PNG government 2025; Forsyth et al. 2021). The real numbers are very likely much higher, as another study in 2024 found that on average only 7 to 15 per cent of SARV incidents are reported by the media, which these estimates rely on (Forsyth et al. 2024). At the same time, almost all interview partners agreed that SARV is pervasive and has been increasing dramatically over the past years across the country. They described SARV as normalised – a daily occurrence in most communities in PNG.

Figure 8 shows that **there are significant regional variations in the manifestation and severity of SARV.** Incidents were reported in all parts of PNG, although the majority are in the Highlands. The wide geographic spread of the incidents is noteworthy, as there is a tendency in PNG to characterise SARV as a Highlands phenomenon. Evidence of SARV from Morobe, Madang, Bougainville, New Ireland, West New Britain and NCD indicate that this is not solely a rural phenomenon (Forsyth et al. 2024).

Environmental and climate change impacts are aggravating SARV. Interview partners in all the geographies covered as part of this assessment shared stories of environmental and climate change impacts interpreted through the lens of sorcery beliefs and leading to SARV. Disasters such as floods and landslides, crop failures or changes in crop availability, changes in water quality or availability and unusual weather patterns were all named as triggers of SARV (Cox et al. 2023). For example, in Hela and SHP, some SARV incidents were associated with the 1997-1998 El Niño droughts (Allen & Bourke 2001). One incident shared by interview partners in SHP involved a young boy that was washed away by a flood after heavy rain. His death was blamed on his mother, who was accused of sorcery and causing the death. These kinds of sudden and unexplainable deaths are a particularly strong trigger of SARV. Also, smaller events, such as garden crops failing after heavy rain, have led to the accusation of women who had passed through those crops. Environmental issues can also be interpreted as sorcery. For example, according to interview partners, the polluting of the Strickland River by the Porgera gold mine, artisanal mining and the resulting health and livelihood impacts were all blamed on sorcery. Another example of SARV was observed in Bougainville between communities in which changing fishing conditions due to the migration of stocks benefitted one community at the expense of another (Blenkin et al. 2024).

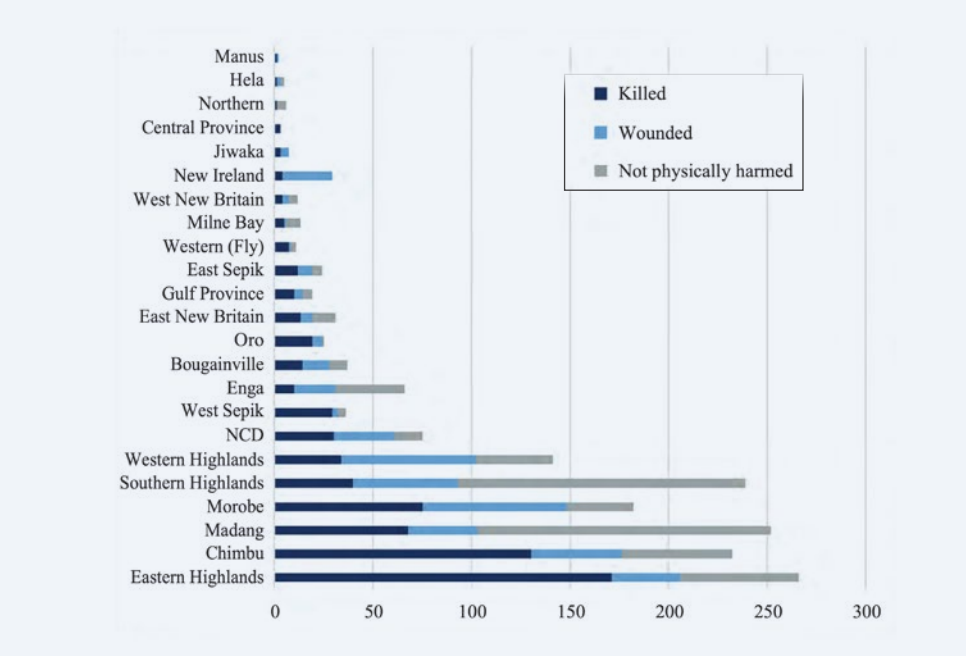

Figure 8: Number of reported victims by type of harm by PNG province, 1996 – 2022 (Forsyth et al. 2024).

Gender and vulnerability are central to these dynamics, and women are at particular risk of SARV. Most interview partners confirmed that it is mainly women who are accused of sorcery. As illustrated in Figure 9, gendered patterns of accusation of SARV seem to differ widely across regions. Women are disproportionately victims of SARV in five of the six provinces that belong to the Highlands (Forsyth et al. 2024). In Enga, 96 per cent of SARV victims were women between 2016 and 2018 (Forsyth et al. 2019). More women were also targeted in the NCD, where there are many migrants from the Highlands (Forsyth et al. 2024). Men are mostly targeted in Bougainville, Madang and Morobe districts (Forsyth et al. 2024). In Bougainville, men were 96 per cent of the victims of SARV between 2016 and 2018 (Forsyth et al. 2019). Notably, cases that involve male victims of SARV are more likely to proceed through the criminal justice system than those in which the victims were women (Forsyth et al. 2017). Part of the explanation comes from deeply rooted and culturally embedded assumptions about and fears around women, especially in the Highlands (Forsyth et al. 2024; Forsyth et al. 2019). Interview partners also shared cases of other vulnerable groups receiving accusations of sorcery – for example, young unemployed and poor youth in urban areas were accused of turning into cats to steal. Children are also victims of SARV; if their parents were accused sorcerers, they are vulnerable to the claim that sorcery passes through their bloodline (Forsyth et al. 2019).

The results for those accused of sorcery are severe – often involving killing, brutal torture and sexual violence, as well as non-physical violence that can result in long-term harm. This violence includes stigmatisation that can lead to social isolation, displacement without possibility of return, property damage and insecurity (Forsyth et al. 2019). In some instances, SARV is linked with intimate partner violence (IPV) and SGBV (UN-PNG 2023).

For example, a study conducted by Oxfam (2016) from 2013 to 2016 showed that SARV perpetrators are more likely to be immediate family members, increasing the risk of intimate partner violence. Other forms of non-physical violence include livelihood insecurity, especially when individuals are targeted, outcasted and socially marginalised (Forsyth et al. 2019).

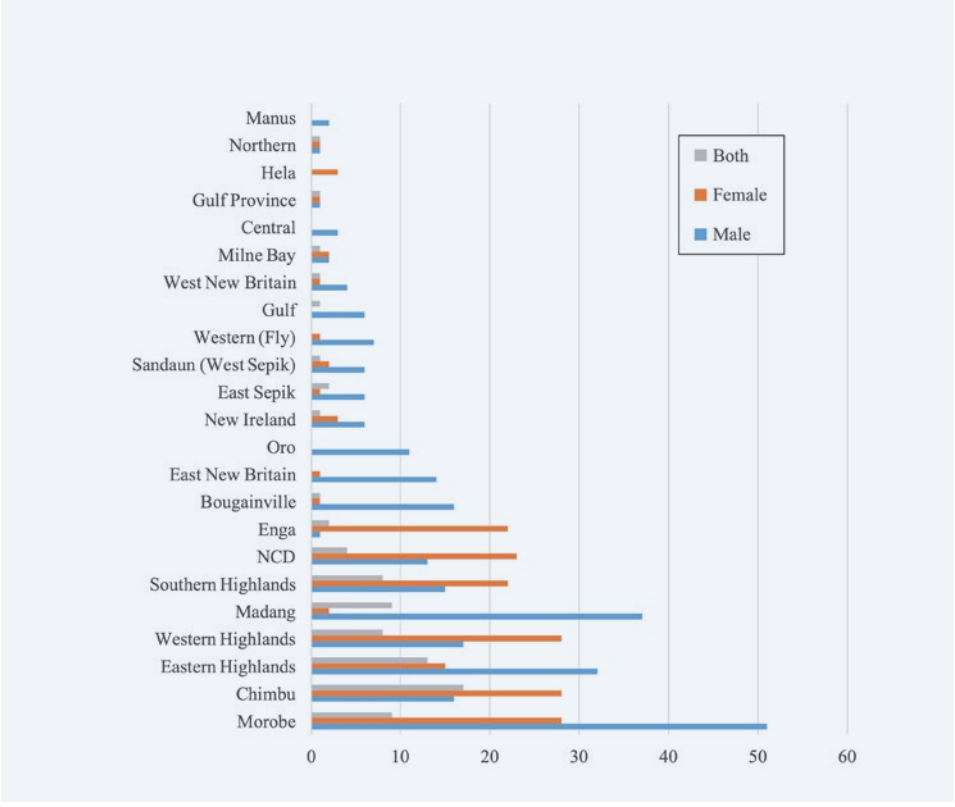

Figure 9: Number of incidents reported by province and gender of victims (Forsyth et al. 2024)

SARV can also trigger or be part of other kinds of conflicts and violence. For example, it can trigger larger-scale intergroup violence with one community accusing the other of sorcery after a disaster. Some interview partners also pointed out that SARV is used to settle older grievances or conflicts around land, for instance.

Several factors aggravate and contribute to the increase of SARV across PNG:

- **Lack of awareness and knowledge:** General lack of awareness about climate change and environmental phenomena makes it easy for environmental events to be interpreted as sorcery occurrences.
- **Weak law enforcement and justice system:** A lack of law enforcement and limited access to legal and justice systems, with police often absent or choosing not to engage in SARV cases, leaves victims helpless (Forsyth et al. 2024; Forsyth et al. 2019).20
- **Ambiguous role of churches:** According to many interview partners, main line churches at higher levels tend to play a positive role in preventing SARV, but many church functionaries at the village level promote harmful beliefs, and some participate in practices such as exorcisms.
- **Village leadership, both protective and weakening:** Village leaders and courts play a crucial role in prevention and justice, with a 2016-2020 study showing non-violent resolution attempts in 32 per cent of incidents (varying by province: Enga 31 per cent, Bougainville 37 per cent, NCD 35 per cent, Jiwaka per cent) (Kipongi & Forsyth 2024). However, some interview partners underlined that weakening traditional institutions are aggravating SARV incidence.
- **Diffusion of responsibility:** Authority figures evade accountability by redirecting responsibility – political leaders frame the issue as a spiritual matter, religious institutions highlight inadequate law enforcement and officials shift burden to community leadership, creating a circular pattern that prevents effective intervention (Forsyth et al., 2019).
- **Media influence:** Social media provides platforms to share SARV incidents, potentially increasing the practice.

Despite challenges with traditional approaches, promising local initiatives are emerging to combat SARV across PNG. Top-down intervention strategies, training and formal interventions have often been ineffective in perpetrator communities that stick to traditional beliefs, have little formal education and are deeply suspicious of outsiders. However, there are many actors actively working on addressing SARV across PNG, revealing examples of successful interventions. These include NGOs, CBOs, grassroots women's human rights defenders and churches such as the Catholic Church. These groups operate safe houses for SARV survivors and work on raising awareness to prevent SARV and to protect victims (UN-PNG 2023). There are also efforts to integrate awareness raising and prevention work into early education and schools. One interesting example identified during the field research involved specific trainings conducted by UNDP and World Vision that linked climate change knowledge, peacebuilding and SARV prevention, providing communities the ability to build resilience to climate change and address violence (UNDP n.d.).

The link between environmental and climate change impacts and SARV in PNG is clear and concerning. Climate-related events and changes are being misinterpreted through the lens of sorcery beliefs, leading to accusations and violence. As the projections in the section on climate risks show, **disaster risks will increase in the future, providing more triggers for SARV.**

20 PNG's "police-to-civilian ratio" is well below international standards. According to the UN, an ideal police-to-civilian ratio is one officer for every 450 civilians. PNG's current ratio, however, is one police officer for every 1,845 civilians. In some provinces, such as PNG's Northern province, there is evidence of the ratio expanding to as high as 1:2700 (Jacobs 2023). These numbers are based on PNG's population estimate at 9 million. However, the population numbers in PNG are contested and the actual number of citizens might be even bigger than this, which would substantialise a bigger police deficiency.

Pathway 2: Climate and environmental impacts aggravating conflicts over natural resources

Natural resource conflicts are widespread throughout PNG and mostly centred on access to and availability of land, forests and fisheries. These conflicts are intensifying due to a complex interplay of factors that include: accelerating environmental degradation, economic developments, ineffective resource management systems, gender dynamics and demographic shifts. Climate change compounds these challenges by shifting land fertility, erasing natural boundaries, declining fish stocks, increasing deforestation and forest degradation and driving displacement. The resulting conflicts and tensions frequently manifest in violent confrontations, particularly affecting communities whose livelihoods and cultural identities are intrinsically linked to these resources.

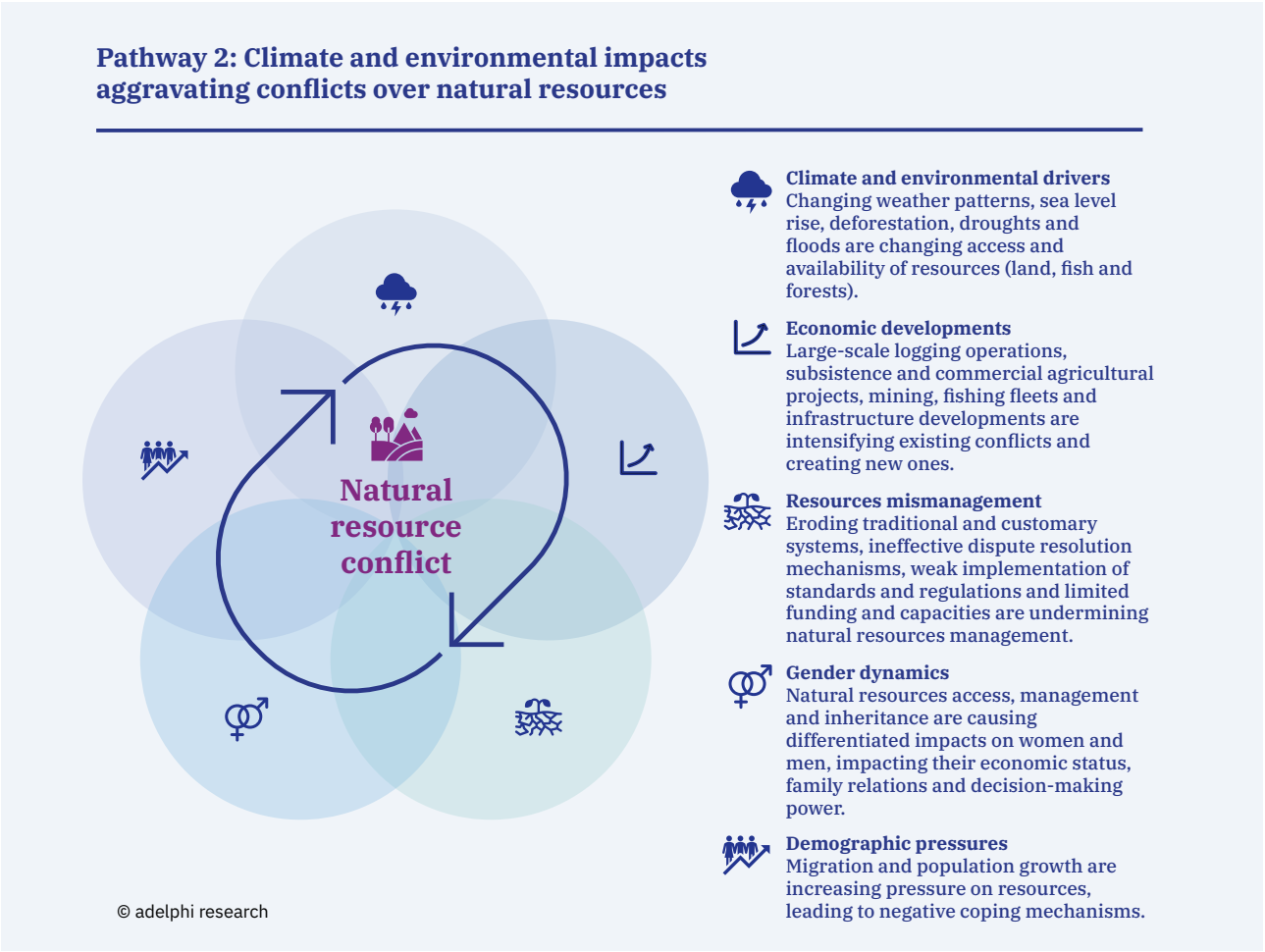

Figure 10: Climate end environmental impacts aggravating conflicts over natural resources (elaborated by adelphi).

LAND CONFLICTS

Land in PNG represents far more than a physical asset – it embodies cultural identity, heritage and social status, serving as a spiritual and cultural cornerstone for communities rather than merely as an economic resource (Weiner & Glaskin 2007).

This deep connection to land has shaped PNG's conflict landscape since pre-colonial times, with disputes now intensifying due to multiple converging pressures.

Land conflicts in PNG occur at three critical levels and across the country. They occur within communities (between families or family members), between separate communities and between communities and external entities such as government and private companies. These disputes regularly escalate into interpersonal or intergroup violence and various forms of protest across the country, with the Highlands region as a particular hotspot for intergroup violence.

Several factors are intensifying these conflicts (Allen & Monson 2014):

- Population growth and demographic pressure
- Expansion of subsistence farming
- Rural-urban and rural-rural migration
- Infrastructure development
- Large-scale exploitation of natural resources (forests, minerals, oil)
- Climate and environmental changes

Climate and environmental changes are already aggravating both land use conflicts and land ownership conflicts[21] through several mechanisms that interact and amplify each other:

- **Agricultural viability and land degradation:** Changing precipitation patterns and rising temperatures are affecting crop yields and agricultural productivity. In the Highlands, excess soil moisture from increased rainfall limits sweet potato yields and enables the spread of pests and diseases (Michael 2019). Warmer temperatures have enabled the spread of coffee leaf rust, reducing yields in lower highland altitudes (Bourke 2018; SPREP and CSIRO 2022b). At the same time, climate change is accelerating land degradation through increased rainfall, flooding and landslides. The Land Degradation Neutrality Target Setting baseline in 2015 showed that 31.5 per cent (14,548,726 hectares) of PNG's land was already degraded (2019). According to interview partners, this is pushing people to encroach on other people's land, leading to conflicts. Simultaneously, other areas are gaining in fertility due to changing climate conditions, acting as a pull factor for people moving into these newly productive zones and also generating conflicts over land rights.

- **Boundary disputes:** Heavy rains, storms and floods are erasing or moving natural boundary markers (stones, trees, water bodies) that traditionally demarcated land ownership, leading to land conflicts. Interview partners shared numerous instances where weather-related disasters triggered boundary disputes that escalated into violence.

- **Displacement and migration:** Climate change impacts such as flooding and drought are also driving displacement and migration, leading to more pressure on and conflicts around land. This is the case in rural areas, when people temporarily move after disaster to a different community (see Pathway 3 for a detailed discussion).

Looking into the future, climate impacts will further exacerbate these dynamics. Over the near-term, climate impacts threaten to exacerbate current patterns of land degradation, including on the tracts of lowland and lower montane forest. Temperature and precipitation increases may reduce yields for sweet potato and coffee, the two most economically important crops in PNG, starting in the near-term in the densely populated Central Highlands (1,600-2,000 metres altitude) and increase pressure for agricultural expansion to higher elevations (Bourke 2018). At the same time, projected increases in annual precipitation raise the risk of floods, erosion and associated landslides in the Highlands and montane regions, while periods of extreme droughts and high-elevation frosts associated with ENSO will further deteriorate soil fertility and degradation without sustainable mitigation practices (Michael 2019; UNDCO 2024).

Infrastructure development is key for improving livelihoods and resilience, but often significantly contributes to land degradation and associated conflicts:

21 Conflicts over land ownership interact with conflicts over land use rights. Under customary tenure, locally entitled groups carry communal rights to transfer land and wield control over how to use land, whereas in-group beneficiaries and sometimes out-of-group beneficiaries (conditionally) possess rights to use land resources in accordance with prescribed activities. Both rights to control land and rights to use land under local specifications affect land availability and planning for alternate desired uses. Conflicts over land control may arise from overlapping or competing claims in the absence of formal records. Conflicts over land use rights may arise, on the other hand, when entitled beneficiaries dispute eligible or conditional uses. Changing environmental conditions in one location may also strain accessible resources and fuel demand for acquiring (often conditional) land use rights elsewhere. See FAO (2002) for further background.

- **Infrastructure conflicts:** Interview partners shared examples in which the construction of critical infrastructure, such as airports or water supply systems, led to conflicts over land rights and compensation. One example occurred at Tari Airport, which was shut down due to claims of compensation payments by landowners in SHP in 2010 (RNZ 2010). A similar example happened at the Kavieng Airport blockage in New Ireland, in which landowners organised a sit-in demanding compensation for their land, triggered by an airport expansion project along with grievances over compensation payments dating back to the 1970s (EJAtlas 2024).

- **Road construction:** Human activities, such as land clearance for agriculture and natural resource extraction, typically expand along road networks and navigable river systems. This means that the extensions of overland transportation routes strongly determine the location of land use change (SOPAC 2007). Planned construction of road corridors under PNG's Medium Term Development Plan (MTDP) through lowland and lower montane forests would connect more rural communities to markets, but also broaden the land accessible for further agricultural conversion and natural resource extraction (Slattery et al. 2018), potentially driving more land conflicts.

Coastal areas and small islands are particularly affected by climate change and **face a number of unique and intensifying land-related challenges.** Shifts in land availability and accessibility differ between small islands and atolls, large islands (New Britain, New Ireland, Bougainville), inundated swamp and floodplain forest and coastal cities such as POM, Lae and Wewak (Bourke 2018). Sea level rise, coastal erosion and changing weather patterns affect all coastal areas, but particularly small islands and atolls (see "Fisheries" subsection below).[22]

This is leading to a number of challenges:

- **Land loss and erosion:** Coastal areas are experiencing significant land loss. For example, the Carteret Islands (Bougainville) have lost 60-70 metres of land due to eroded shorelines (Caritas 2015 cited by Kuir-Ayius 2024), while the Kikori River Delta (Gulf Province) has receded an average of 43 metres per year (Shearman 2010).

- **Agricultural viability:** Saltwater intrusion and soil salinisation are reducing the viability of cash crops such as coconut and garden staple crops like taro. This is already affecting 74 of 90 hectares of land on Takuu, Bougainville (Bourke 2018, Moesinger 2019a).

- **Changing habitability patterns:** The increasing shortage of usable land is leading to more competition and tensions. Small low-lying islands face not merely complete submersion, but rather the fundamental disruption of island-specific land use patterns. For example, saltwater intrusion renders agricultural areas unsuitable for farming, making land functionally "unusable" long before it is physically lost. External dependency and trade relationships will increasingly determine whether people can continue to live on affected islands as local food production becomes more difficult (Blenkin et al. 2024).

- **Emerging tensions in atolls:** Interview partners confirmed that environmental changes are creating new tensions over land in atolls where such conflicts were previously rare.

- **Adaptation conflicts:** In response to land loss, some private landowners in Bougainville have started reclaiming land, often using coral rocks that damage reefs and sometimes collecting materials from areas owned by other communities, sparking new conflicts. Interview partners shared instances in which newly created reclaimed land triggered disputes over ownership rights.

Land conflicts in PNG are often closely linked to challenges around land governance:

22 Future land loss estimates for small islands and atolls remain difficult to calculate not only as a result of data monitoring gaps, but also because of past and future human and environmental changes that remain highly island-specific. Recent evidence suggests that most Pacific islands display long-term stability given cyclical shoreline fluctuations (save for the smallest islands), though sea level rise and human activities will affect future sediment patterns in locally particular ways (Duvat 2019). For example, Duvat's (2019) global assessment found that Takuu Atoll (Bougainville) experienced beach contraction and a shift in its island footprint towards its inner lagoon. In 2008, storm waves caused washover sedimentation that led to vertical island building. However, decades-old seawalls and sediment mining for settlement plays a role in the islands' longer-term destabilisation. If sea level rise outpaces coral growth in the future, greater wave energy would strike the island and unpredictably alter sediment transport processes.

- **Colonial legacy and lacking formal titles:** A majority (97 per cent) of land in PNG is customarily owned as a direct consequence of colonial policies (Yala 2006, Filer 2017; Apelis et al. 2011; Weiner & Glaskin 2007). Land was assigned to indigenous populations under customary rules, while land dealings were channelled through the colonial administration. This created a critical gap in terms of formal titles of ownership, as well as the leasing and selling of land throughout PNG (Apelis et al. 2011).

- **Traditional systems under pressure:** Traditional systems that were once effective no longer work under the increasing pressures of economic development, demographic change and environmental pressures (Yala 2006; Kwapena 2021).

- **Cash economy impacts:** The introduction of cash economy in rural areas created incentive structures for individuals to make false claims on land for immediate cash, leading to more ownership issues and land disputes. This led to the commoditisation of land, challenging communal ownership and giving rise to new disputes and conflicts within the same communities and clans. Without adequate land registration systems, these disputes often spiral into conflict (Kwapena 2021).

- **Development challenges:** The customary land tenure system, while important for cultural preservation and community cohesion, can significantly complicate and delay the implementation of development projects and lead to conflicts, especially if not implemented in a conflict-sensitive way and without proper consultations (Filer 1997; Yala 2006; Allen & Monson 2014).

- **Weak dispute resolution:** Land court systems are centralised with limited funding and capacity, making remote areas less likely to access resolution structures. The absence of a judicial body to determine land ownership and the lack of locally trained mediators further complicate dispute resolution. Reform attempts have been unsuccessful due to inadequate resources, flaws in legislative design and limited capacities (Kwapena et al. 2021; Oliver & Fingleton n.d.).

Many interview partners confirmed these complexities by sharing cases of different groups or individuals who claimed ownership of the same land, leading to conflicts in which traditional dispute resolution systems failed. These conflicts often also have a long histories that extend back generations.

LAND REFORM ATTEMPTS: A HISTORY OF CHALLENGES AND CONFLICTS

There have been many attempts of land reform aimed at providing legal titles for customary land that have proven ineffective or conflictive, creating instead new challenges and conflicts (Yala 2006). In the 1990s and 2000s, reform attempts led to violence and protests (Apelis et al. 2011). Efforts such as the "lease-leaseback scheme" that was introduced in 1979 to allow customary landowners to lease some of their land to the government, which would then create a formal title and lease it back to the landowners were wrought with corruption and led to land grabs[23] (Filer 2017; Kwapena 2021).

Most recently, the government introduced the Incorporated Land Groups (ILGs) as a new government policy to maximise the benefit of integrating customary land in development policies through land leasing for economic opportunities such as oil, gas, mining, forestry and large-scale agricultural projects (Yala 2006; Power, n.d.). Through the ILGs, payments for land rents, royalty and equity are transferred. However, instead of serving the interests of the landowner groups, this process led to rent-seeking abuse practices, misuse of revenues by landowner group leaders, inequality in the distribution of benefits and lack of accountability and transparency, all of which fed into new conflict dynamics (Apelis et al. 2011; Yala 2006; Power n.d.). This is most evident in SHP, which contains the largest number of ILGs and also hosts most of PNG's oil and gas projects, underscoring the close correlation between the establishment of ILGs in areas where collecting payments from projects is necessary (Yala 2006). Another land reform attempt for the ILGs was put in place by the government of PNG in 2017. However, this process was expensive and far exceeded the capacity of rural communities (Kwapena et al. 2021).

23 According to the Tirana declaration (2011), land grabs occur when land alienation is associated with human rights violations or a lack of thorough environmental or social assessments.

Gender dynamics play a crucial role in land ownership and conflict patterns across PNG, with significant regional variations that reflect the country's diverse cultural landscapes. These gender dimensions fundamentally shape vulnerability to climate impacts and capacity for adaptation. In many regions, particularly the Eastern and Western Highlands, land ownership follows patrilineal patterns where rights are passed down through male lineage (Richardson et al. 2021). This limits women's direct land ownership and decision-making power on land use, despite the fact they are often responsible for subsistence agriculture and food production for the family (Yala 2006). Interview partners pointed out that in patrilineal systems, families often see women and girls as less economically important, since they cannot inherit land and will join their husband's family. This perception leads to the exclusion of women and girls from educational opportunities, further decreasing their resilience to external shocks like climate change. In some coastal and island communities, including parts of Milne Bay and Bougainville, land inheritance follows a matrilineal pattern, allowing women to play a central role in land management and inheritance (Togolo 2023). These systems empower women by granting them significant influence over land-related decisions. Yet even in matrilineal systems, women still face challenges in broader societal contexts where male dominance remains prevalent (Richardson et al. 2021; Abay et al. 2024), limiting their ability to fully exercise their land rights and participate in conflict resolution processes.

FORESTS

PNG's forests, covering approximately 78 per cent of the country's land area (36 million hectares), **are vital for biodiversity conservation, carbon sequestration and local livelihoods** (PNGFA 2022). Figure 7 showcases the diverse types of forests in PNG, with low altitude forests on uplands as the most prevalent, followed by low altitude forests on plains and fans and lower montane forests. PNG's forests constitute 13 per cent of the world's tropical forests and absorb 10 times more carbon than the country's emission rates, making them vital for biodiversity conservation and global climate protection efforts (Filer 2022). While protected areas do exist in PNG, they only cover about 4 per cent of the total land area (West & Kale 2015; Filer 2022).

FOREST TYPES	AREA (HA)	%
Low altitude forest on plains and fans	8,907,510	24,8%
Low altitude forest on uplands	11,121,353	31%
Lower montane forest	8,009,029	22%
Montane forest	390,631	1%
Dry seasonal forest	2,353,272	6%
Littoral forest	148,102	0,4%
Seral forest	320,382	0,9%
Swamp forest	2,462,395	7%
Savanna	619,922	1,7%
Woodland	1,059,481	3%
Scrub	220,106	0,6%
Mangrove	285,971	0,8%
Planted forest	52,823	0,2%
Total	**35,950,979**	**100.0%**

Table 3: PNG Forest types and area in hectares as of 2019 (PNGFA 2022).

The relationship between communities in PNG and their forests is deep and unique. With over 85 per cent of PNG's people living within the forest and surrounding rural areas, the forests play an important role in their livelihoods and have deep cultural ties beyond economic interests (Greenpeace 2010). Indigenous forest inhabitants have developed systems using local knowledge that ensure equitable benefits for both the forest ecosystem and their own communities. In the Muyuw region, for instance, indigenous communities practice tree identification and cutting patterns that do not harm the forest ecosystem. They selectively harvest specific high-value forest trees for economic purposes, ensuring those trees are regenerated, while other mid-sized trees remain untouched because they exist on the fringes of garden areas where the ground is so filled with coral limestone that it cannot be worked. Despite indigenous people's deep understanding and management of their environment, outsiders often perceive these practices merely as logging activities, disregarding the cultural and ecological considerations involved (Filer 1997).

Forest-related conflicts in PNG primarily revolve around commercial logging operations and larger-scale agricultural projects rather than subsistence activities. While interview partners reported some local disputes over forest clearing for subsistence agriculture, most significant conflicts emerge from large-scale commercial logging or forest conversion for agricultural development. These conflicts typically stem from three key issues:

1. **Inadequate consultation with local communities and landowners leads to tensions** when logging companies enter areas claimed by indigenous populations, often under the pretext of promoting "development" (Mutton 2021; Filer 1997; Bell et al. 2015). Interview partners described instances in which companies promised to create croplands, jobs and business opportunities but abandoned areas after extracting timber.

2. **Disputes over benefit distribution, compensation and royalty payments** are widespread. A well-documented example occurred in 2000 in the Purari Delta when Aumu villagers detained a cargo ship headed to a logging camp, because they were excluded from royalty payments and concerned about negative impacts on the Aivei River. The company and police responded with violence, initiating raids on the village, destroying property and displacing residents (Bell et al. 2015).

3. **Environmental degradation from logging operations aggravates livelihood insecurity and disaster risks.** Between 2000 and 2019, PNG lost approximately 353,000 hectares of forests (0.98 per cent deforestation rate), with subsistence and commercial agriculture accounting for 67 per cent of this loss and oil palm development for 29 per cent (PNGFA 2022). Forest degradation affected an additional 8 per cent of forests during this period, increasing CO2 emissions and threatening communities that depend on forests for their livelihood security (PNGFA 2022). Experts suggest that one of the causes of the 2024 Enga landslide could have been deforestation, which decreased slope stability and undermined tree roots that naturally reinforce the ground and drain water out (Rognon 2024).

Weak governance exacerbates these types of insecurity. The PNG Forest Authority faces challenges in its capacity to fully regulate the industry and address environmental impacts and conflicts (Filer 2022; Fleishman 2022). Interview partners highlighted issues with the reforestation levy, which logging operations must pay but that rarely translate into actual reforestation activities. Similarly, the Log Export Development Levy (LEDL), which is a tax paid by logging companies meant to fund infrastructure in logged areas, suffers from poor transparency and implementation. A 2017 study found many LEDL-funded projects were either incomplete or never implemented, with affected communities unaware of the fund's existence (Hamago & Ezebilo 2017).

Beyond resource conflicts, logging operations in remote areas have been linked to other forms of violence, including sexual and gender-based violence, human trafficking for sex work and forced labour. Reports indicate foreign logging companies have illegally brought women from countries such as China and Indonesia into PNG for sex and domestic servitude (UN-PNG 2023; US Department of State 2021).

Climate change is increasingly affecting PNG's

forests through complex interactions between temperature, precipitation and existing environmental pressures:

- **Changes in precipitation patterns,** particularly wetter annual and seasonal northwest monsoon conditions, are raising the risk of floods and landslides, especially in already degraded areas of lower montane and low-altitude forest (Michael 2019). These precipitation changes, while varying in impact across forest species, generally adversely affect current growth and productivity. Interview partners confirmed these observations, noting that some tree species appear to be growing less vigorously than in the past.

- **Different forest types face distinct climate-related threats.** Warmer temperatures particularly threaten the limited proportion (1 per cent) of montane forests above settlement and cultivation zones (>1,800 metres). Montane cloud forests at higher elevations, which depend on wind-driven clouds for up to one-third of their moisture, are vulnerable to upward shifts in cloud layers that would reduce typical moisture despite annual precipitation increases, leading to dry-out during more variable dry seasons (CEPF 2012). Similarly, lowland swamp forests face greater rates of evapotranspiration due to warming temperatures, potentially drying out vegetation during dry seasons and extreme droughts despite overall precipitation increases (CEPF 2012; Adams et al. 2017).

- **Forest fires** represent another significant threat exacerbated by climate change. Between 2000-2015, fires degraded or disturbed nearly 20,000 hectares of forest (Gamoga et al. 2021). Fires occur most frequently in the savanna, woodland and scrub forests of the Southern region, which face potentially more frequent or intense extreme droughts in the near- and medium-term (Gamoga et al. 2021).

REDD+ IN PNG: CHALLENGES AND OPPORTUNITIES

Governance issues and other systemic problems also hinder reducing emissions from deforestation and degradation, plus (REDD+) projects that aim to reduce emissions from deforestation and forest degradation and hold a lot of potential for PNG. However, early efforts under the voluntary carbon market by private investors were rushed and undermined indigenous rights, as exemplified by the Kamula Doso project in the Western province. The project contained inconsistencies, non-factual scientific bases and risks of continued logging. There were also reports of coercing landowners to sign over their land to the project (Greenpeace 2010). To address these issues, the government of PNG put forward a national REDD+ Strategy in 2017, as well as a Benefit Sharing Distribution System (BSDS) guideline and Grievances Redress Mechanism (GRM) in 2022 (UN-REDD 2022). These frameworks still lack effective implementation and coordination across different levels (Fujisaki 2016). The proposed REDD+ project in Oro province by Kanaka Management Services (KMS) exemplifies these challenges: while it promises to prevent over 800 million tons of CO2 emissions, it fails to demonstrate genuine benefits for the environment and the inclusion of customary landowners (Hemming & Babon 2022).

FISHERIES

PNG has a vast marine territory and resources. It encompasses over 16,093 kilometres of coastline and an Exclusive Economic Zone (EEZ) spanning more than 2.4 million square kilometres. This includes the eastern portion of the world's most biodiverse marine area, known as the Coral Triangle (Adams et al. 2017). PNG's fisheries, particularly its tuna industry, are globally significant, providing 14 per cent of the global market share while playing a crucial role in the country's economy, livelihood security and food security (Global Fishing Watch 2024; International Trade Administration 2024).

Multiple interconnected climate and environmental threats are undermining PNG's valuable marine resources, creating significant challenges for coastal communities and the fishing industry. These pressures include:

- Rising sea levels, ocean warming and acidification, expanding low-oxygen zones and more frequent extreme weather events linked to ENSO are shifting fish stock distribution and availability (IW:LEARN 2024).

- Unpredictable weather patterns, including monsoon winds and precipitation variability, make subsistence fishing more time-consuming and resource-intensive (Moesinger 2019b).

- Deforestation and agricultural runoff cause siltation that degrades water quality and damages coral reefs (CEPF 2012, Adams et al. 2017).

- Interview partners working with local communities report the breakdown of traditional ecological indicators, such as seasonal plant appearances that previously signalled fish and turtle arrivals, undermining sustainable management practices.

These environmental pressures are creating cascading security challenges as competition for dwindling resources intensifies and governance systems struggle to manage conflicts effectively:

- **As resources decline, tensions between fishers increase.** Fisherfolk have constitutionally protected customary land ownership rights over marine resources such as corals, reef fishes and mangroves, which are increasingly declining, forcing them to venture further out into other areas they were not accessing before and bringing them into conflict with other communities (Cinner 2005).

- **Resource depletion is also driving dangerous adaptation strategies.** The reduction in availability of fish and clams pushes islanders towards nearshore harvesting (causing further depletion), open-ocean fishing in increasingly dangerous and unpredictable conditions and mariculture harvesting, which faces growing challenges from stronger winds and currents (Moesinger 2019b). In Bougainville, destructive fishing practices coupled with environmental shifts present a significant problem, with unsustainable fishing contributing to the decline of marine life, including the destruction of coral. This triggered conflicts among fishing communities, who compete for access to diminishing resources and fishing areas, leading to disputes over territorial boundaries (Blenkin et al. 2024).

- There are **conflicts between commercial fishing fleets and local communities.** Local communities accuse commercial fishing fleets of illegally overexploiting the marine resources that have significant impacts on their livelihood security and subsistence (Aini et al. 2023). This happened, for example, when commercial fishing fleets accessed inshore fisheries without the necessary permits in the Gulf of Papua Prawn Fishery (GPPF), where one-third of the total prawn catch was caught from within a zone that was closed to the commercial fleets (Kompas & Kuk 2008).

In addition, **Illegal, unreported and unregulated (IUU) fishing is a big environmental security challenge,** with PNG ranking 90 out of 152 countries on the IUU fishing index in 2021 (Macfadyen & Hosch 2021). With its massive EEZ, PNG claims the South Pacific's largest fisheries zone. This presents both potential for economic benefit but also challenges in effective monitoring of fishing activities. For instance, the limited third-party oversight of the sector enabled islanders to overfish bêche-de-mer (sea cucumber) and resulted in a locally devastating national moratorium from 2010-2017 and sporadic years afterwards for atolls in Bougainville (Moesinger 2019a, Filer 2024). This lack of regulation is largely due to diminishing resources for effective surveillance of the EEZ by the National Fisheries Authority (NFA), which is the lead public body tasked with addressing IUU in PNG (Kingi 2024).

Climate change projections indicate these challenges will intensify in coming decades, threatening both marine ecosystems and the communities that depend on them for survival:

- Studies suggest PNG may experience up to a 30 per cent decline in Skipjack Tuna fisheries by the century's end under high-emissions scenarios, likely depending on changes to the West Pacific Warm Pool, ocean currents and ENSO patterns (World Bank 2021, Bell et al. 2013).

- Projected increases in coral bleaching events and shifts to algae-dominated reefs will produce cascading effects on marine ecosystems that currently support approximately 2,800 fish species (CEPF 2012, Adams et al. 2017).

- Even under low-emission and conservation scenarios, the Solomon Sea marine ecoregion will struggle to rebuild biomass from current levels, endangering marine biodiversity, food security and economic livelihoods (Cheung et al. 2022).

Pathway 3: Disaster and conflict driving displacement

Displacement in PNG represents a growing security challenge driven by both violent conflict and climate-related disasters. These displacement events create cascading vulnerabilities, strain host communities and often generate new conflicts. Displaced populations face heightened risks of violence, food insecurity and loss of access to basic services, with women and children particularly vulnerable. With limited institutional capacity, complex land ownership systems and increasing climate risks, displacement is becoming one of PNG's most urgent and intractable security challenges.

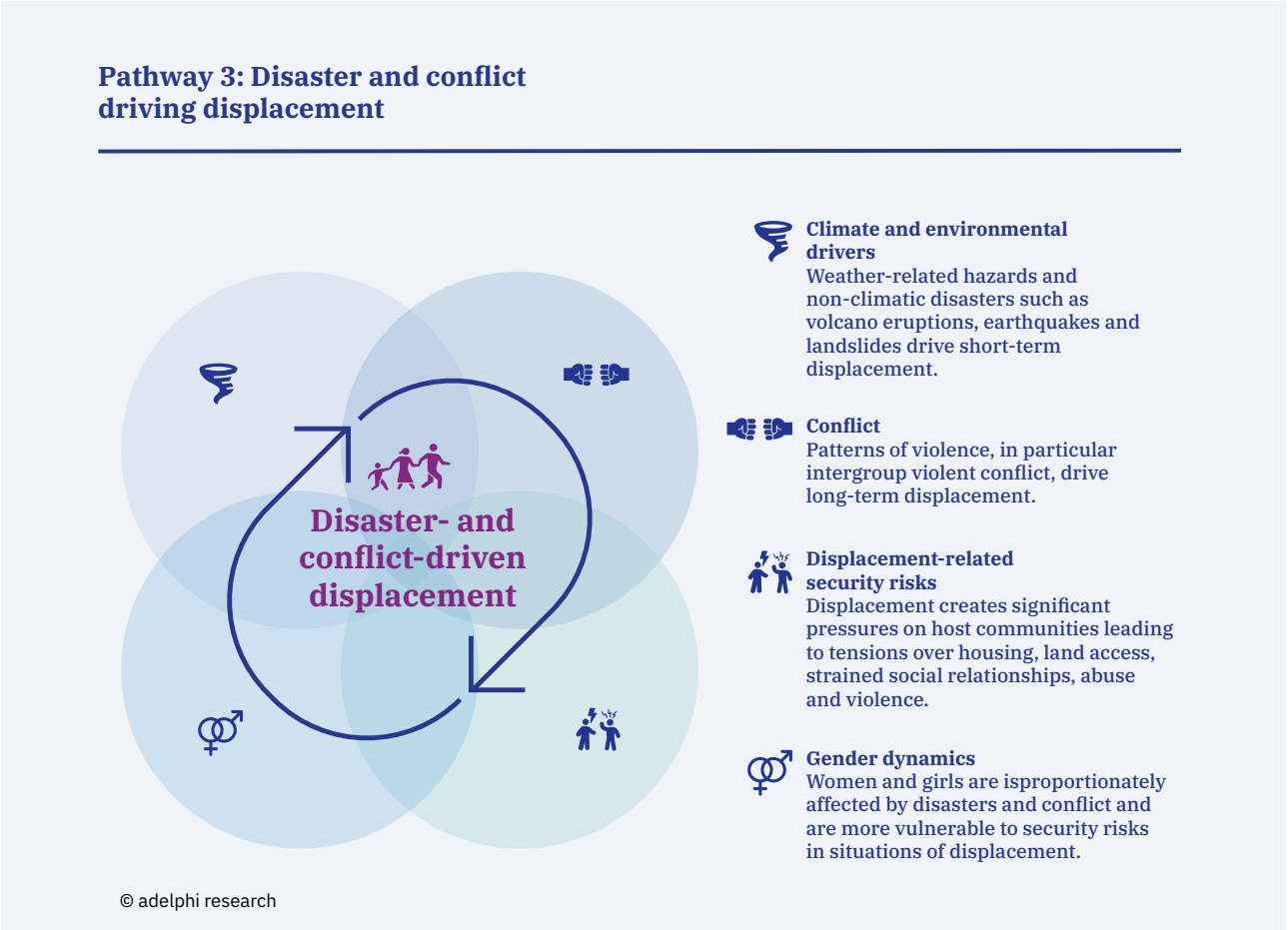

Figure 11: Disaster and conflict driving displacement (elaborated by adelphi).

Internal displacement is a growing security challenge in PNG. Both violent conflict and climate change-related disasters contribute to this challenge. While comprehensive statistics on displacement are not available, the best available data shows that between 2008 and 2023, violence triggered almost 75,000 internal displacements, while disasters led to almost 296,000 displacements over the same period, with the highest number in 2023 standing at 13,000 displacements (Cazabat et al. 2022; IDMC 2023; IOM 2024). In 2024, around 30,970 people were displaced because of both conflicts and natural hazards, with 71 per cent displaced by flooding, landslides and earthquakes (IOM 2025). Conflict displacement has been increasing in recent years (UNDP 2022; Cazabat et al. 2022; UN-PNG 2023). Key factors contributing to conflict-driven displacement include intergroup violence, election-related violence and SARV.

However, the actual numbers for disaster and conflict-related displacement are likely much higher, as most interview partners underlined that there is a general lack of reliable data on internal displacement, and the precise scale of displacement within the country remains unclear in particular when it comes to disaster displacement.

Disaster displacement is driven by a number of hazards – reflecting the fact that PNG is one of the most at-risk countries in the world for natural hazards (Cazabat et al. 2022). Floods are the main driver of displacement in PNG, especially in the Highlands. At least 22,000 people in PNG were affected by riverine flooding and another 8,000 by coastal flooding each year between 2010 and 2021, amounting to 43 per cent of total disaster displacement (Figure 12); 29 per cent were triggered by earthquakes such as the 2018 earthquake that hit the Highlands, 14 per cent by volcanic eruptions like that of Mount Ulawun in West New Britain in 2019, 10 per cent by wet mass movement[24] and 4 per cent by storms (Cazabat et al. 2022; IOM 2024).

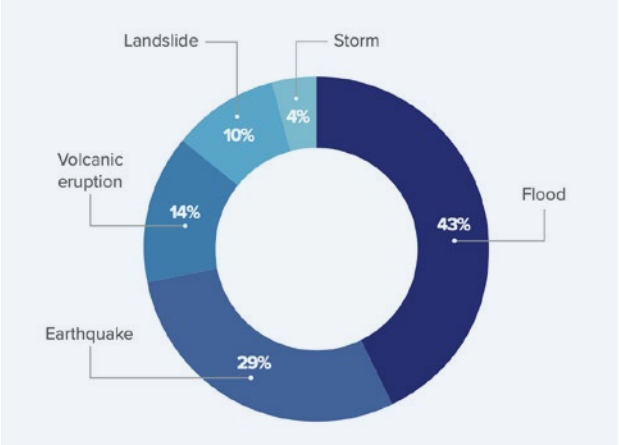

Figure 12: Percentages of new disaster displacements by hazard type from 2011 to 2021 (Cazabat et al. 2022).

There are important differences in displacement patterns:

- **Disaster displacement tends to be more temporary in nature,** with people often returning to their original locations once immediate threats subside. Interview partners shared many stories of people returning after floods to the same location they lived in before and rebuilding their houses, as no alternative land for resettlement is available. This means that they often rebuild their homes in hazard areas where they face the same risks as before.

- **Conflict-driven displacement tends to be more long-term** and in some provinces, such as Hela and SHP, many individuals and families have been displaced multiple times, posing problems in terms of data and tracking.

Displaced populations generally move to communities where they have family and tribal ties – an important source of resilience in terms of initial shelter and support. However, this creates significant security relevant challenges. Interview partners and the literature describe the pressure on host communities in terms of housing, access to land for subsistence agriculture and social relationships as very high (Cazabat et al 2022). This often translates into tensions and conflicts as well as abuse and discrimination against displaced population groups, and it also contributes to decreasing social cohesion and less cooperative norms. These security-relevant challenges express themselves in different ways:

- Tensions and conflicts around natural resources are common. For instance, a significant number of female internally displaced persons (IDPs) report being chased away from their gardens by host communities and prevented from accessing locally available resources such as forest products needed to construct their shelters (IOM 2017). Sometimes these tensions also escalate into violent conflicts between community members.

- IDPs are hindered from accessing centres that provide basic social services. For example, sometimes children cannot attend school and members of the community cannot access health services (IOM 2017).

- IDPs often face food insecurity as they often lack access to land for subsistence agriculture and access to basic services, making them more vulnerable to different shocks such as weather, climate, geological and water-related disasters (IOM 2017).

24 Wet mass movements include landslides, avalanches and sudden subsidence (IDMC 2014).

- Interview partners shared many instances of sexual abuse and violence, forced marriages, transactional sex and forced labour in the context of displacement. Those displaced by conflict sometimes face stigma, as they may be seen as bringing conflict and violence with them to the community. There is also always a risk that the perpetrators of violence responsible for their displacement may continue to pursue victims further.

- Interview partners also shared many instances of security risks increasing in times of disaster and food insecurity. This included a rise in petty crime as individuals tried to cope with the lack of income and food by stealing produce from someone's garden. This in turn often leads to accusations and conflicts in times of crisis.

Women and girls are the most vulnerable and affected by disasters, violence and abuse from within their communities and outside (World Bank 2021; IOM 2017). For instance, women, adolescent girls, female-headed households, persons living with disabilities, pregnant and lactating women, older persons and children, were all particularly at risk of violence, including SARV, in the aftermath of the 2019 earthquake (UN-PNG 2019). Interview partners and existing research alike reveal that when drought or flooding deprives communities of safe drinking water, women and girls are forced to journey ever farther from home, exposing themselves to the threat of harassment, abuse and SGBV along the way (IOM PNG 2022). Such violations do not just scar individuals; they can also trigger wider cycles of violence, as male relatives seek retribution for the harm inflicted upon their family. However, in some cases women also support their male kin in intercommunal violence, by joining camps preparing for a confrontation, providing forms of support or backup for the fighters and occasionally becoming combatants themselves. They do so to fulfil their social obligations as good wives and kinswomen (Abay et al. 2024).

The general lack of disaster risk management (DRM) capacities and resources from the national to sub-national level is exacerbating these problems. Financial loss and recovery costs regularly exceed available funds (World Bank 2018). For instance, from 2006-2012, the National Disaster Center (NDC) has worked with a budget of only $1.3 million annually, and before that, less than $500,000, which is far less than what is needed for risk management and reduction (UNDRR 2019). In addition, the existing disaster management and emergency institutions are disconnected, leading to delayed decision-making, lack of collaboration and duplication (Griffin et al. 2023). The core agencies responsible for immediate disaster responses are under different national departments and ministries (Aisi & Espi 2022). The Disaster Assistance Act has not been updated since 1984, leaving it with an outdated mandate that falls under different governmental bodies, resulting in convoluted tasks and no budget authority. Additionally, there is a lack of appropriately trained and skilled staff at the national, sub-national, district and local levels (Aisi & Espi 2022). Another challenge relates to gender-based differences in access to assets and credit, treatment by formal institutions and access to policy discussions and decision-making. All of these constrain women's opportunities and resilience capacity (World Bank 2021).

A particular long-term challenge related to displacement is the question of resettlement. As outlined above, many disaster-displaced individuals return and rebuild their homes in hazard prone areas. Those facing more permanent displacement because of conflict or permanent climate-related displacement driven by loss of land also face significant challenges in finding places to resettle (see Pathway 2). All interview partners identified the shortage of available land and the complexities of traditional land ownership as the principal barriers to effective resettlement. Strikingly, none of the respondents were able to propose a feasible solution, with many expressing a sense of resignation and perceiving the challenge as intractable. The intricate nature of land rights, deep-rooted cultural connections to ancestral territories and the limited availability of safe, habitable land have collectively created an insurmountable obstacle – one that is widely regarded by stakeholders as exceptionally difficult to overcome.

THE CARTERET ISLANDS RELOCATION: CLIMATE MIGRATION CHALLENGES IN PRACTICE

Challenges of resettlement creating cascading vulnerabilities are also reflected in the best documented and reported case of relocation in PNG: the relocation of Carteret Islanders in Bougainville. The relocation process has been complex and challenging. Recent plans to resettle started in the 2000s due to the intensifying impacts of climate change and aimed to relocate half of the island's population by 2020[25]. A lot of support was provided by international donors and local organisations such as Tulele Peisa – a local women-led NGO – and the Catholic Church, by securing land titles, livelihood support and housing (Boege & Rakova 2019). However, securing land proved extremely difficult due to financial constraints and cultural tensions, particularly in a post-conflict society where employment opportunities are scarce (Connel 2016). Additionally, interview partners reported tensions between the host communities and the displaced populations mainly because of social and cultural differences, livelihood changes and feeling apprehensive about their safety (e.g. due to fear of sorcery accusations by the other community). The displaced Polynesians were also afraid of discrimination from the Melanesian majority in mainland Bougainville. All of these challenges presented a difficult adaptation process to manage (Boege & Rakova 2019). While some Carteret Islanders seem to have integrated well – as exemplified by cases of intermarriage – interview partners underlined that a significant number of families returned to the islands due to difficulties adapting to a new lifestyle and perceptions of strict rules, mismanagement and lacking transparency.

Climate projections indicate that displacement risks will significantly increase across PNG in the coming decades, with distinct regional patterns and compounding factors creating complex challenges:

- **Sea level rise:** By mid-century under the high-emission SSP3-7.0 scenario, sea levels are projected to rise 18-23 cm nationwide (except for the Gulf of Papua and Torres Strait at 10-18 cm). By the century's end, increases could reach 60-70 cm along the Momase coast and islands, 45-60 cm along the Gulf of Papua and over 70 cm in parts of the Solomon Sea (NASA 2025).

- **Vulnerable island communities:** Small and low-lying islands are at particular risk. For example, the Louisiade Archipelago in Milne Bay faces the highest projected sea level rise – 23 cm by mid-century and potentially 72 cm by 2100. With most of the Islands region population living within one kilometre of shore (CEPF 2012), displacement risks are substantial without adaptation measures.

- **Extreme sea level events:** More immediate and greater displacement threats across PNG come from extreme sea level events that combine tidal extremes (e.g. king tides), weather-driven events (storm surge and swell), wave dynamics and exposure (depending on coastal depth, presence of a reef or harbour), seasonal variations (temperature, ocean currents) and interannual variations (due to ENSO) on top of sea level rise (CSIRO and SPREP 2022a). Storm surge and swell have a 39 per cent chance of displacing approximately 10,000 people in the next 50 years (Cazabat et al. 2022).

- **Increasing inland flood risks:** Risks for inland floods are also increasing across the country. Under a "middle-of-the-road" scenario, by mid-century severe flooding (>1 metre) during 100-year flood events is projected to increase in major river systems including the Fly-Strickland (Western), Purari (Gulf), Sepik (Sandaun, East Sepik) and Ramu (Madang) watersheds (WRI 2023).

- **Growing landslide threats:** Projected precipitation increases during the northwest monsoon season (>100 mm across the Highlands under both scenarios by mid-century) will also elevate landslide risks, particularly in Western, Sandaun, Western Highlands, Chimbu and Morobe provinces, which already experience frequent landslides (Robbins 2014).

Against this background, the compounding effects of both conflict and climate-related displacement, coupled with limited institutional capacity and complex land ownership systems, present an increasingly urgent challenge for PNG.

25 The initial phase of resettlement from the Carteret Islands to mainland Bougainville started in the 1980s due to significant population pressure on scarce resources such as fisheries and the absence of immediate cash incomes. This process was interrupted by the civil war, leading to many resettled households returning to the islands (Connel 2016).

Pathway 4: Climate change impacts and conflict driving internal migration and security risks in urban areas

The rapid growth of urban areas in PNG is creating a complex web of security challenges amplified by climate change. As migrants move to cities seeking more security and better opportunities, they face a set of new climate and security risks. The concentration of people in hazard-prone informal settlements, combined with limited access to job opportunities, basic services and infrastructure, creates conditions in which both environmental vulnerabilities and security risks are heightened.

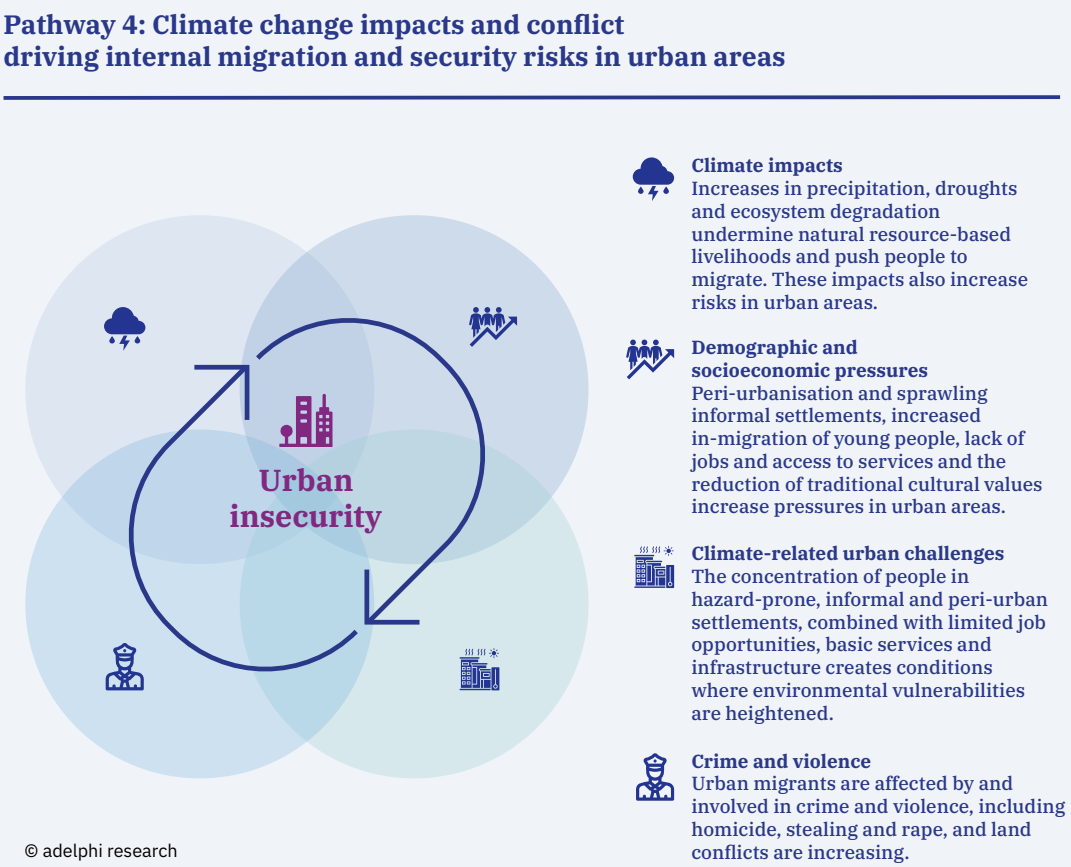

Figure 13: Climate change impacts and conflict driving internal migration and security risks in urban areas (elaborated by adelphi).

Livelihood insecurity and violence are powerful push factors for internal migration in PNG. A study from 2022 looking at migration to POM and Lae found that most migrants are searching for better livelihood options, more safety and less violence, better education for their children and access to better basic services (Kavan & Kopel 2022).

Climate change impacts and environmental degradation act as additional push factors mainly through their negative impacts on livelihood insecurity. Seventy per cent of households in PNG rely on subsistence farming and cash cropping for their livelihoods, which are directly affected by climate change impacts (World Bank 2021):

- **Changes in temperature and precipitation already affect the production of subsistence and cash crops.** Increased temperatures have led to observed shifts in the growing ranges of lowland crops. Examples include coconut and pandanus growing 300 metres higher in altitude compared to 30 years prior and cocoa crops now producing yields in Highland provinces (Bourke 2018). At the same time, bananas found in upper ranges of settled highland areas now also grow in areas close to sea level as a result of precipitation increases and changes in temperature extremes (Michael 2019) (see Pathway 2 for more details on land use change impacts). Meanwhile, droughts threaten production of lowland staple crops such as water-intensive sago, especially in the Southern region (Michael 2020).

- **These impacts will increase in the future.** Temperature extremes and increases in precipitation may limit yields and enable the spread of pests and diseases that affect staples, such as sweet potato, and plantations crops, such as coffee in the Highlands and cocoa in the Islands (CSIRO and SPREP 2017, 2022b, 2022c). In addition, the expansion of agricultural activities and natural resource harvesting in response to shifting suitability ranges may further lead to terrestrial and marine ecosystem degradation and biodiversity loss.

Internal migrants mainly migrate to province capitals or the two largest cities – POM and Lae – which have seen rapid growth (Kavan et al. 2022). Between 1990 and 2010, urban areas witnessed an increase of almost one million person (Laki 2022). Currently, almost 15 per cent of PNG's population is living in urban areas, with the number of urban inhabitants likely to reach 3.5 million persons by 2030, more than tripling between 2010 and 2030 (Bourke & Allen 2021; IOM 2015; UN-PNG 2023). According to the 2021 PNG estimated census, the population of NCD amounts to 513,918 inhabitants and that of Lae to 224,983 inhabitants, together making up the majority of urban population in PNG (NSO 2021). Interview partners confirmed ongoing rural-to-urban migration, normally towards provincial capitals, larger towns in neighbouring provinces, Lae and POM. Some also reported circular migration – people returning from towns and cities to their villages.

Migrants often face significant challenges in terms of climate vulnerability and hazards in the towns and cities they move to:

- **Informal settlements:** They often settle in peri-urban informal housing or marginal areas where access to basic services such as water and electricity is limited, as well as access to jobs and educational and income opportunities. These informal settlements lack basic infrastructure and are mainly situated in hazard-prone areas due to low spatial planning enforcement. This also means they often have low levels of adaptive capacity, are vulnerable to evictions or losing their access to land and livelihoods after a disaster (Mitchell et al. 2016).

- **Climate risks:** Migrants also face a new set of climate risks in cities, because they experience significantly higher temperatures than surrounding areas. POM averages 0-1°C hotter than surroundings, while Mendi (in the Southern Highlands) is 3-4°C higher than its environs (Roberts et al. 2023). Heavy precipitation damages infrastructure and contaminates water sources, while extreme heat and droughts increase disease risk and strain energy networks (SPC 2012; Sanderson et al. 2022).

- **Environmental degradation:** The growth of such urban settlements places pressure on local terrestrial and marine resources and frequently leads to clearance of adjacent forests and vegetation for subsistence gardens, enhancing exposure to runoff and erosion without preventative measures (CEPF 2012, Zari et al. 2019).

These climate risks and vulnerabilities are prevalent in urban centres across PNG: For example, in POM, almost 50 per cent of residences are in informal settlements, rendering them highly vulnerable to climate shocks and disaster risks (World Bank 2021). Another example is Wewak, the fifth largest urban centre in PNG. Wewak, a coastal town, is located in East Sepik province and is highly vulnerable to the adverse impacts of climate change. Similar to POM, in recent years, Wewak has faced a surge of internal migrants searching for better livelihood opportunities and mostly moving from disadvantaged rural areas. Many of them reside in informal settlements situated on swampy land with

poor infrastructure related to drainage, garbage collection, water supply and sewerage. Increased climate impacts such as soil erosion, storm surges, sea level rise and prolonged droughts are exacerbating these vulnerabilities, forcing people to be constantly on the move (Mitchell et al. 2016).

In addition to these climate and disaster risks, **migrants also face a new set of security risks, in particular very high levels of crime and violence.** For example, out of 416 cities, POM ranked 4th in the World Crime Index of 2023,[26] and the homicide rate was 33 per 100,000 people between 2010 and 2013, which would rank among the top 50 most dangerous cities in the world (Ivaschenko et al. 2017).

Youth are particularly affected by and involved in crime and violence in cities. In POM, more than half of young people say they have been victims of crime, and over a third admit to having committed crimes themselves (Ivaschenko et al. 2017). Many interview partners described a situation in which young males lack perspective, feel excluded and marginalised and are lost between new, Western and older, traditional ways of living. A key driver of risk is high unemployment: 60 per cent of urban youth are out of work, and only a small fraction have formal jobs (Ivaschenko et al. 2017; Ige 2024). Together, the lack of economic perspectives and the feeling of being lost and excluded makes them more vulnerable to engage in drug abuse, criminal and violent behaviour and election-related and communal violence. A particular group at risk seem to be those young men who didn't finish their education or who cannot find any jobs after they finished their education (Ige 2024). Violent and armed youth gangs, which have grown significantly in urban areas, play an important role in facilitating these activities. These gangs sometimes offer a relative sense of belonging to migrant urban youth (UN-PNG 2023). Interview partners reported that some young women, facing similar pressures, sometimes are forced to resort to transactional sex.

However, **this perception of young people as a problem must be assessed critically.** While young people are often blamed for a lot of the security problems in cities, when probing interview partners, they pointed to another important factor that increases criminal and violent behaviour. Namely, political leaders and business elites often recruit and arm young people for their own interests and to coerce support. Thus, it is not just livelihood insecurity and lacking perspectives that are the problem, but also powerful actors recruiting and using youth for their own interests and providing them with modern arms, which have substantially increased the deadliness of crime, communal conflicts and electoral violence (Cox et al. 2024; Forsyth et al. 2024). It is also important to underline that the youth of PNG present opportunities for inclusive development and can be agents of change for peacebuilding across PNG, as exemplified by initiatives like the youth ambassadors for peace centre in Hela province, dedicated to supporting peacebuilding training and actively engaged in conflict mediation throughout Hela (Conciliation Resources n.d.).

These challenges are happening against the background of larger social change that goes hand in hand with urbanisation and decreasing social cohesion within communities and families and between generations. Here are two examples of these kind of changes:

- **The change in the Haus Man culture:** Haus Man (men's house)[27] is a communal living space occupied by men that was common across PNG (Eves 2016; Jones 2012). The Haus Man used to be a place where young men would gather, live and receive guidance towards adulthood by older male members of the community. While this tradition was thought to consolidate male privilege, it also equipped young men with the necessary knowledge and skills needed to practice their livelihoods in the village, learning their Kastom,[28] as well as receiving some training on contemporary issues (Eves 2006; World Vision Australia 2006). However, the men's house tradition has been

26 These figures are based on website surveys from Numbeo, which rates crime on a scale from 0 to 100. According to Numbeo, a score below 20 indicates a very low crime level, 20 to 40 is considered low, 40 to 60 is moderate, 60 to 80 is high and above 80 is classified as very high (Numbeo n.d.).

27 Different regions in PNG have different names attributed to this social structure. In East and West Sepik, for example, it is often called Haus Tambaran (Spirit House). However, in the Highlands region, it is mostly referred to as Haus Man (Men's House).

28 Kastom refers to the underlying system of beliefs, practices and values of a certain community in PNG that defines dispute resolution mechanisms and traditional governance.

declining since the colonial era (Eves 2006; Jones 2012). Interview partners described that in some cases, the Haus Man has instead become a place for young men to gather and be unsupervised, amplifying harmful behaviour such as substance abuse.

- **Changes in family structures:** Many interview partners described social changes around nuclear families. While in the past men and women would largely grow up and live separately –was the case in Haus Man structures – this has been transitioning towards nuclear family units with husband, wife and children living together. This has decreased social cohesion and cooperative norms within communities, as the family unit has become more important and the community at large less important. This has been happening in rural areas, though at an even faster pace in cities.

Another security-relevant challenge around internal migration is an increasing number of land conflicts in urban and peri-urban areas. As in other land-related conflicts, overlapping land claims often play an aggravating role. Interview partners describe tensions over land playing a role in communal tensions and clashes in urban areas. Interview partners in Buka and POM describe the unregulated leasing and selling of land as well as unregulated squatting as major challenges (see case study 3 on urban areas: POM and Lae). Informal land sales often create disputes between families and clans over land rights. In the Motu Koita area of POM, where land dealings without family consultations took place, disputes ended up in village courts (Laki 2022). Land grabbing and illegal squatting on customary land are also causing increased social tensions between communities and between landowners and the government (Laki 2022).

As PNG faces accelerating climate change impacts and continued urbanisation, the security challenges outlined in this section are likely to intensify. Urban populations are projected to significantly increase; at the same time, climate-related stressors will become more severe. In urban areas, higher temperatures, floods and droughts will put additional strain on basic service access to energy and transportation systems, as well as food and water security, disproportionately impacting informal settlements situated in marginal, hazard-prone areas. Increased temperatures and rainfall will also raise the risk of vector= and water-borne disease outbreaks, such as malaria and cholera in cities like POM. This means that the pressures on informal settlements, basic services and social cohesion will only grow. Altogether, environmental vulnerabilities, limited economic opportunities and weakening social structures contribute to volatility in urban areas. Without significant improvements in urban planning, service provision and youth engagement, cities risk becoming flashpoints where climate impacts and social tensions converge to create new security challenges. The experiences of POM and other urban centres today may well be harbingers of more widespread challenges to come.

Pathway 5: Conflicts and tensions around the extractives sector – mining, oil and gas

The extractives sector remains a significant driver of tensions and conflicts in PNG. Mining, oil and gas projects have triggered many conflicts throughout the country's history and continue to do so today. These conflicts primarily revolve around large-scale projects and their environmental impacts, land rights and benefits sharing, and they are often intertwined with larger conflict dynamics in different parts of the country. A lot of the challenges in the extractives sector are caused or aggravated by a lack of oversight and implementation of social and environmental standards. Climate change is now adding another layer of complexity, amplifying environmental risks like landslides, flooding and pollution, which further strain relationships between the government, companies and communities. The following section will explore these dynamics along three examples that illustrate the history, variety and complexity of mining conflicts in PNG.

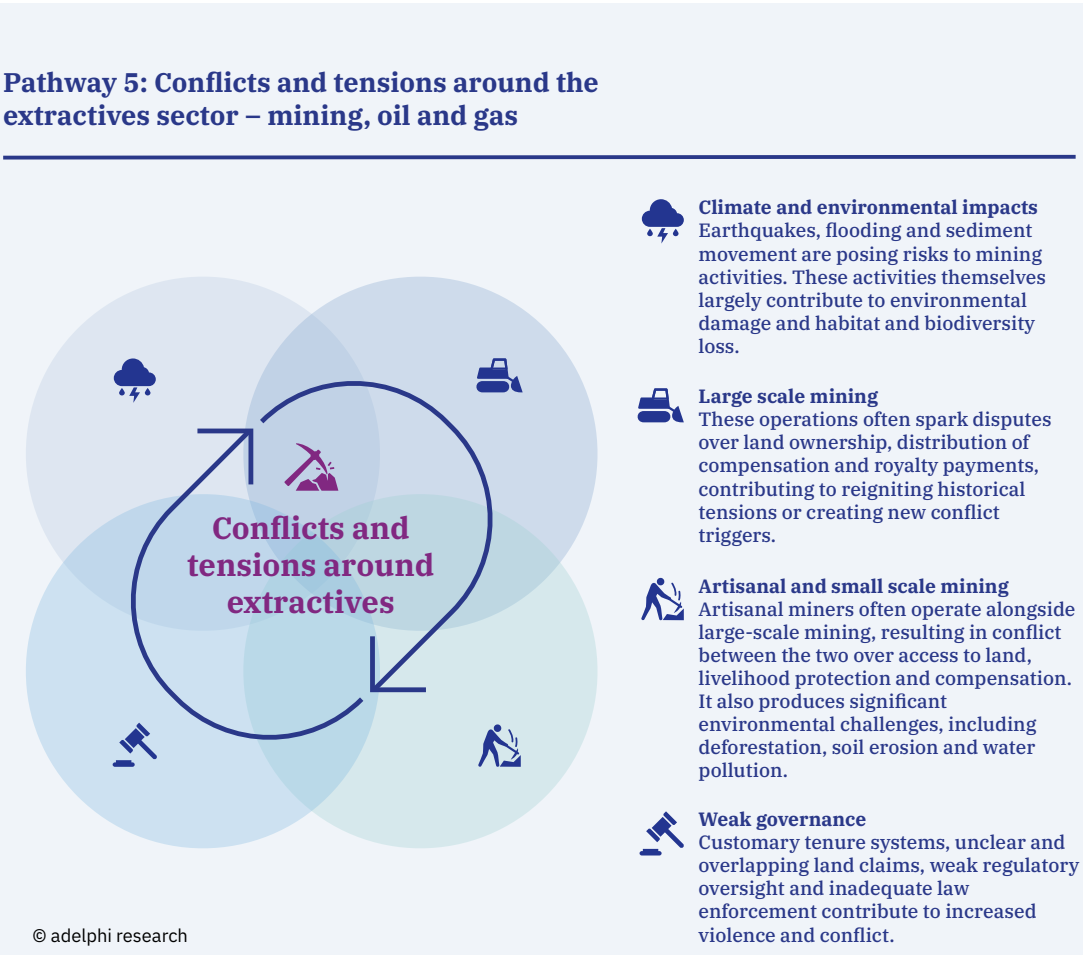

Figure 14: Conflicts and tensions around the extractives sector - mining, oil and gas (elaborated by adelphi).

The first example is the $19 billion **PNG Liquified Natural Gas (LNG) project by ExxonMobil** that includes gas extraction and processing, aiming to produce and export 6.9 million tonnes of natural gas per year over a period of 30 years (PNG LNG n.d.). In 2024, PNG LNG marked its tenth year of

production, operating at 8 million tons per year, which was 30 per cent above its nameplate capacity of 6.9 million tonnes (Nikše 2024). Its main production facilities are the Hides Gas Conditioning Plant (HGCP) in Hela province, and the creation of the province itself is closely linked to this project (see first case study on the Highlands region: Hela and SHP). Different conflicts and security issues emerged around this project:

- **From the outset, disputes over land ownership and compensation emerged,** with tensions between the government, local landowners and the project operators often escalating into roadblocks, the destruction of equipment and frequent protests that resulted in work disruptions and even death. In addition, violent conflicts due to overlapping land claims erupted between landowners, leading, for instance, to four deaths during a violent conflict between two communities over land claims in January 2010 (Ejatlas 2023; Gridneff 2010).

- Today, conflicts and tensions seem to mainly revolve around the distribution of benefits and royalties. also affecting larger-scale conflict dynamics with many interview partners pointing to grievances over the lack of benefit sharing beyond the communities directly affected by the operations and the perception that the provincial government is not using the incomes generated by the project for local economic development, undermining its legitimacy. Contributing to this problem is the fact that the royalties received from the PNG LNG project are linked to the netback value of the gas sold. This ensures that royalties are only paid if and when the project's revenues are higher than the costs incurred, sanctioning large capital allowances that cancel out any tax liabilities. This also meant that the project yielded near zero fiscal tax revenues for the government until 2021 (World Bank 2017; ExxonMobil n.d.; Minister of Treasury 2020; Minister of Treasury 2024).

- Because of the project's importance for the government, **communities also target the project to get the attention of the government on other issues.** For example, community members from SHP recounted an incident in which local residents resorted to direct action following the death of a community member in POM. After the perceived lack of response from law enforcement and government authorities, community members blockaded roads and seized several ExxonMobil vehicles.

- **Extractives operations can also interact with disasters and conflict in complex ways,** as exemplified by the 2018 earthquake that had its epicentre only a few kilometres away from where the HGCP is located. The earthquake was the largest to strike the PNG Highlands since the start of written records, and its intensity went well beyond anything in the lived experience of the local population. It led to the widespread destruction of housing, aid posts, schools and roads, and it triggered massive landslides. Following the earthquake, the attitudes of local communities towards ExxonMobil became more violent, due to their belief that the earthquake was caused by the project, despite the inaccuracy of this claim (Main, 2018). The landowners of the Angore gas field, which is close in proximity to the HGCP, took up arms against ExxonMobil's facilities and destroyed the company's camp site, including its vehicles, buildings and machinery. After the attack, soldiers from the PNG Defence Force (PNGDF) were deployed to Hela province in order to protect the PNG LNG project from further attacks. The underlying grievances remain to this day (Gugg et al. 2019).

The project's environmental impacts are hard to assess. A preliminary and comprehensive environmental impact analysis at the beginning of the project noted its adverse contribution to biodiversity and the disruption of habitats, rivers, and coastal floods, as well as mudflow, deforestation and loss of vegetation cover, particularly in Hides Ridge, and surface water pollution as a result of potential leaks (Ejatlas 2023; PNGLNG 2009). In addition, the project is also estimated to directly contribute to more than 660 million tonnes of CO2 through the gas produced (Anton 2020). No subsequent comprehensive environmental assessments were available for this study. However, anecdotal evidence from NGOs suggests impacts on local livelihoods by restricting access to fishing areas and through dust pollution from road construction associated with the project's activities (Oxfam 2022).

Another well-documented example of conflicts around mining is the **Porgera gold mine in Enga province.** The mine is an open pit and underground gold and silver mine located 140 kilometres west of Mount Hagen. It was the second largest mine in PNG. Production started in the second half of 1990 and stopped in 2020. Exports of gold and silver averaged 12 per cent of total exports' value for the period 1991-2019 and 7 per cent for 2019. (Fallon 2020). However, despite its significant economic contributions, the Porgera mine also brought with it a number of conflicts and security-relevant challenges:

- From the beginning, **human rights violations, environmental issues and conflicts overcompensation with the local landowners were linked to the mining operations** (Pryke & McLeod 2020). For decades, human rights violations were reported and documented, including the excess use of force against men, women and children by the mine's security forces and police. Between 2006 and 2010, further reports emerged of men and boys killed and beaten, women and girls raped and houses destroyed (Coumans 2022; HRW 2011).

- **Challenges also arose around small-scale mining.** Since 1939, long before the opening of the mine, the majority Ipili people of Porgera were already involved in small-scale alluvial gold mining. Alluvial mining continued to dominate the cash economy of the immediate Porgera area until 1990, when the mine was operated by the Porgera Joint Venture (Tulin 2005). Following the opening of the mine, alluvial miners continued to trespass into the mine, leading to clashes with the mine's guards and resulting in the killings of many alluvial miners. There were also reports of bodily harm, torture, arbitrary arrest and detentions of trespassers by the mine's security forces (Tulin 2005).

- **The long-term environmental impacts of the mine were and are a cause of conflict and insecurity.** Interview partners shared accounts from communities living along the Strickland River that have been and continue to be affected by these environmental impacts. The alleged pollution of the river and the government and operating company's perceived inaction have led to protests and roadblocks (HRW 2011). The health and livelihood impacts have pushed local communities to resettle, causing conflicts in the receiving areas. Interview partners also point towards an increase in SARV, with environmental impacts and health issues seen as sorcery.

In 2020, PNG's government took the decision to not renew the mining lease, citing efforts to gain more control over and benefits from the mining sector (Pryke & McLeod 2020). The mining companies Barrick Gold and Zijin Mining sued the government, and after lengthy negotiations, a deal was struck to reopen the mine under a majority ownership (51 percent) of the government and stakeholders and a minority ownership (49 per cent) of Barrick Gold and Zijin Mining (Gray 2024; Luma 2023). The opening of the mine was delayed a few times. In December 2023, the mine was reopened under a Special Mining License (Luma 2023). This new arrangement provides the government with enough leverage to assert more control over the mine's operations, but whether the new mine and operators will be able to avoid future tensions and conflicts remains an open question (Wiseman 2023).

A last example is the **Panguna mine in Bougainville,** which also led to conflicts and security-relevant challenges:

- The **mine was the main trigger for Bougainville's devastating civil war from 1988 to 1998,** leading to its proclamation of autonomy from PNG. Opened in 1972 by Bougainville Copper Limited (BCL), a subsidiary of Rio Tinto, it was once one of the world's largest open-pit copper mines. Grievances that sparked the conflict centred on environmental damages and the unequal distribution of benefits (Hermkens 2025). The outbreak of the conflict led to the closure of the mine (see second case study on coastal areas: Bougainville).

- **Small-scall gold mining that emerged after the mine's closure created new challenges.** After the mine's closure and the cessation of fighting, local communities started alluvial small-scale gold mining – first in the mining pit, though this successively spread into the tailings and then the surrounding mountains and other parts of Bougainville (O'Faircheallaigh et al. 2017). Driven by a lack of alternative livelihoods, the small-scale mining sector expanded rapidly. It now employs around 30,000-40,000 individuals, according to

experts interviewed. This has had wide-ranging environmental impacts – in particular, mine-related flooding and sediment movement, elevated metal levels in the river system, as well as mine chemicals and metals in the soil of the areas that were used for chemical storage and from waste rocks and tailings (Tetra Tech Coffey 2024). The government is aware of these issues and planning to better regulate the sector, although this is likely to be met by resistance as alternative livelihoods are lacking and alluvial gold mining is very lucrative.

The PNG and the Autonomous Bougainville Government (ABG) are also actively working towards reopening the mine. In particular, the ABG sees the mine and its potential revenues as an important building block towards economic and political independence from PNG. However, against the background of its conflict history, this process is risky and likely to create new or reignite old conflicts, if not managed sensitively and well.

Looking across these examples, **weak governance is a key factor aggravating conflicts in the extractives sector.** These include a lack of control and enforcement regarding environmental and social standards, deficient participatory processes to ensure free, prior and informed consent within local communities, corruption, a lack of transparency and challenges around royalty sharing. The complex land tenure and traditional land ownership also play an important role as aggravating factors in these conflicts. In particular, unclear and overlapping land claims often lead to conflicts over who will receive compensation and royalty payments. They also lead to complex compensation arrangements that often involve many parties with diverging interests. Traditional land ownership in PNG also makes the regulation of small-scale mining more challenging.

The adverse impacts of climate change will likely aggravate existing environmental challenges, leading to disruptions of production and adding another layer of complexity to the management of the extractives sector. Increased cumulative precipitation, especially during La Niña events, can increase the risk of landslides, floodings and problems with containment of tailings, which in turn affect mining activities and can lead to further environmental damage, such as water pollution from sedimentation, coral bleaching and soil pollution. Mine tailings disposed into riverways, such as from Ok Tedi (Western) and Tolukuma (Central), also contribute to downstream flooding in addition to pollution of flora and fauna, which occurred along the Fly-Strickland and Auga-Argabanga Rivers, respectively (Vogt 2013). Under a "middle-of-the-road" scenario, by mid-century, 100-year flood inundation of >1 metre particularly increases along the Fly-Strickland River (WRI 2023). Land clearance for road access, extraction sites and processing facilities may further exacerbate runoff, erosion, landslides and risk of flood and water contamination without appropriate re-vegetation (SOPAC 2007). Greater near-term landslide risk would occur under SSP1-2.6, but greater medium-term risk would occur under SSP3-7.0 (see "Precipitation" and "Inland Flooding").

The extractives sector is of a very high economic significance for PNG, its provincial governments and, in the case of Bougainville, its independence process, **and it will continue to play an important role in the years to come.** This is reflected in PNG's development strategy (2010-2030), which identifies the extractives sector as one of most important economic sectors next to agriculture, fisheries and forestry (PNG-DNPM 2010). One example of this growing sector is the new Papua LNG project implemented by Total Energy, ExxonMobile and Santos, which is expected to start production in 2025-2026 (Luma 2023). Other important extraction projects will either commence in the near future or have already started production, including P'Nyang LNG, Stanley Condensate Project, Ok Tedi Mine, Tolukuma gold mine, Lihir mine and Simberi mine. As PNG continues to rely on extractive industries for its economic development, the lessons from the past underscore the critical need for stronger environmental protections, more effective benefit-sharing mechanisms and improved governance frameworks to ensure sustainable resource management. Without addressing these fundamental issues, future resource projects risk perpetuating the same cycle of environmental degradation and conflict that has characterised much of PNG's extractives sector history.

Pathway 6: Response measures intensifying tensions and conflicts

The implementation of development, climate change adaptation and disaster response projects and measures in PNG, while intended to build resilience and reduce vulnerability, can inadvertently create or exacerbate existing tensions and conflicts, particularly in regions with scarce resources and fragile governance. Unequal aid distribution, land disputes, and inadequate community consultations exacerbate grievances, while corruption and favouritism deepen mistrust. Gender dynamics further complicate responses, with women frequently excluded from decision-making despite facing disproportionate impacts. However, examples of conflict-sensitive and gender-responsive projects show the potential to address these challenges effectively. As climate change intensifies, integrating adaptation and peacebuilding offers a vital pathway to foster resilience while reducing the risk of conflict.

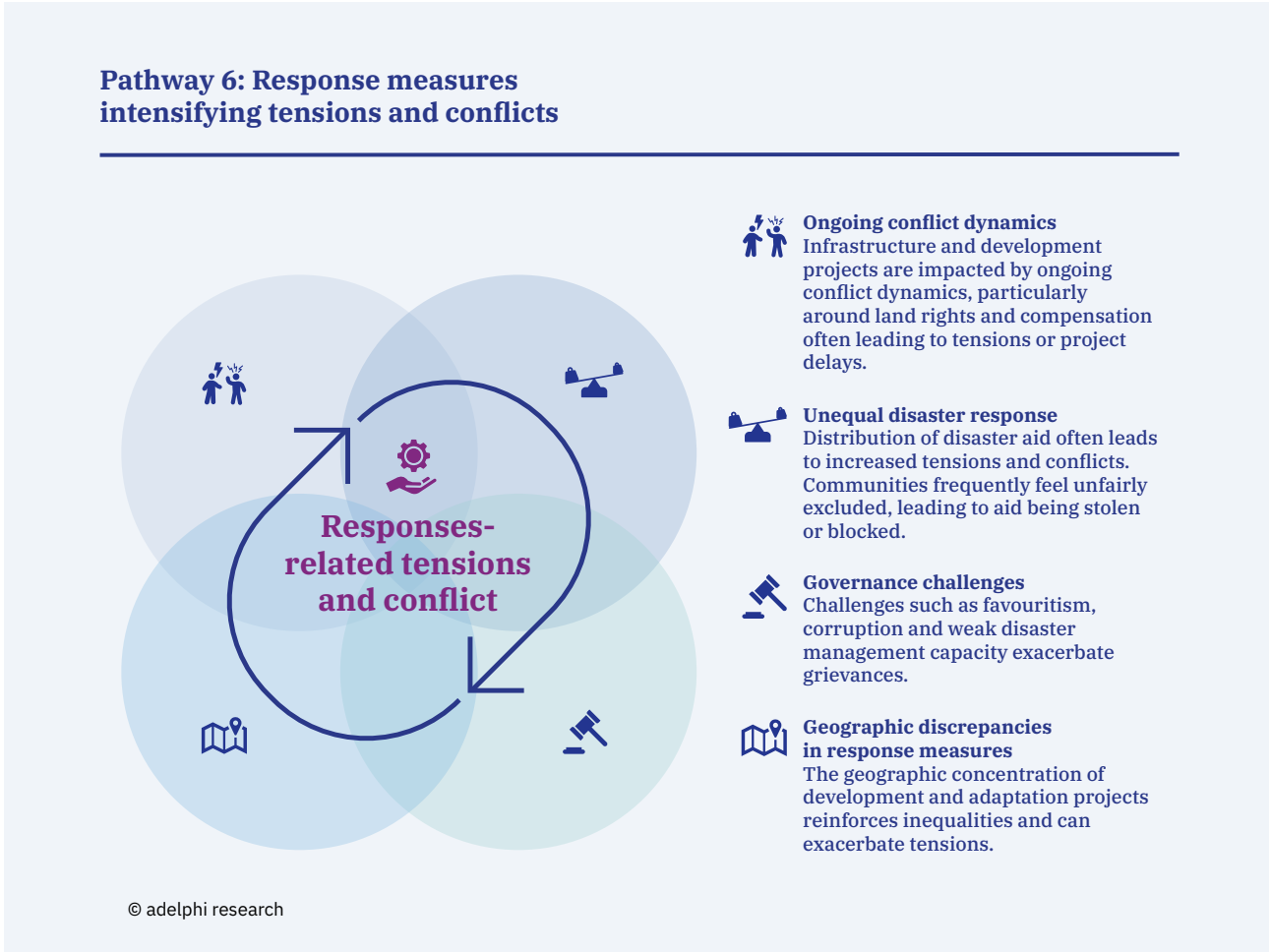

Figure 15: Pathway 6: Response measures intensifying tensions and conflicts (elaborated by adelphi).

Lacking and unequal disaster response measures are a particularly significant source of tension. Interview partners across all regions covered by the assessment reported that the distribution of disaster aid often leads to increased tensions and conflicts, especially in remote regions where resources are scarce and communities are particularly vulnerable. The reason for these tensions is often that communities feel they are unfairly excluded. This often leads to stolen or blocked aid by local leaders

or groups, as they feel their community should also receive support. For instance, in 2015, community members from Yalo Bridge and Seven Kona in Kagua district blocked the road leading to the Erave district and stopped a shipping container full of relief supplies for the drought (RNZ 2015). Inadequate and slow institutional responses can also be a source of tensions, as exemplified in the aftermath of the earthquake that hit the Highlands in 2018, when the focus and scope of immediate relief responses reignited grievances between communities over distribution of benefits from the PNG LNG projects (World Bank 2024).

Favouritism and corruption play an aggravating role. Interview partners shared stories of communities receiving or not receiving disaster aid in the Highlands depending on their political allegiance to the local member of parliament. However, inadequate or unequal responses are also often due to limited and weak disaster management capacities as outlined above (see Pathway 3). On the other hand, conflict and violence itself also hinder disaster response. For instance, the response to the Enga landslide in 2024 was complicated logistically by intergroup violence, as PNGDF escorts were needed to ensure the safety of rescue relief teams (UNDP 2024).

Development and infrastructure projects are also interacting with existing conflict dynamics in complex ways, in particular around land. The customary land tenure system, while important for cultural preservation and community cohesion, can significantly complicate and delay the implementation of development projects and lead to conflicts, especially if not implemented in a conflict-sensitive way and with proper consultations (Filer 1997; Yala 2006; Allen & Monson 2014). Interview partners shared examples in which the construction of critical infrastructure, such as airports, roads or water supply systems, led to conflicts over land rights and compensation (see Pathway 2). This is particularly challenging for larger infrastructure projects that require significant land areas or affect multiple communities. One example occurred at Tari Airport, which was shut down due to claims of compensation payments by landowners in SHP in 2010 (RNZ 2010). A similar example happened at the Kavieng Airport blockage in New Ireland, in which groups of landowners from Omo and surrounding villages organised a sit-in and demanded compensation for their land – where the airport currently sits. This issue was triggered in 2020 by the airport expansion project, along with already-existing grievances regarding overcompensation payments that sometimes dated back to the 1970s. This delayed the opening of the expanded airport until payments were settled with the landowners (EJAtlas 2024). The long-term impacts of development projects can also potentially impact to conflict dynamics. One example is the planned road construction under PNG's MTDP, which would go through lowland and lower montane forests to connect rural communities to markets. These projects also open up new forest areas for potential agricultural conversion and natural resource extraction, potentially adversely impacting the indigenous population residing around those areas, causing habitat and biodiversity loss, as well as new conflicts (Slattery et al. 2018; SOPAC 2007).

Similar dynamics could be observed with resilience building and climate adaptation projects in PNG that have encountered difficulties because they were not designed in a conflict-sensitive manner. One example are initiatives aimed at improving water management or agricultural resilience that favour certain groups, leading to competition and tension over resources. In rural areas, perceived (or actual) discrimination in services provision sometimes increases tensions between users and local authorities. This was the case in the Goroka district, where rural communities are not provided access to safe water services, but surface water from their area is diverted to other urban areas (UNICEF 2025). How difficult and sensitive these processes can be also illustrated another example in the Goroka district, where WASH facilities are systematically compromised because of lack of community consultations, leading to inefficient resource allocation and fostering community perceptions of illegitimate motivations behind the decision over where the water infrastructure was placed. WASH facilities were placed in schools and hospitals, while community households lacked access to water. This situation prompted residents to tap into the water infrastructure at schools and hospitals, exacerbating tensions and sometimes resulting in the temporary closure of these institutions (UNICEF 2025).

Another recurring theme in the interviews was **the geographic concentration of development and adaptation projects in certain areas while others receive little attention.** This is not a novel problem – since PNG's independence in 1975, colonial powers' growth-oriented development strategies caused income distribution inequalities, with centralised economic investments in resource-endowed areas (Mannan 1975). In terms of development projects today, this uneven distribution often follows patterns of accessibility and existing relationships between communities and implementing organisations. This was particularly the case in the Highlands, where accessibility is especially challenging because of security risks and lacking infrastructure. This pattern can reinforce existing inequalities and create new grievances. This is particularly problematic as it often means that the most vulnerable communities, which are typically harder to reach, receive the least support.

Gender dynamics also play an important role in how response measures impact communities. Interview partners highlighted that women are often excluded from decision-making processes related to response measures, despite the fact they are disproportionately affected by both climate change impacts and the outcomes of these interventions. This exclusion can lead to response measures that fail to address the specific needs and vulnerabilities of women and girls, potentially creating new security risks or exacerbating existing ones. For example, a review of El Niño-related drought response in 2015 revealed that women were frequently overlooked and marginalised in humanitarian aid efforts as the male-headed households were designated by assistance organisations for collecting the aid, leaving women-headed households, co-wives, widows and children vulnerable and without support (ABC 2017; Care International 2017).

There are also many positive examples of projects in PNG that have successfully navigated potential conflicts through conflict sensitivity and gender responsiveness. Interview partners shared experiences from WASH projects that tried to avoid unintended negative impacts in particular the capture of water infrastructure by landowners or more powerful community members by putting a specific focus on conflict-sensitivity, ownership and awareness raising before and during implementation for example by creating management committees and carefully considering where boreholes, water pipes and faucets are installed. While these approaches were more resource- and time-intensive, they helped to avoid later conflicts over who can access water.

Going beyond conflict-sensitivity, **there are also instructive examples of projects specifically linking climate change adaptation and peacebuilding** to simultaneously increase the resilience of local communities against climate change and prevent conflict and violence. For example:

- The UNDP project "Preventing Climate-Induced Conflicts Through Empowered Women leadership" was implemented from 2021-2024 in Hela and SHP to increase the active participation of women in community action to mitigate climate-induced conflict risks and increase the overall resilience of the communities in the face of conflict and hazards (UNDP n.d.).

- The project "Reduction of economic and human loss and displacement by natural disasters through community-based resilience building and the capacity building of the Government at all levels in Papua New Guinea" by IOM, USAID, Morobe Provincial Administration and Markham District Development Authority (DDA) assisted IDP communities to access safe and clean drinking water after the stoppage of the water scheme almost 20 years ago, by rehabilitating boreholes and water points. Prior to this, women and children were forced to walk for an hour to fetch water along the banks of the Markham River, subjecting them to harassment on their long routes. The project contributed not only to water security in the district but also to preventing SGBV and promoting women's empowerment. Women and children are now able to go to school and care for their households and gardens (PNG IOM 2022).

- Peace Dividends Initiative (PDI)'s project "Investing in climate resilience and economic opportunity in conflict-affected settings" in Bougainville aims to improve livelihoods for communities that were affected by the conflict in different parts of the island and to build more sustainable peace. The project specifically integrates climate change adaptation and mitigation with the goal to help

communities adapt to climate change and, to some extent, even mitigate it (Peace Dividends, n.d.). One example of these projects is transitioning from the use of firewood to the use of coconut husks as fuel for the drying process of cacao beans, in an effort to reduce pressure on forests.

Looking ahead, as climate change impacts intensify and the need for adaptation and response measures increases, these experiences underscore important lessons:

1. The importance of developing more conflict-sensitive approaches when implementing response measures to consider the local context, existing power dynamics and potential sources of tension.

2. The need for better coordination between different actors and more inclusive decision-making processes to ensure the meaningful participation of all affected community members, including women and other vulnerable groups.

3. The effective integration of climate change adaptation and peacebuilding approaches can create significant co-benefits.

Interconnected, but different risks and geographies: Case studies

This section zooms in on three distinct but interconnected geographies in PNG, emphasising the contextual specificities across these regions. The pathways in the previous section build on these case studies and as such, there are similarities and repetitions between both. However, the following provides a different perspective and focus on how the unique geographic, historical, cultural, social and political contexts of each region distinctly shape climate- and environment-related security risks. By highlighting these contextual differences, the section provides a nuanced understanding of how these factors influence and are influenced by the pathways in varied ways across PNG.

The Highlands region: Hela and Southern Highlands Province

The Highlands region, including Hela and SHP, represents one of the most complex and challenging environments in PNG, where climate impacts, conflict and governance challenges intersect and amplify each other. Alongside persistent cycles of communal violence, weak governance and the growing influence of political and economic elites, the region is increasingly exposed to severe climate change impacts – rising temperatures, erratic rainfall and frequent disasters. These dynamics drive a range of interconnected risks, including escalating SARV, displacement, urban migration and conflict around extractive industries. Together, they create a volatile landscape where insecurity and vulnerability are deepening, and climate change accelerates and intensifies existing security challenges.

Southern Highlands Province: © adelphi research.

The Highlands region stands out as the country's most violent region, with Hela and SHP ranking third and fifth among the worst affected (see Table 1). Despite gaps in reliable data, estimates based on national media and court reports point to widespread and deeply rooted intergroup violence, though these figures likely understate the true scale of the problem and reveal no clear trend over recent years (Forsyth et al. 2024). There is broad consensus among interview partners that issues related to well-armed young men and SARV are intensifying. Decades of conflict have entrenched cycles of retribution and normalised a culture in which disputes quickly escalate. The growing availability of small arms and high-powered firearms has made violent encounters increasingly lethal (Forsyth et al. 2024; Raicu et al. 2024). Interview partners also note that violence is often more severe in remote communities, where state presence and support are limited.

Both provinces show similar and distinct patterns of violence. In general, the data and interview partners indicate that violence in Hela is more pronounced than in SHP, primarily due to intergroup conflicts that are often described as "tribal" and to intensified resource competition. In SHP, intergroup violence is more frequently attributed to competition for political power and influence. Many of the conflict's root causes and triggers are common across the two provinces (see Figure 16). Another commonality is that while intergroup and election-driven violence and conflicts are at the forefront and attract a lot of attention, more normalised forms of violence, in particular SARV and SGBV, are also widespread. They significantly affect the physical and psychological well-being of large parts of the population, in particular women and girls (Forsyth et al. 2024). Government presence in both provinces is very limited, even in the capitals Mendi and Tari, and practically absent in more rural and remote areas. This institutional gap is even more severe in Hela, where the province's recent establishment has left its administrative capacity underdeveloped.

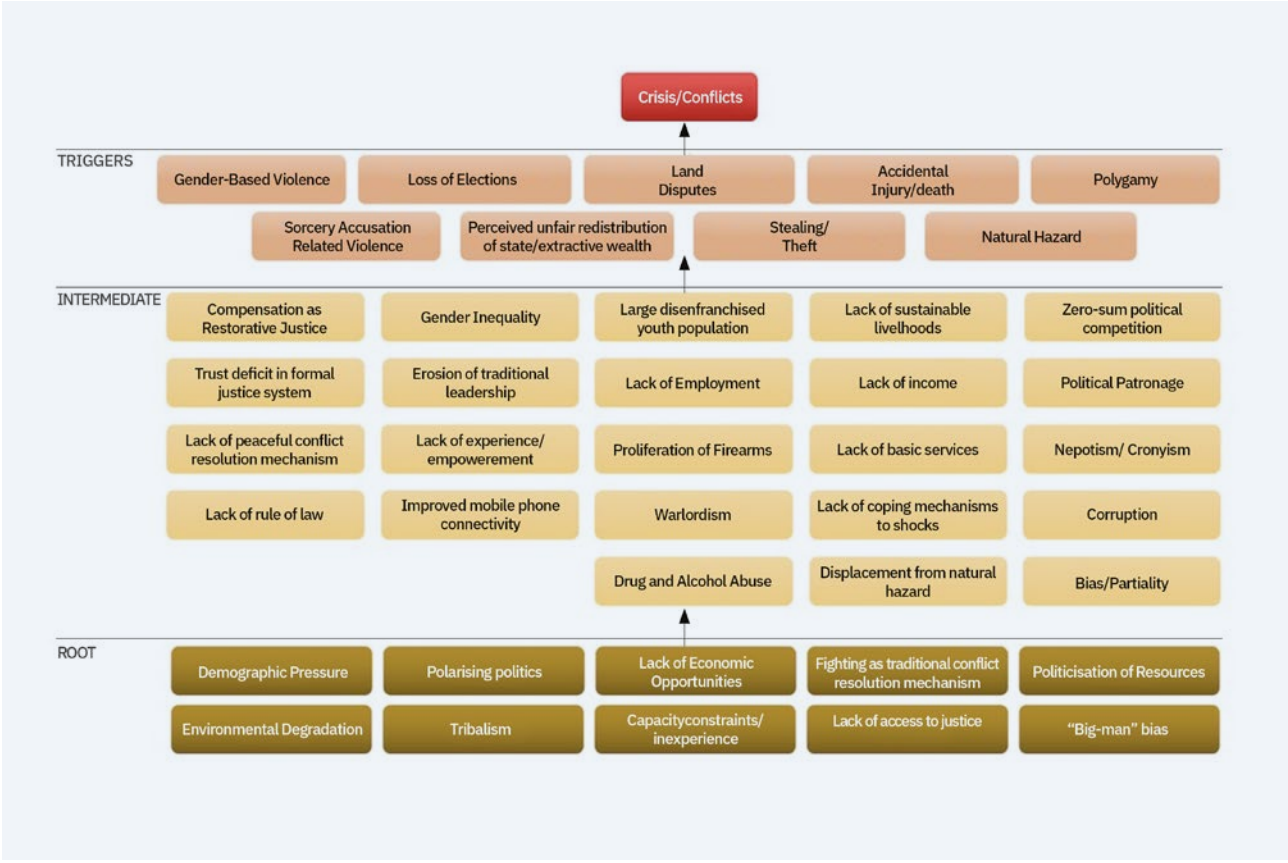

Figure 16: Summary of conflict triggers and causes: context analysis of the provinces of SHP and Hela (UN-PNG 2023).

CLIMATE CHANGE IMPACTS AND ENVIRONMENTAL CHALLENGES

The region is already experiencing significant climate-related challenges, with weather-induced disasters as a primary driver of environmental and climate-related security risks. Interview partners consistently highlight an increase in weather-induced disasters and rising temperatures. These changes are having substantial impacts on agricultural practices and crop viability. While some areas have seen opportunities for new cash crops, others, for example peri-urban areas around Mendi, are experiencing negative impacts. Drought risks are also felt across the two provinces, with the 1997 and 2015 El Niño events causing large-scale food and water shortages in Hela and Southern Highlands. Based on factors such as staple crop tolerance, population percentage employed in agriculture and indicators of child nutrition, drought vulnerability ranks severe in the Southern Highlands and moderate in Hela (Aitkenhead et al. 2023).

Rising temperatures in PNG's Highlands threaten agricultural zones and community resilience. Between 1971 and 2020, Hela province experienced significant warming of 0.28°C per decade annually and 0.30°C per decade during austral summer (December-February). Future projections for Hela and SHP are alarming, with temperatures in Southern Highlands expected to rise by a best estimate of 1.20°C (0.76°C and 1.79°C possible) under SSP3-7.0 and 0.85°C (0.52°C and 1.29°C possible) under SSP1-2.6 by mid-century (see Figure 17), with greater warming occurring at the end of the dry season. These changes will shift temperature conditions by approximately 200 metres in elevation, threatening both lowland and highland crop viability (Michael 2019). The impacts extend beyond agriculture, as Southern Highlands will experience the largest subnational increase in tropical nights (minimum temperature >20°C) in the country,[29] while both provinces face growing risks of inland flooding, flood-induced landslides and more intense droughts during El Niño phases.

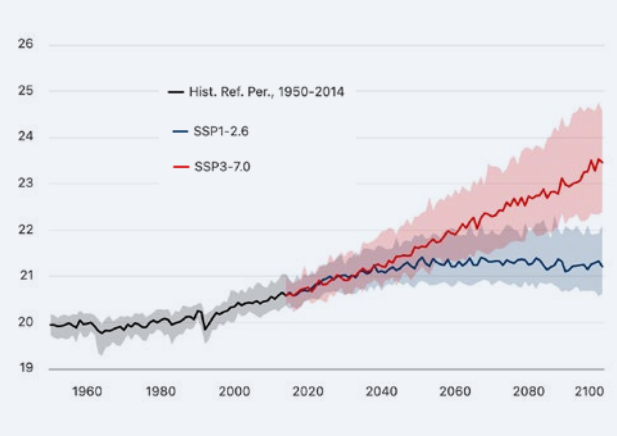

Figure 17: Projected average mean temperature in SHP through 2100 (Ref. Period 1995-2014) under SSP1-2.6 (Blue) and SSP3-7.0 (Red). [30] Note diverging temperature trajectories between scenarios by mid-century. Shaded extents indicate 10th and 90th percentile values.

Rainfall patterns are intensifying in the Highlands: Precipitation trends in SHP reveal a concerning trajectory of increasing rainfall intensity and variability. Between 1971 and 2020, annual observed precipitation in SHP increased dramatically by 187 mm per decade, with austral spring (September-November) seeing a significant rise of 97 mm per decade. Future projections are even more striking, with SHP expected to experience the highest precipitation increase in all of PNG by mid-century. Under the high-emission scenario (SSP3-7.0), annual rainfall is projected to increase by +257 mm, reaching a total of 4,967 mm, though with considerable uncertainty ranging from +3 mm to +623 mm. Even under the low-emission scenario (SSP1-2.6), precipitation is expected to increase by +183 mm, with possible variations between -86 mm and +498 mm.[31] Figure 18 illustrates a long-term trend of wetter conditions during both the northwest monsoon and southeast monsoon seasons, with only austral winter potentially experiencing drier conditions later in the century. Particularly concerning is the projected increase in five-day precipitation intensity during peak seasons under both scenarios, heightening the risk of flash floods, landslides and infrastructure damage.[32]

29 By mid-century under SSP3-7.0, tropical nights of this intensity increase by a best estimate of 61 nights (35 nights and 93 nights possible) and under SSP1-2.6, tropical nights increase 43 nights (21 nights and 68 nights possible).
30 Data and visual produced using: World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.
31 In the near term under SSP3-7.0, precipitation increases in the SHP by +132 mm (-84 mm and +336 mm possible). Similar rates of precipitation change occur in Hela province
32 For example, intensity for such events in the SHP between March and May by mid-century increases +27 mm (-10 mm and +129 mm possible).

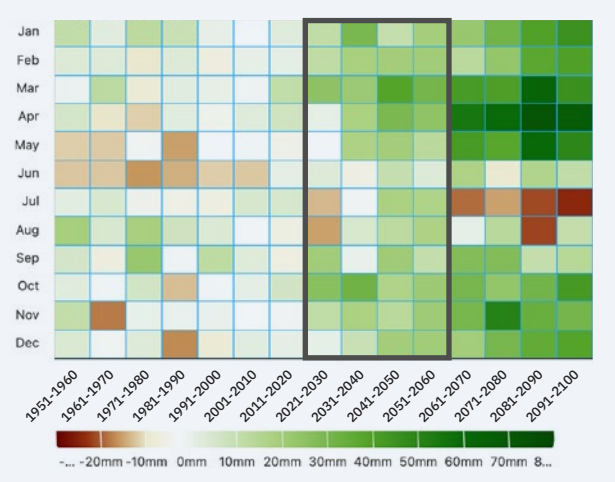

Figure 18: Historical and projected precipitation change (mm per decade) in SHP from 1951-2100 (Ref. Period 1995-2014) under SSP3-7.0. [33] Near-term and medium-term periods outlined in a gray box. Note long-term trend of months throughout the northwest monsoon and southeast monsoon seasons becoming wetter, except for potentially drier months during austral winter later in the century (as a decadal average)

Disaster risks are increasing: Increasing cumulative rainfall under both high- and low-emission scenarios is set to increase flood-induced landslides, endangering settlements, vital infrastructure and agricultural land throughout the region. This heightened flood risk exists alongside an equally concerning drought vulnerability, as El Niño phases continue to decrease cloud cover over the New Guinea Highlands, leading to periodic drought conditions and cooler frost-forming temperatures at night (UNDP 2023). Even as minimum temperatures are projected to rise, frost conditions during severe El Niño events will persist, posing a dual challenge to agricultural production.[34] Although droughts may become shorter in duration, their intensity is expected to increase in the coming years, placing further strain on highland communities over the medium-term under all emission scenarios (UNDP 2023). In the lowlands of SHP, these more intense drought events threaten the production of staple sago crops that are crucial for local food security (Michael 2019). The upper watershed of the Kikori River (Tagari-Hegigio, Wage-Mubi tributaries) and Purari River (Lai and Erave tributaries) spanning southern Hela and central Southern Highlands face extremely high riverine flood risk (WRI 2023). The ensemble average 100-year flood inundation depth increases under a "middle-of-the-road" SSP2-4.5 emission scenario in Hela province by mid-century, but changes only marginally across SHP over this period (UNDP 2023).

The Highlands are also vulnerable to geological hazards. Situated on the Pacific Ring of Fire, PNG's Highlands are also facing very high earthquake risks in terms of frequency and severity (UN-PNG 2023). The aftermath of the 2018 7.5 magnitude earthquake that hit the Highlands was felt across the country. It affected 544,000 people as of August 2018, with over 270,000 people in need of immediate humanitarian assistance (UNCT PNG 2018) and led to the shrinking of the economy of PNG by 0.8 per cent (UN-PNG 2023). The estimated cost of rehabilitating social infrastructure such as health and education facilities across Hela, SHP and Western provinces was approximately $105 million (UNCT PNG 2018). Fourteen pr cent of families in the earthquake-affected area were displaced, with almost 11,000 households lacking durable solutions (UNCT PNG 2018). The following years saw five more earthquakes in SHP and Hela provinces, albeit on a smaller scale (World Data 2025). This plays into a wider, more connected web of instability and conflict in the two regions, exacerbating vulnerability and driving further insecurity.

CLIMATE AND ENVIRONMENTAL SECURITY PATHWAYS

Pathway 1: Environment and climate change impacts contributing to SARV

SARV represents a pervasive, severe and escalating security challenge across Hela and SHP. Environmental and climatic events – particularly weather, climate, geological and water-related disasters such as heavy rains, floods, landslides and their consequences, including deaths, crop failures and contaminated water supplies – are frequently interpreted as manifestations of sorcery. While available data likely vastly underestimates the true magnitude of this issue, it also identifies

33 Data and visual produced using: World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.
34 Due to unique microclimatic conditions seasonally and interannually, available climate projections cannot illuminate significant changes in future frost-forming conditions beyond the potential for more intense ENSO events. For more details in Hela and SHP, see UNDP 2023.

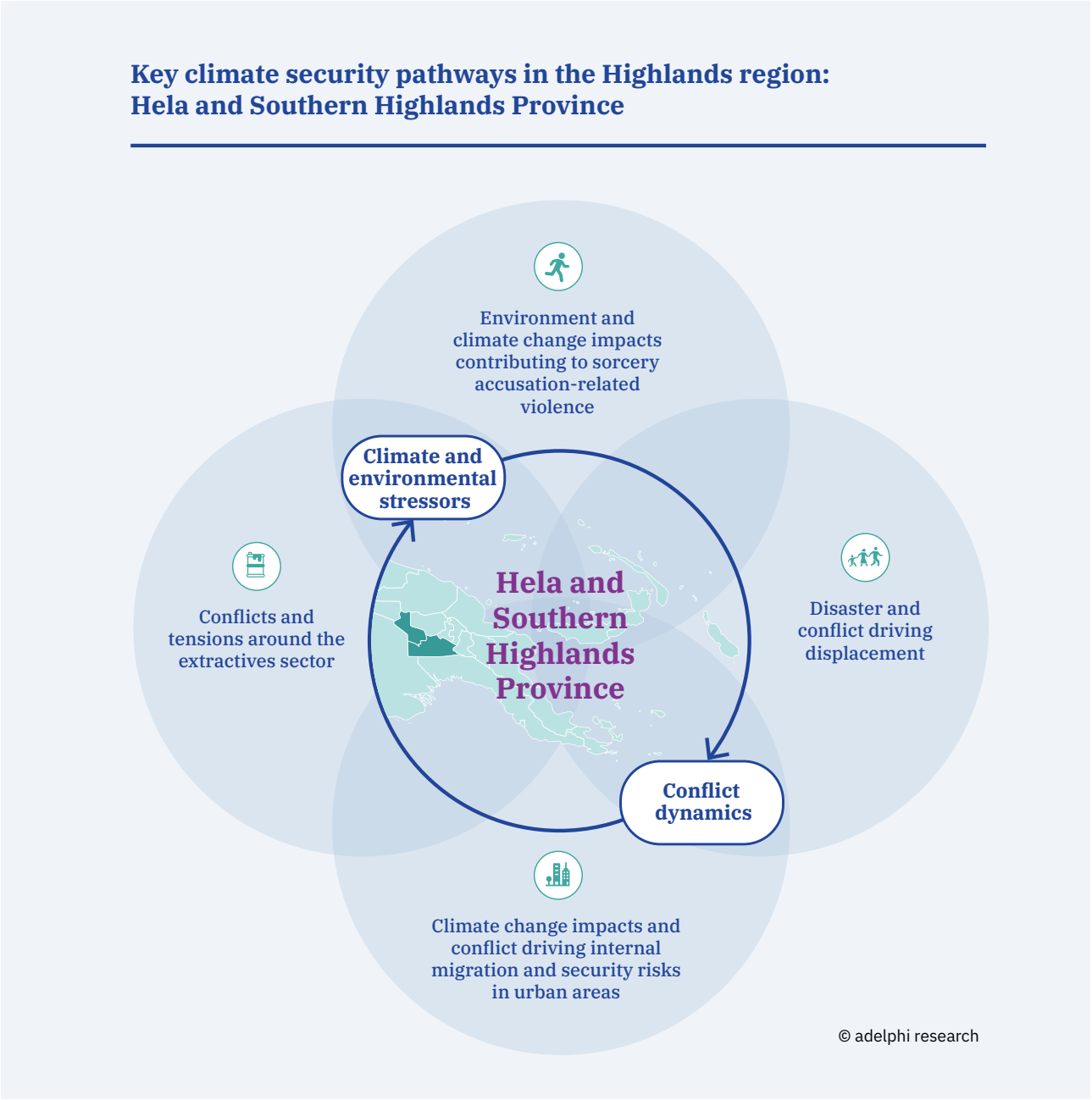

Figure 19: Key climate security pathways in the Highlands region: Hela and Southern Highlands Province (elaborated by adelphi).

SHP as a significant hotspot, ranking fifth nationwide with over 200 documented victims between 1996 and 2022. Curiously, Hela province ranks near the bottom in these same studies (Forsyth et al. 2017; Forsyth et al. 2024), which starkly contradicts interview findings that identify SARV as a major security concern there as well – suggesting substantial underreporting of incidents. Interview participants emphasise that this form of violence has become normalised in both provinces, occurring daily and often inflicting severe harm on the accused. As climate change intensifies, bringing more frequent and severe heavy rainfall, flooding, landslides and extreme droughts (see climate impacts section above), the environmental triggers for SARV accusations will multiply, further intensifying this critical security challenge.

Women are disproportionately targeted in the Highlands, with violence frequently involving brutal torture, killings, permanent displacement and significant trauma. This gender disparity is rooted in complex social dynamics. These include deeply entrenched misogyny and discrimination against women within highland communities, women's status as outsiders who enter communities through marriage and the fact that underlying tensions and narratives that fuel SARV accusations fundamentally differ between men and women (Forsyth et al. 2024).

This crisis is intensified by several critical governance challenges common across both provinces: widespread climate change illiteracy, ineffective law enforcement and severely limited access to legal and justice systems. Police presence is notably absent in remote areas, and even where available, officers frequently avoid involvement in SARV cases, leaving victims without essential protection (Forsyth et al. 2019). Compounding this institutional weakness, Hela's residents often possess superior weaponry to both PNG police and military forces, further explaining law enforcement's reluctance to intervene in SARV incidents (Cox et al. 2023).

Pathway 2: Disaster and conflict driving displacement

Displacement in Hela and SHP represents a complex and increasing challenge, with both conflict and disasters driving population movements. According to interview partners, conflict remains the primary driver of displacement, particularly election-related violence. While comprehensive province-specific displacement data is lacking, partial statistics support the significance of conflict-driven displacement. Since 2021, documented figures show that over 15,000 people across Hela, Enga and SHP have been internally displaced specifically due to election-related violence (IOM 2022a). At the same time, disasters have been and are increasingly driving displacement. For example, the earthquake that hit the Highlands in 2018 affected almost half a million people and displaced around 42,500 people (IOM 2018). More recently, in 2021, river and surface flooding in SHP alone forced more than 260 people from their homes (IDMC 2022).

There are several high-risk hotspots for disaster-driven displacement. Environmental hazards – including weather, climate, water and seismic events – present acute risks to subsistence agriculture and critical infrastructure that connect remote settlements to essential resources, markets and livelihood opportunities, particularly in isolated Local Level Governments (LLGs) such as Mt. Bosavi (Southern Highlands), Lake Kopiago (Hela) and densely populated Upper Wage (Hela) (UNDP 2023). This combination of hazard exposure and socio-economic sensitivity creates potential hotspots for disaster-induced displacement across the region. Hela province bears a greater population burden directly exposed to inland flooding and earthquake-triggered landslides, concentrated primarily in South Koroba LLG along the Tagari River, west of Tari (UNDP 2023). The epicentre of the devastating 2018 magnitude 7.5 earthquake, which struck just south in Hela's Komo LLG, underscores this vulnerability. High and very high seismic-induced landslide risks extend southeastwards through Lake Kutubu LLG (Southern Highlands), threatening vital oil and gas infrastructure. In Southern Highlands, nearly half of mountainous areas face high to very high precipitation-induced landslide risks, disproportionately endangering settlements in Nipa LLG and Lower Wage (Hela) to the north (UNDP 2023). Interview participants identified additional disaster displacement hotspots, including Kopiago in Hela, where escalating weather-induced disasters force population movements, and remote regions near the Western province border experiencing displacement due to drought and heavy rainfall-induced food insecurity. Displacement patterns across both provinces reveal an important distinction – conflict-driven displacement tends to be more permanent and often involves multiple relocations, while disaster-related displacement is typically temporary, though this transience creates its own unique set of challenges.

The displacement situation in both provinces is characterised by significant pressures on host communities and complex social dynamics that can escalate into violence and conflict. Displaced individuals and families typically move to communities where they have existing family and tribal ties. These provide initial support, although substantial pressure on host communities is created in terms of housing, land access for subsistence agriculture and social relationships. This has led to various forms of tension and conflict. In both provinces, IDPs face high levels of harassment, abuse and food insecurity (IOM 2017; Raicu et al. 2024). Woman and girls are particularly affected by these risks (IOM 2017).

Both in Hela and SHP, disasters and food insecurity create additional cascading security risks that affect entire communities. During these periods, there is typically an increase in petty crime as people struggle to cope with lack of food and income (UN-PNG 2023). In addition, women and girls face heightened risks, as they often have to travel longer distances to access water, food or other resources, exposing them to increased risks of abuse and SGBV. When such attacks occur, they can in turn spark

retaliatory actions from victims' families, transforming localised incidents into broader community clashes (IOM PNG 2022).

Resettlement is a critical long-term challenge across both provinces. Many disaster-displaced people ultimately return to rebuild their houses in known hazard-prone areas due to the absence of viable alternative land, while those facing more permanent displacement from conflict- or climate-related factors struggle to secure durable resettlement solutions. Conflict-displaced individuals frequently desire to return to their homes but remain unable to do so when their safety is compromised. Many live in fear of retaliation, particularly when conditions for meaningful peace processes are absent (Lakhani & Willman 2014). This situation becomes especially challenging when displaced persons face obligations to pay compensation, either personally or through family networks. The substantial financial burden of these compensation demands often prevents them from initiating necessary peace processes, leaving them trapped in prolonged uncertainty and facing secondary displacement to yet another location (Raicu et al. 2024). The prevalence of violent land conflicts, the complexity of land tenure, cultural attachments to ancestral lands and the scarcity of safe, habitable areas have created what many interview partners describe as an intractable issue when it comes to resettlement. This is particularly concerning as climate projections point towards increasing displacement risks in the years to come (see climate impacts section and Cazabat et al. 2022).

Pathway 3: Climate change impacts and conflict driving internal migration and security risks in urban areas

Internal migration in Hela and SHP is increasingly shaped by a complex interplay between climate change impacts, violent conflict and deteriorating rural livelihoods, creating demographic shifts with significant security implications. The predominant population movement in both provinces flows towards the main urban centres of Tari and Mendi, though those with greater financial resources often continue onwards to larger cities, particularly POM and Lae (Yamarak 2015; Cox et al. 2023). This urbanisation trend is driven by multiple converging factors: weather-induced disasters, longer-term climate change impacts on agricultural productivity, persistent intergroup violence and severely limited economic opportunities in rural areas. These powerful push factors propel people – especially youth – towards urban centres in search of new livelihood opportunities, improved access to essential services (notably education and healthcare) and escape from endemic violence (Cox et al. 2023).

As temperatures continue to rise and extreme weather events such as droughts and heavy rainfall **intensify** (see climate change impacts section above), **rural livelihoods face mounting pressures.** For instance, excess soil moisture already constrains the region's staple sweet potato yields, and projected precipitation increases will further inhibit crop growth while facilitating the spread of agricultural pests and diseases (Michael 2019). Rising temperatures are similarly enabling the spread of coffee leaf rust fungus, which has significantly reduced both smallholder and plantation coffee yields in lower highland altitudes, including important coffee-growing regions of eastern SHP (Bourke 2018; SPREP and CSIRO 2022b). The devastating crop losses caused by drought and high-altitude frost during the 2015-2016 El Niño event further exemplify the acute food insecurity triggered by interannual climate variability in the Highlands (Bourke 2018).

The urban consequences of this migration create significant challenges in both provinces. Extreme hazards such as landslides, floods and droughts pose significant risks within these urban destinations, particularly in informal settlements lacking basic infrastructure and services. For example, a precipitation-induced landslide in December 2021 spurred displacement in Mendi (IDMC 2025). Beyond direct disaster impacts, mounting pressure in urban areas manifests in growing land scarcity, surging criminality, eroding social cohesion and escalating violence. Young migrants bear the heaviest burden of these urban challenges, typically settling in precarious informal housing in hazard-prone areas with minimal access to essential services, employment opportunities and education (Ige 2024; Yamarak 2015). Interview participants consistently highlight that young men with incomplete education or unemployment are especially vulnerable, frequently turning to substance abuse, criminal activities and participation in election-related or intergroup violence. Young women confront their own distinct vulnerabilities

in this unstable urban environment, with some resorting to transactional sex as a survival strategy.

Traditional institutions are weakening while political actors increasingly exploit disaffected youth in power struggles. These challenges are exacerbated by a generational disconnect and a cultural displacement exemplified by the above-described changes in the Haus Man culture (see Pathway 4). Traditional spaces for mentoring young men have, in some cases, become unsupervised gathering places that amplify harmful behaviours. Interview partners and current research (Forsyth et al. 2024; Cox et al. 2023) also point to the increasing role that political and economic elites play in exploiting these marginalised male youth to gain and maintain political power (Forsyth et al. 2024; Cox et al. 2023). They often supply them with modern firearms, significantly increasing the deadliness of communal conflicts and electoral violence. This proliferation of firearms prevents the police from intervening in communal conflicts (Lakhani & Willman 2014).

Pathway 4: Conflicts and tensions around the extractives sector – mining, oil and gas

The extractive landscape in Hela and SHP have been shaped by decades of oil and gas development, creating a complex history of resource-related tensions and conflicts. Existing as a single administrative unit until 2012, both provinces share a contentious legacy, with the former unified SHP serving as the site of PNG's first oil project (Postcourier 2021; Zurenuoc & Herbert 2017). Following the provincial separation, interview participants indicate that extractive activities have ceased to function as a significant conflict driver in SHP, while Hela continues to navigate the complex security implications of ongoing resource development.

Hela province's creation was very closely linked to gas, specifically the $19 billion PNG Liquified Natural Gas (LNG) project (PNG LNG n.d.). The project's significance extends beyond its economic impact, having catalysed the establishment of Hela as a separate province. Local political leaders used the project to pursue greater autonomy and recognition and were successful. In 2012, Hela province separated from SHP to form its own province. The creation of the new province carried hopes for improved local governance, resource management and economic benefits. However, these aspirations have largely remained unfulfilled (Zurenuoc & Herbert 2017).

From its inception, the project has been entangled in complex conflict dynamics. Initial disputes centred around land ownership and compensation issues, leading to roadblocks, equipment destruction and frequent protests that sometimes halted operations. While early conflicts often involved violent confrontations between landowners over overlapping land claims, more recent tensions primarily concern benefit-sharing and royalty distribution (UN-PNG 2023). For example, in 2016, some of the Huli landowners shut down one of the project's main facilities to express their "immense frustration, disappointment and palpable anger at the absence of benefits" (Filer 2019).

The project remains a focal point for broader grievances, with communities expressing frustration over the perceived failure of the provincial government to distribute wealth beyond directly affected areas. The project's strategic importance to the government has inadvertently made it a target for communities seeking to voice grievances about broader governance issues, creating a complex web of conflicts that extends far beyond traditional resource-related disputes. This complex web crystallised in 2018, when Huli people regarded the earthquake, which closed down the PNG LNG operations for weeks, as a manifestation of the "resource curse" that has undermined the promise of development that was contained in the benefit-sharing agreements (Filer 2019).

Looking into the future, climate change poses significant risks for the mining sector in Hela and SHP, potentially increasing the risks of conflicts over environmental impacts. Cumulative increases in precipitation and greater seasonal intensity increase flood and landslide risk, especially during La Niña years in Hela and SHP. This particularly threatens land cleared for oil and gas well sites, access roads, transport pipelines and processing facilities without mitigation measures (SOPAC 2007). Floods and landslides also may increase the risk of groundwater or surface water contamination along the Upper Kikori River Watershed and PNG LNG transport network (SOPAC 2007; WRI 2023).

Coastal areas: Bougainville

Bougainville is one of PNG's most climate-vulnerable coastal regions, where rising sea levels, extreme weather and environmental degradation intersect with the enduring impacts of civil war. Atoll and coastal communities face acute risks of displacement, resource conflict and livelihood loss, as seen in the relocation of Carteret Islanders. Alongside these pressures, Bougainville continues to contend with communal violence, SARV, SGBV and deep divisions over mining and land. As the region moves towards possible independence, the combined challenges of climate change, disaster risk and unresolved conflict are reshaping security and development prospects.

Panguna mine, Bougainville: © adelphi research

CONTEXT

Bougainville represents a distinct coastal context within PNG, shaped by its unique post-conflict legacy and growing environmental challenges. The repercussions of the Bougainville civil war, which lasted nine years (1988-1998) and claimed more than 20,000 lives, continue to influence the region's social and political dynamics. The conflict was one of the deadliest in the Pacific Island states since the Second World War, and the product of the combination of colonial legacies, a desire for self-determination, disputes over land rights and resource distribution, and environmental damage, particularly concerning the Panguna mine (Regan 2017; Boege 2013; Dinnen et al. 2025). In 1989, these grievances resulted in the outbreak of several localised violent incidents and the closure of the Panguna copper mine. The intervention of the PNGDF escalated the violence into eight years of conflict (Conciliation Resources n.d.). Eventually, the Bougainville Peace Agreement (BPA) was signed in 2001 and the ABG was established in 2005.

Today, **the legacy of the prolonged war is still affecting the people of Bougainville** in various ways. Armed groups that didn't align with the BPA remain active in parts of the country, play significant roles in the governance structure and contribute to violence and the proliferation of arms and weapons (Blenkin et al. 2024; Bajon 2024). The conflict left the community with profound personal and collective trauma that continues to reverberate through society. Beyond violence from non-state armed groups, Bougainville experiences persistent communal violence, SGBV, SARV and deep divisions over mining prospects (Blenkin et al. 2024). The conflict has also fundamentally altered traditional social structures and governance systems. Particularly significant is the erosion of traditional authority, with clan and community leaders having lost considerable power during the conflict and subsequently struggling to reassert their influence in the post-conflict period.

Bougainville remains caught in a protracted transition to independence, creating political tensions despite overwhelming public support for sovereignty. In 2019, a referendum of independence was conducted and achieved a 97.7 per cent endorsement rate with only over 2 per cent voting to remain part of PNG with "greater autonomy" (Conciliation Resources n.d.). Following the referendum, the people of Bougainville started to have high expectations for the rapid transition to independence, which unfortunately did not materialise (Blenkin et al. 2024). In practical terms, the National Parliament House of PNG was designated as the final decision-making authority in Bougainville when it comes to ratification of the referendum, which makes coordination and cooperation between the ABG and the parliament an important cornerstone in the transition to independence. However, the slow progress in discussions between the ABG and the parliament on Bougainville's future political status has contributed to increased tensions within Bougainville (Blenkin et al. 2024). Currently, a consultation process between the ABG and PNG government has been ongoing since May 2021, and a new independent mediator, Sir Jerry Mateparae, a former New Zealand Governor General, was appointed in September 2024 to support the talks between the two governments (ABC 2024; Himata et al. 2023). The outcome of this process is still in development, with high hopes to bring closure before the 2025 Bougainville elections (PINA 2024).

CLIMATE CHANGE IMPACTS AND ENVIRONMENTAL CHALLENGES

Bougainville is facing a range of climate impacts including warmer nights, increased coastal flooding and marine degradation, as well as inter-annual drought risks. Projections indicate that, by mid-century, mean austral winter temperatures will rise by 1.09°C (ranging from 0.77°C to 1.53°C) both under high- and low-emission scenarios. Notably, the frequency of tropical nights when minimum temperatures exceed 23°C is expected to increase significantly: by a best estimate of 64 nights annually under the high-emission scenario, and by 47 nights under the low-emission scenario (see Figure 20). These warmer nights prolong exposure to heat, preventing restful sleep and imposing health risks on vulnerable demographic groups.

Bougainville's precipitation projections reveal a highly uncertain future marked by potential increases in rainfall and extreme weather events. Climate models show limited agreement regarding the island's future precipitation patterns, largely due to potential shifts in the SPCZ that influence Bougainville more significantly than mainland PNG. Under the high-emission scenario (SSP3-7.0), mid-century mean annual precipitation is projected to increase by +178 mm, but with substantial model disagreement ranging from -124 mm to +329 mm. Projections under SSP1-2.6 show slightly less change but similar uncertainty. Figure 20 reveals a long-term trend of increasing rainfall during the late northwest monsoon wet season beginning around mid-century, while patterns for other months remain highly uncertain. The intensity of extreme rainfall events is also expected to increase, with larger five-day precipitation amounts during the wet monsoon season, though model agreement is low. These heavier rainfall events threaten the production of economically vital cash crops such as cocoa (Michael 2019).

Bougainville's unique geographic position creates a distinctive climate response pattern that requires targeted adaptation strategies different from those appropriate for mainland PNG. Unlike the mainland, Bougainville experiences droughts during La Niña phases rather than El Niño phases, with moderate precipitation increases corresponding to positive IOD phases (Aitkenhead et al. 2023). With climate projections indicating more extreme positive

IOD phases and continued strong La Niña events, Bougainville likely faces persistent or increasing risks of extreme floods and droughts in the near and medium term (Cai et al. 2018; Lopez et al. 2022). Given these uncertainties, decision-makers should implement robust adaptation strategies that prepare for extreme flooding during positive IOD years and later months of the northwest monsoon season, while developing drought resilience measures for La Niña years. This distinctive climate profile requires Bougainville-specific approaches to climate adaptation that differ from mainland strategies.

Coastal areas and atolls face particularly severe challenges. Situated on the eastern edge of the Solomon Sea, Bougainville faces high coastal flood risk and similar rates of projected sea level rise and sea surface temperature increases as Lae (see third case study on urban areas: POM and Lae) (WRI 2023). Saltwater intrusion is increasingly compromising freshwater supplies and damaging crops such as coconut, while simultaneously reducing the extent of protective mangroves and coral reefs that support local fisheries. The consequences of rising seas are already visible through significant land loss in low-lying areas, with king tides now regularly inundating coastal communities and islands that were previously safe from such events. The marine ecosystem degradation presents an existential threat to fishing-dependent communities across Bougainville. Coral bleaching is decimating reef systems that serve as critical habitat for fish species central to local diets and economies. Local fishermen report having to venture significantly farther offshore to find viable fishing grounds, substantially increasing both safety risks and operational costs (Blenkin et al. 2024). The environmental pressures are particularly acute in the region's atolls, where communities face increasing extreme weather events, heightened food and water insecurity and accelerating land loss.

In addition to these climate-related risks, **Bougainville also faces geological hazards such as earthquakes, tsunamis and volcano eruptions.** In 1968, 17 post-Miocene strato volcanoes were identified in Bougainville, three of which were active or potentially active. These are Bagana – the most active one – Balbi and Loloru volcanoes (Blake 1968). Mount Bagana has been erupting continuously since February 2000, with the most recent eruption in 2023 (Global Volcanism Program 2023; Blenkin et al. 2024).

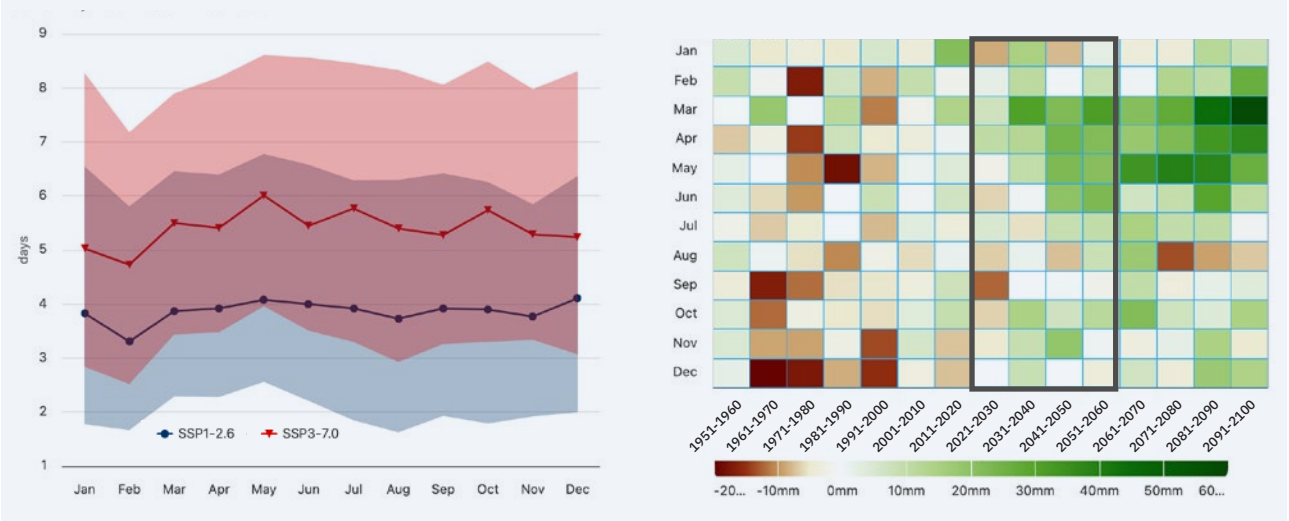

Figure 20: Left: Projected change in number of tropical nights (min. temp. >23°C) in Bougainville for 2040-2059 (Ref. Period 1950-2014) under SSP1-2.6 (Blue) and SSP3-7.0 (Red). [35] Note year-round increases, but greater increases during austral fall under SSP3-7.0. Shaded extents indicate 10th and 90th percentile values. Right: Historical and projected precipitation change (mm per decade) in Bougainville from 1951-2100 (Ref. Period 1995-2014) under SSP3-7.0. Near-term and medium-term periods outlined in a gray box. Note long-term trend of late northwest monsoon wet season becoming wetter, starting around mid-century, but other months remain more uncertain.

35 Both figures' data and visuals produced using:
World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.

The eruption of Mount Bagana led to ash flows destroying housing, contaminating drinking water and devastating gardens, food sources and forests in the impacted regions. Around 8,000 individuals were affected and required aid (Blenkin et al. 2024). The island also experiences high earthquake and tsunami hazards, with average annual losses reaching $6.5 million (GEM 2021).

CLIMATE AND ENVIRONMENTAL SECURITY PATHWAYS

Pathway 1: Climate and environmental impacts aggravating conflicts around natural resources

Natural resource conflicts in Bougainville are intensifying due to the convergence of climate

Key climate security pathways in coastal areas: Bougainville

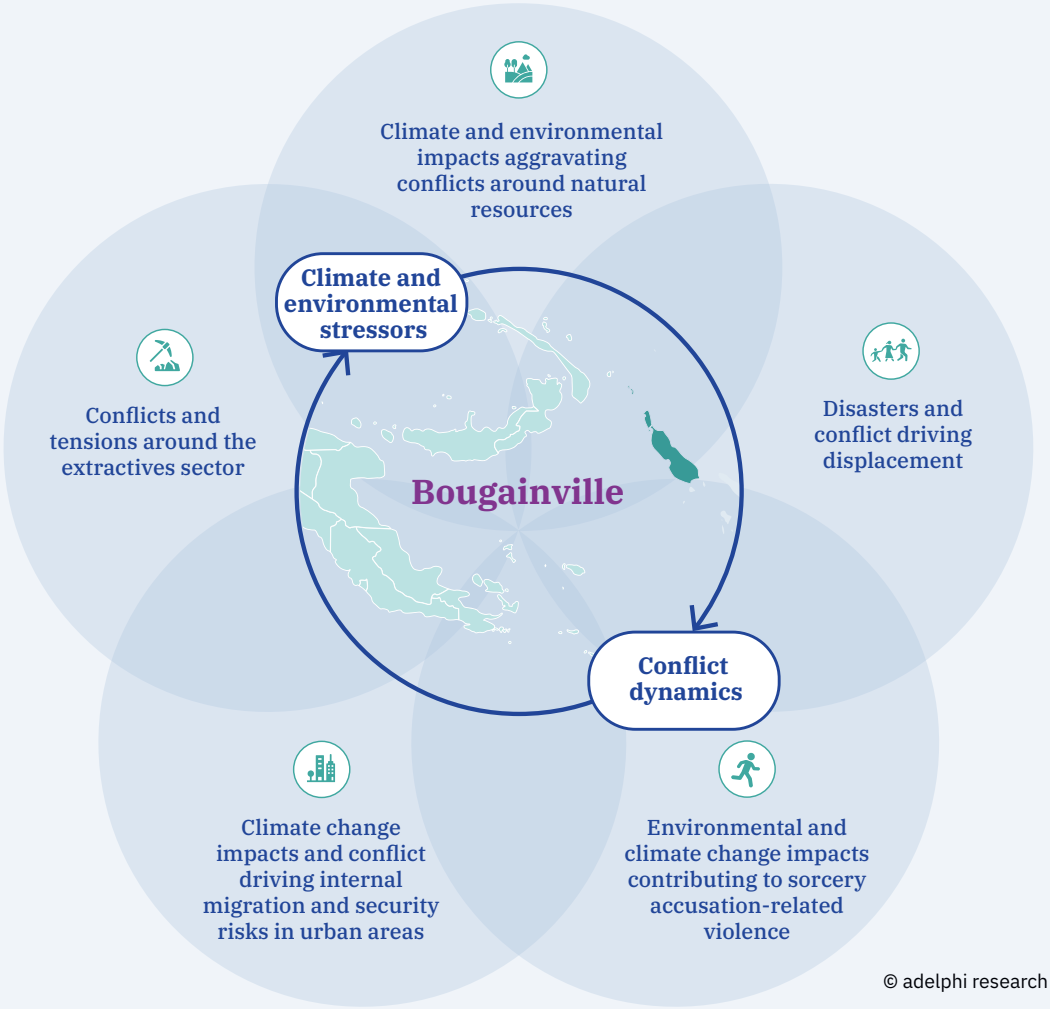

Figure 21: Key climate security pathways in coastal areas: Bougainville (elaborated by adelphi).

change impacts, economic development pressures and demographic shifts, creating a complex web of security challenges. These conflicts manifest differently across land, forest and fishery resources, generating interconnected challenges for communities and governance systems.

Climate and environmental change are exacerbating and driving new land conflicts in Bougainville (Blenkin et al. 2024; Hennings 2016). Rising sea levels and climate-related resource degradation, combined with population and economic pressures, are intensifying land shortages and land use conflicts across Bougainville. Interview partners report that traditional boundary markers such as stones and trees are being moved or erased by environmental impacts, leading to violent conflicts over territory. Livelihood insecurity further compounds the problem, as people move into new areas through purchase or squatting, often leading to unregulated land sales and heightened communal tensions (Yala 2006). For instance, interview partners in Buka described the process of unregulated selling and leasing of land as a significant challenge that can ignite communal tensions and clashes. Gender dynamics play a significant role, with interview partners sharing examples of men taking land from women or forcing them to sell, effectively diminishing women's traditional land rights. These land disputes can fuel intergroup conflict or trigger sorcery accusations. In the atolls, land conflicts represent a relatively new phenomenon, as less land scarcity in the past meant fewer tensions over land. However, increasing land scarcity is now leading to growing tensions, though these conflicts still tend to be less violent than in other areas of Bougainville.

In response to coastal land loss, **some communities have initiated adaptive measures that have created their own environmental and social challenges.** Private landowners have begun reclaiming land, often using coral rocks in the process. This practice has led to multiple problems. First, environmental impacts damage coral reefs, affecting both fisheries and natural wave protection. Second, conflicts over the collection of coral rocks from other locations and new disputes over land rights to the reclaimed areas emerge, as questions arise about ownership of newly created land that is normally claimed by the owner of adjacent land.

Bougainville's marine resources face mounting pressures from climate change, overfishing and governance disputes, threatening economic security and creating tensions. These fisheries represent both a critical livelihood source and a significant economic asset, with approximately 30 per cent of PNG's annual tuna catch in 2019 – valued at $333 million – harvested from Bougainville waters (Nomos 2022). This is creating tensions between PNG's government and the ABG to reach a revenue-sharing agreement, since PNG stands to lose at least one-third of its tuna fisheries revenue under such an agreement (Nomos 2022). Climate projections compound these tensions, with models predicting eastward migrations of tuna species under higher-emission scenarios, potentially reducing fish distributions around Bougainville by mid-century (SPC 2019). Beside tuna, fisheries resources more broadly are under increasing pressure from overfishing, climate change impacts and environmental degradation. For instance, overharvesting of bêche de mer (sea cucumber) resulted in a national moratorium from 2010-2017 with devastating economic impacts for local communities (Moesinger 2019a, Filer 2024). Reduced availability of fish and clams continue to prompt more intensive nearshore harvesting and increasingly dangerous and unpredictable conditions for open-ocean fishing, while stronger wind and currents continue to impose additional observed challenges for mariculture harvesting (Moesinger 2019b). As rising sea levels, ocean warming and acidification and other environmental changes are shifting the availability and distribution of fish stocks (Bell et al. 2013), disputes over access and usage rights increase. Interview partners report that these changes are forcing fishers to venture into new areas they previously didn't access, creating conflicts with other communities. The situation is further complicated by the cutting of mangroves, which has altered the proximity of fishing areas to land as well as unsustainable fishing practices (Blinken et al. 2024). Looking into the future, even under a low-emission and conservation scenario, the fish populations and marine life in the Solomon Sea may struggle to recover from their currently depleted levels (2010-2014 average) (Cheung et al. 2022). Coral bleaching events, ocean acidification and reef degradation will further exacerbate these challenges and may produce cascading effects across marine species and food security.

Forests are also under increasing pressure in Bougainville. Over the last several decades, unsustainable logging and agricultural conversion reduced forest cover especially on the southern side of the island. As a biodiversity hotspot, Bougainville comprises numerous unique ecosystems housing globally threatened species, including lower montane forest, floodplain forests, vegetation on karst landscape and volcanos (e.g. Mount Bagana), swamp forests and wetlands and coastal mangrove forests (CEPF 2012). Given future temperature increases and potential shifts in precipitation, suitable areas for habitation may shrink and face competition from invasive species (Adams et al. 2017). Interview partners also report that increasing temperatures and precipitation are affecting tree growth and traditional knowledge about forest management.

Forest resource extraction has become a flashpoint for violence. Climate change impacts combine with the cutting of trees for timber and to clear farming areas, driven by population growth and livelihood insecurity, in turn leading to smaller localised conflicts. In addition, in South Bougainville, violent conflicts have erupted around larger-scale logging operations and, according to some interview partners, logging companies' failure to properly consult with communities. These conflicts seem to be also linked to armed groups from the former conflict that are still active in this part of Bougainville. For example, in 2022, the Tonolei logging site in South Bougainville triggered fighting between two opposing breakaway armed factions of the Me'ekamui group.[36] The attack on the Tonolei logging site claimed the lives of three people and caused significant property destruction (ABG Gov 2022). This area had witnessed intensified land disputes that previously triggered violence, with armed factions having a strong influence among the population (AFP 2022).

Pathway 2: Disasters and conflict driving displacement

Displacement patterns are heavily influenced by the island's exposure to disaster risks and conflict-related displacement, with both factors contributing to a complex displacement landscape. As in other parts of the country, when disaster-related displacement occurs, people tend to return to their original locations, while conflict-driven displacement often results in more permanent relocation. While comprehensive numbers on displacement for Bougainville are missing, according to interview partners, conflict-induced displacement remains a pervasive issue, albeit on a much lower scale than during the civil war. For example, in 2019, nearly 500 individuals from the Konnou Constituency were displaced due to increased violence, necessitating their relocation to either host families or the Buin Skills Training Centre (DTM 2019).

At the same time, **Bougainville faces multiple disaster risks that regularly trigger displacement.** These include geological hazards like volcanic activity, earthquakes and weather-related hazards such as heavy rainfall leading to inland flooding and landslides (UNDP 2017). In July 2023, for example, the Mount Bagana volcano eruption displaced a total of 3,920 people (DTM 2023). Bougainville also grapples with both natural and human-caused bush fires, and has experienced extended periods of drought, with a recent drought lasting three months (NARI gov 2024). Coastal areas and atolls face additional pressures from king tides, sea level rise and progressive land loss. In 2021, king tides exacerbated by La Niña displaced roughly 53,000 in the Islands region, including Bougainville (McLennan and LaFortune 2021). These events exemplify future expected impacts exacerbated by sea level rise, storm surges and interannual tidal changes.

The management of disaster-related displacement faces significant challenges. Interview partners report substantial tensions around disaster response, particularly regarding aid distribution. One documented example is the Mount Bagana eruption, which brought with it conflicts associated with humanitarian responses that in turn triggered psychosocial distress and reawakened trauma among populations already affected by past violence (Blenkin et al. 2024). Women are disproportionately impacted, facing both security risks during and after disasters, such as harassment and gender-based violence, while simultaneously facing exclusion from

36 The Me'ekamui group was established by a former leader of the Bougainville Revolutionary Army (BRA) who did not sign the peace treaty and proceeded to establish his own self-proclaimed kingdom in the city of Tonu, South Bougainville (Wyeth 2021; PBF 2020; Regan 2017).

decision-making processes around displacement management and response, ultimately pushed to high-risk coping mechanisms (Blenkin et al. 2024). While there is some progress with a draft disaster management plan and committee for Bougainville, major gaps remain, including the absence of an early warning system and the government's limited disaster management capacities (IOM 2022c).

Pathway 3: Environmental and climate change impacts contributing to SARV

SARV is a prevalent and increasing challenge across Bougainville. As in other regions, environmental and climate impacts – in particular, weather, climate, geological and water-related disasters that may result in death – can trigger SARV. Slow-onset changes, such as shifting fishing conditions caused by migrating fish stocks, can also drive SARV by creating hardship for some communities while benefiting others (Blenkin et al. 2024). While atolls seem to be less affected than the mainland, interview partners underlined that SARV was not present in the atolls at all in the past, but is increasingly present now.

Multiple interconnected factors have accelerated SARV's spread across Bougainville in the post-conflict era. Data on SARV in Bougainville remains extremely limited, though newspaper-based estimates position it as 9th among 23 PNG provinces assessed for incident numbers, placing it just above the lesser affected provinces (Forsyth et al. 2024). Almost all interview partners were concerned about the increase of SARV cases in Bougainville and identified several factors that drive this increase. The erosion of traditional protective mechanisms is one of the most significant drivers, as authorities and clans that previously exercised control over SARV incidents diminished in influence in the post-conflict period. Several interview participants highlighted social media's growing role in spreading SARV beliefs and practices, with some Bougainville communities increasingly influenced by practices imported from PNG's Highlands region. The COVID-19 pandemic notably accelerated this trend, with a marked increase in SARV cases during 2020. Limited testing capacity and rapid virus transmission led many to attribute unexplained illnesses to sorcery rather than disease (Blenkin et al. 2024). Lastly, SARV is also sometimes used as a mechanism to settle other issues or old grievances, including some dating back to the conflict period (Dinnen et al. 2025).

Notably, Bougainville is showing different gender patterns in SARV compared to most other regions of PNG. Unlike most other parts of PNG, where women are predominantly targeted, SARV victims in Bougainville are mainly men – accounting for up to 96 per cent of victims between 2016 and 2018 (Forsyth et al. 2017). Physical violence has largely manifested in the form of property damage (69 per cent), threats (52 per cent), minor physical violence (46 per cent) and major physical violence (36 per cent). These forms violence often converge together and lead to killing, burning, torture and banishment (Forsyth et al. 2019).

Pathway 4: Climate change impacts and conflict driving internal migration and security risks in urban areas

Climate-induced migration is reshaping Bougainville's demographic landscape. Environmental pressures and climate change are amplifying internal migration movements within Bougainville from rural to urban areas such as Buka, Kokopau, Arawa and Buin (Blenkin et al. 2024). Interview partners report that these migration patterns show distinct geographical and causal variations. Movement from Central and Southern Bougainville to Buka is primarily driven by conflict and livelihood insecurity that is further aggravated by climate and environmental changes. Meanwhile, sea-level rise, coastal erosion and increasing extreme weather events are driving significant population movements from Bougainville's outer islands and atolls to the mainland. These environmental pressures are creating heightened food, land and water insecurity, making traditional livelihoods increasingly unsustainable. Combined with limited access to basic services, these changes are pushing communities to relocate (Blenkin et al. 2024). The scale of this climate-induced movement is significant – according to interview partners, approximately two-thirds of the atoll population (around 10,000 people) has already relocated to the mainland, while 5,000 remain in increasingly precarious conditions. However, despite the degradation of environmental conditions, significant numbers of this group are also returning.

Urban migration is generating complex security challenges in Bougainville's destination areas. Population movements are creating increasing pressures, particularly in Buka. The city faces multiple challenges, including land issues stemming from unregulated leasing and selling of land, as well as unregulated squatting. Interview partners report that this has already led to communal tensions and clashes. Migrants face significant livelihood insecurity as they struggle to adapt from a rural lifestyle to an urban environment where families must fend for themselves. There is increasing alcohol and drug abuse, particularly among younger people, with smaller incidents of violence – although not at the scale of other cities such as Mendi, Tari or POM (see Pathway 4). However, interview partners also see that the situation has some positive aspects, such as increasing tax revenues and business activity. As in other parts of the country, existing analysis (Blenkin et al. 2024) and interview partners also warn that these changes go hand in hand with a decrease in social cohesion and cultural cooperative norms and an increase in individualism.

The Carteret Islands relocation illustrates the complex challenges of climate-induced displacement and the difficulties of managed relocation. It is often cited as the first community having to relocate because of climate change, with individuals forced to leave their homes due to rising sea levels. The consequent relocation of people to Tinputz, North Bougainville, has created new challenges, including conflicts both within the relocated community and between displaced people and host communities (Blenkin et al. 2024) (see Pathway 3). Beyond this example, relocation needs in Bougainville are increasing and the government is attempting to relocate more families to donated land but faces two primary challenges: providing sustainable livelihoods and deescalating tensions with the host communities. Trying to assess how the need for relocation will develop in the future is hindered by difficulties to calculate land loss for small islands and atolls. Whereas recent research shows that trends are island-specific, on-the-ground assessments estimated that the Carteret Islands lost about 60-70 metres of land due to eroded shorelines and saltwater intrusion (Duvat 2019; Caritas 2015 cited in Kuir-Ayius 2024). International migration remains an option primarily for better-off individuals, with interview partners noting that programmes for agricultural work in Australia appear to mainly benefit those with good connections.

Pathway 5: Conflicts and tensions around the extractives sector

Bougainville's approach to mining development will be pivotal in determining whether natural resources become a foundation for independence or a source of renewed conflict. It is dominated by the history and potential future of the Panguna mine, which was a driver of the nine-year civil war (Regan 2017). Climate change exacerbates the mine's environmental impacts, which are still felt to this day, including mine-related flooding and sediment movement, elevated metal levels in the river system and mine chemicals and metals in soil from areas used for chemical storage and waste rocks and tailings (Tetra Tech Coffey 2024). Bougainville's future, particularly the transition to independence, is closely tied to plans to reopen the Panguna mine, with hopes that it will provide crucial revenues and economic development (Fildes 2023). However, this process also carries significant risks and potential for renewed conflict. While the government has already granted exploration licenses and signed land access compensation agreements with landowners, interview partners estimate it will take at least 15-20 years before operations could commence. The process faces complex challenges, including the need for extensive consultations, special attention to landowner interests and complex compensation arrangements. These processes need time, which does not align with the government and private companies' interests to have the development process start as early as before the 2025 elections (Fildes 2023). However, if the process is rushed or stakeholders feel inadequately consulted, conflict risks increase substantially.

Ensuring equitable benefit distribution from mining operations presents a critical governance challenge for Bougainville's future stability. A key challenge will be ensuring that the mine creates wider benefits for all of Bougainville rather than just the landowners who receive compensation and those directly benefiting from employment opportunities (Regan 2017). Revenues must be managed transparently and effectively to generate broader developmental impacts. Achieving this will be challenging and time-consuming, with corruption remaining

a major risk. Additionally, ensuring high environmental and social standards with strict oversight will be of paramount importance. This requires the government to develop appropriate capacities and institutions – a challenging task that, if unsuccessful, carries very high risks for conflict and political instability, particularly given the mine's conflict history.

A significant parallel development has been the growth of alluvial gold mining creating environmental and social challenges. According to interview partners, 30,000-40,000 individuals are engaged in alluvial mining, operating not only inside the Panguna mine site and its tailings but also in the surrounding mountains and other parts of Bougainville (Regan 2017). According to interview partners, local population groups started alluvial gold mining in the pit when the mine closed due to the conflict. Over the years the technologies employed became more sophisticated and the sector experienced massive growth, largely driven by the lack of alternative livelihoods. Artisanal mining also moved out of the mining pit into the tailings and then into surrounding areas and other parts of Bougainville. In many remote areas, poor road access makes gold the only viable economic income-generation option, as agricultural products like cacao and coconut cannot be transported to market. While alluvial mining has provided significant livelihood benefits for miners, it has also resulted in substantial environmental impacts, including large-scale deforestation, soil erosion and pollution from sediment, mercury and cyanide used in processing. These environmental impacts are amplified by climate change, particularly through increased heavy rain events that, combined with deforestation, lead to more landslides and soil erosion. The working conditions in alluvial mining are not safe, with regular accidents and exposure to hazardous substances (O'Faircheallaigh et al. 2017). In addition, interview partners report instances of child labour.

Government efforts to regulate the alluvial mining sector face significant capacity and resource constraints despite recognition of the urgent need for action. According to interview partners, the government is aware of these problems but is facing the enormous challenge of how to improve environmental and social standards and provide alternative livelihoods while lacking the capacity and financial resources to do so. Nevertheless, it has started the process of formalising and registering small-scale and alluvial miners (ABG 2024; O'Faircheallaigh et al. 2017). Interview partners warn that this effort is likely to face resistance as miners fear losing their livelihoods and assert their land ownership rights, creating potential for conflicts. The challenging accessibility of many mining areas adds another layer of complexity to any regulatory efforts (O'Faircheallaigh et al. 2017).

The mining sector in Bougainville stands at a critical crossroads, where decisions made today will significantly shape the region's path towards independence and sustainable development. The parallel challenges of managing both large-scale mining interests and the widespread alluvial mining sector require careful balancing of economic opportunities with environmental protection, social equity and conflict prevention. Success will depend largely on building robust governance frameworks and institutional capacity, while ensuring inclusive consultation processes that acknowledge historical grievances and protect local interests. These efforts become even more urgent in the context of climate change, which threatens to amplify existing environmental impacts and social tensions if not properly addressed.

CLIMATE AND ENVIRONMENTAL SECURITY CHALLENGES FOR INDEPENDENCE

Climate change and environmental pressures pose significant challenges to Bougainville's path towards independence, intersecting with and amplifying existing security challenges. These environmental pressures are aggravating several key security issues, including disasters, natural resource management, intergroup violence and SARV, while simultaneously creating new challenges around livelihood insecurity and urban development.

The economic dimension of these climate and environmental security challenges is particularly significant for independence aspirations. Climate change impacts are undermining efforts to develop a sustainable green and blue economy as they are negatively impacting sectors such as tourism and fisheries, which are crucial for an independent Bougainville. The resource extraction sector, particularly mining, presents both opportunities and risks in this context. The potential reopening of the Panguna

mine illustrates this complexity – while seen as a potential economic cornerstone for independence, it carries significant conflict risks and environmental challenges (Fildes 2023; Tetra Tech Coffey 2024). The growth of small-scale alluvial mining, while providing livelihoods for many, is creating environmental impacts that are exacerbated by climate change. A better regulation of the sector is crucial to decrease these risks, yet it will be challenging and likely highly conflictive.

This insight underscores how Bougainville's focus on post-conflict reconstruction and independence preparations must now be balanced with increasing attention to climate change adaptation and environmental protection. The success of Bougainville's independence may well depend on how effectively it can address these interlinked challenges of environmental change, economic development and social stability. This situation reflects a broader challenge captured by one interview partner's observation:

> "For years we focused on peace, but while we were doing that, we weren't seeing that something else is happening to us (referring to climate change)".

Urban areas: Port Moresby and Lae

POM and Lae, PNG's two main urban centres, are crucial hotspots where climate change impacts, migration patterns and security challenges intersect. Both cities face mounting pressures from rapid urbanisation, fragile governance and the enduring legacy of colonial planning. Climate impacts – rising temperatures, flood and drought risks – are compounding existing vulnerabilities, especially in informal settlements. These dynamics have led to weakened social cohesion, intensified competition over land and resources and heightened risks of crime and violence, particularly among marginalised youth. As POM and Lae continue to expand, the intersection of environmental stress, urban migration and unresolved land issues is reshaping their security and development prospects.

Port Moresby: © lloydphotography/ pixabay

CONTEXT

POM and Lae are the "heartbeat" of PNG's economy – containing the two largest and busiest ports in the country and contributing to almost 70 per cent of total trade volume by ports (Odhuno 2019). POM is the capital and largest city of PNG and a main commercial centre that attracts large-scale local and international business investments (Conn & McLay 2016). Lae is considered the manufacturing hub of PNG and is the most important getaway to the Highlands through its air- and seaport (Post Courrier 2023).

Drivers of insecurity in POM and Lae are complex and multidimensional, stemming from colonial legacies and associated challenges of state consolidation, as well as the disproportionate effects of global economic shifts (Dinnen 2017). The main security risks in POM and Lae today are urban crime, political instability, violence, drug smuggling, gun culture and SGBV (Laki 2022; Dinnen 2017).

The scale of urban violence and crime in these cities reflects deep-rooted systemic challenges that have persisted for decades. Both cities are recognised among the most dangerous globally (Dinnen 2017). In 2023, POM ranked the 4th place worldwide in the World Crime Index out of 416 cities, and the homicide rate was reported at 33 per 100,000 people between 2010 and 2013, which ranks it among the top 50 cities in the world. In POM, violent crime has long been attributed to gang activities involving unemployed young men from the city's expanding settlements. During the 1980s and 1990s, cyclical patterns of localised crime waves started to emerge, followed by overly forceful police operations, ultimately resulting in more violence and confrontations (Dinnen 2017). This pattern persists today; for instance, in 2016, armed men attacked and killed a student in the dormitories of the University of Technology in Lae before setting four buildings ablaze, leading to class suspensions and academic year disruption (RNZ 2016).

POM and Lae are also centres of political instability. For example, during the last elections in 2022, election counting centres were attacked by supporters of opposing candidates and people armed with machetes and iron bars fought in the close vicinity of the National Parliament House and the Supreme Court. This highlights the underlying grievances associated with elections in POM (USIP 2022). The scale of instability in POM and Lae was further evidenced in January 2024, when an outbreak of violence followed a police strike and resulted in 15 deaths in POM and five in Lae amid widespread looting and rioting (SBS 2024; ACLED 2024).

SGBV also remains widespread in POM and Lae, with one study documenting more than 2,000 SGBV cases in POM and the Central Province between December 2017 and October 2018, yet resulting in only 195 arrests and 11 convictions (Australian Government DFAT 2022). The unreported numbers are likely to be much higher.

CLIMATE CHANGE IMPACTS AND ENVIRONMENTAL CHALLENGES

POM and Lae face increasing climate-related risks, including warmer days and nights, inland and coastal flooding, as well as elevated interannual drought risks associated with El Niño phases.

Urban centres face escalating heat stress that threatens public health and livability. By mid-century, temperatures in Morobe province (where Lae is located) are expected to rise by 1.17°C (0.82°C and 1.69°C possible) under high-emission scenarios and 0.86°C (0.52°C and 1.32°C possible) under low-emission scenarios. POM will experience nearly equivalent mean temperature increases for the same time. Lae will experience the country's largest increase in hot summer days above 25°C – adding 43 days (25 days and 70 days possible) under low-emission scenarios and 56 days (39 days and 93 days possible) under high-emission scenarios each year. Nights will offer little relief, with 42 additional tropical nights above 20°C annually (28 nights and 70 nights possible) by mid-century. POM also faces more intense conditions, with projections showing an increase of 79 days (36 days and 148 days possible) additional hot days above 30°C each year by mid-century under low-emission scenarios to 108 days (58 days and 202 days possible) under high-emission scenarios (see Figure 22).

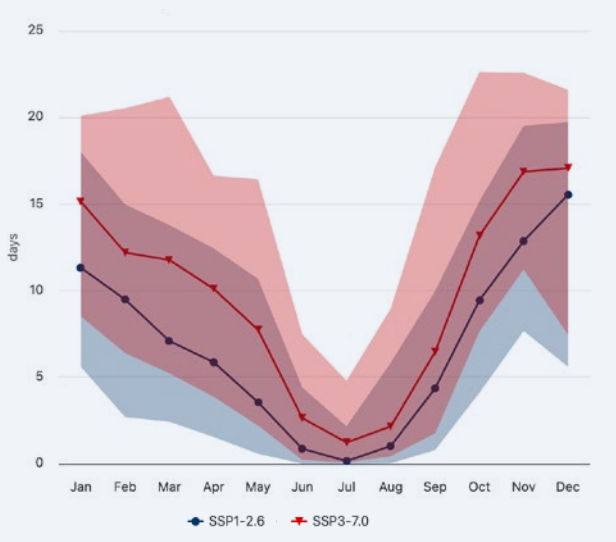

Figure 22: Projected change in number of hot days (max. temp. >30°C) for 2040-2059 (ref. period 1950-2014) in POM (NCD) under SSP1-2.6 (blue) and SSP3-7.0 (Red).[37] Note dramatic increases – largest under SSP3-7.0 – throughout the year except for austral winter. Shaded extents indicate 10th and 90th percentile values.

37 Data and visual produced using:
World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.

The capital will also experience 62 nights (42 nights and 81 nights possible) to 75 nights (61 nights and 94 nights possible) more warm nights above 23°C annually. These heat conditions pose serious health risks, particularly for the elderly, pregnant women, children, outdoor workers and people with existing health conditions who are most vulnerable to rising temperatures.

Morobe province has experienced PNG's largest rainfall increases and faces uncertain future precipitation patterns. Compared to all other provinces, Morobe has already experienced the largest observed precipitation increase (1971-2020) of +346 mm per decade, with the greatest seasonal increase at the end of the dry season (September-November). While Morobe's projected annual mid-century precipitation continues to increase under high emission scenarios by +174 mm, there is considerable uncertainty in the amount of change with some models projecting a slight decrease (-80 mm and +415 mm possible). Under low emission scenarios, projections show potential decreases from the historical baseline, ranging from -114 mm to +321 mm possible. The left-hand panel of Figure 23 illustrates historical (1951-2020) and projected (2021-2100) precipitation changes (mm per decade) in Morobe province under SSP3-7.0. It highlights a long-term trend of wetter northwest monsoon wet seasons and drier southeast monsoon dry seasons by mid-century. In spite of these uncertainties, decision-makers in Lae should prepare for wetter annual precipitation totals, more intense wet seasons (especially during La Niña years) and periodically drier dry seasons (especially during El Niño years).

Compared to Morobe, POM will see smaller overall changes in rainfall each decade, but these changes are still significant given the city's normally drier climate. POM's projections reflect similar uncertainty with respect to future ENSO variability but greater potential change relative to its historical baseline: annual mid-century precipitation increases under high emission scenarios by +62 mm, amounting to 1,670 mm total (-60 mm and +125 mm possible) and with even less model agreement under low emission scenarios by +33 mm or 1,641 mm total (-89 mm and +96 mm possible) (see Figure 23). Average largest five-day precipitation intensity increases under both scenarios by mid-century in each city during the wet season, exacerbating flood risks.[38] The right-hand panel of Figure 23 shows historical (1951-2020) and projected (2021-2100) precipitation changes (mm per decade) in the NCD under SSP3-7.0. It shows a long-term trend of wetter wet seasons, though how much drier the dry seasons will become is less certain. Decision-makers in POM should therefore prepare for more intense northwest monsoon wet seasons, especially during La Niña years, and drier, less predictable southeast monsoon seasons, especially during El Niño years (discussed below).

Both cities face significant flood risks from rivers and coastal areas that threaten urban infrastructure and settlements. Despite models showing greater agreement that rainfall will intensify later in the wet season, natural variability and uncertainty in climate projections mean there is still a wide range of possible changes in the near- and medium-term. The Markham River, which flows through Lae district before reaching the Huon Gulf, presents high riverine flood risk, while the relatively short Busu River flowing along the eastern portion of the district presents extremely high flood risk (WRI 2023). While Lae faces lower coastal flood risk due to its relatively protected location in the Huon Gulf, POM faces medium-high coastal flood risk in addition to high inland flood risk, both of which threaten informal settlements (described in subsections below). The average 100-year flood depths for the Markham and Busu Rivers in Lae are not expected to change significantly under a "middle-of-the-road" SSP2-4.5 emission scenario by mid-century (WRI 2023). However, seasonal flooding already occurs and will continue to occur in the near- and medium-term along agricultural land upstream from Lae, and large concentrations of infrastructure and buildings are located in flood-prone urban areas along these rivers (Antea Group 2017).

38 For example, intensity for such events in Morobe by mid-century increases annually by +27 mm (-39 mm and +91 mm possible) under SSP3-7.0 and slightly lower under SSP1-2.6. By mid-century under SSP3-7.0, average largest five-day precipitation increases by a large relative proportion in POM during March-May by +19 mm (-29 mm and +65 mm possible), with a similar shift under SSP1-2.6.

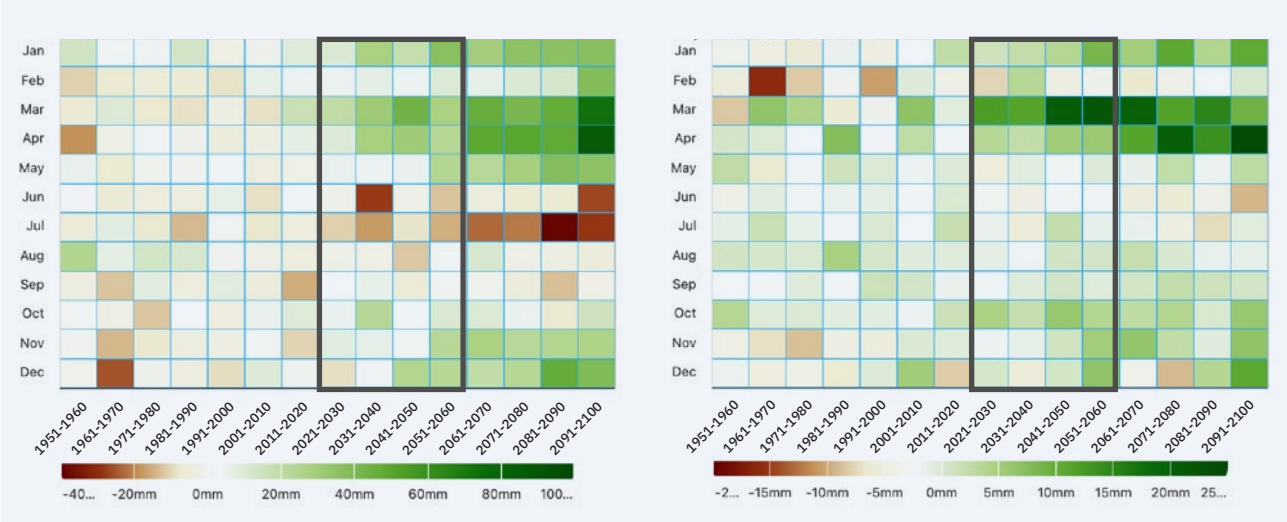

Figure 23: Left: Historical and projected precipitation change (mm per decade) in Morobe province from 1951-2100 (ref. period 1995-2014) under SSP3-7.0. [39] Near-term and medium-term periods outlined in gray boxes. Note long-term trend of wetter northwest monsoon wet season and drier southeast monsoon dry season by mid-century. Right: Historical and projected precipitation change (mm per decade) in NCD from 1951-2100 (ref. period 1995-2014) under SSP3-7.0. Note long-term trend of late northwest monsoon season becoming wetter, but extent and magnitude of southeast monsoon season becoming drier is not as clear. NCD features a smaller change per decade compared to Morobe.

POM and Lae face similar rates of projected sea level rise, a best estimate of approximately 20 cm by mid-century under both scenarios and 66 cm by the end of the century under SSP3-7.0.[40] Important locations vulnerable to king tides and storm surge along NCD's 209-km coast include Koki Market, villages on customary land, Lancron Naval Base, and Harbour City (UN Habitat 2013).[41] As opposed to Lae,[42] POM experiences indirect effects (storm surge, wind gusts, heavy precipitation) associated with an average of less than one tropical cyclone per season, mostly during the wet seasons of neutral ENSO years (PCCSP 2011). Scientists expect more intense tropical cyclones, rather than higher storm frequency, in the medium-term (CSIRO and SPREP 2021; ADB 2022). Based on available tidal gauges and satellite observations (CSIRO and SPREP 2022a), extreme high-water events that typically occur once every ten years can cause sea levels to rise up to 1.49 metres above normal (or 1.81 metres when combined with large waves) at POM. POM's relatively high extreme sea level projections compared to other locations result from large tidal variations, as well as the influence of swells during cyclone season in the Coral Sea. Local factors such as coral reefs play an important role in dampening wave action felt onshore and must be considered when anticipating potential impacts.

Both cities face serious drought risks that threaten water and energy security, with POM being particularly vulnerable. At the same time, El Niño phases correspond with droughts and delays in monsoon onset in both POM and Lae. Based on factors such as staple crop tolerance, population percentage employed in agriculture and indicators of child nutrition, drought vulnerability ranks severe in POM and moderate in Morobe (Aitkenhead et al. 2023). POM's monsoonal climate with a relatively short wet season and distinct dry season exhibits greater susceptibility to interannual drought,[43] with rainfall totals varying by three times between the wettest and driest years (UN Habitat 2013). During the dry season, both cities experience medium-high

39 Data and visuals for both figures produced using:
World Bank (2025). Climate Change Knowledge Portal. From: https://climateknowledgeportal.worldbank.org/.
40 Projected sea level rise for coordinates -10°S, 147°E under SSP3-7.0 ranges from 13 cm to 28 cm (17th percentile, 83rd percentile) by 2050 and 46 cm to 94 cm (17th percentile, 83rd percentile) by 2100. Under the lower-emission SSP1-2.6 scenario, sea level rise increases by a best estimate of 40 cm by the end of the century, ranging from 23 cm to 63 cm (17th percentile, 83rd percentile) by 2100.
41 While a seawall protects much of POM's coastal urban development, it requires updates and repairs.
42 While tropical cyclones do not significantly impact Lae, average annual losses in Morobe province due to high seismic risk and dense urban assets in Lae amount to $12.4 million (GEM 2021). POM, by comparison, only maintains moderate seismic risk.
43 However, other parts of Papua New Guinea's Southern Region possess more severe levels of drought exposure than POM.

interannual water variability, expected to continue over the medium term and pose economic, health and food security risks (WRI 2023). During the 2015 El Niño, for example, energy demand exceeded available water at major hydropower facilities – the Sirinumu Dam in Central province, which supplies POM, and the Yonki Dam in Eastern Highlands province, which supplies the Highlands and Lae (Kuleshov et al. 2019).

CLIMATE AND ENVIRONMENTAL SECURITY PATHWAYS

Pathway 1: Climate change impacts and conflict driving internal migration and security risks in urban areas

Both cities are primary destinations for internal migration from other districts, driven by a combination of conflict and livelihood insecurity that is increasingly exacerbated by climate change impacts. As described in Pathway 4 above, the urban population of PNG is significantly increasing (Bourke & Allen 2021; IOM 2015; UN-PNG 2023). While population numbers are disputed and potentially under enumerated, the 2021 official census estimates the

Key climate security pathways in urban areas: Port Moresby and Lae

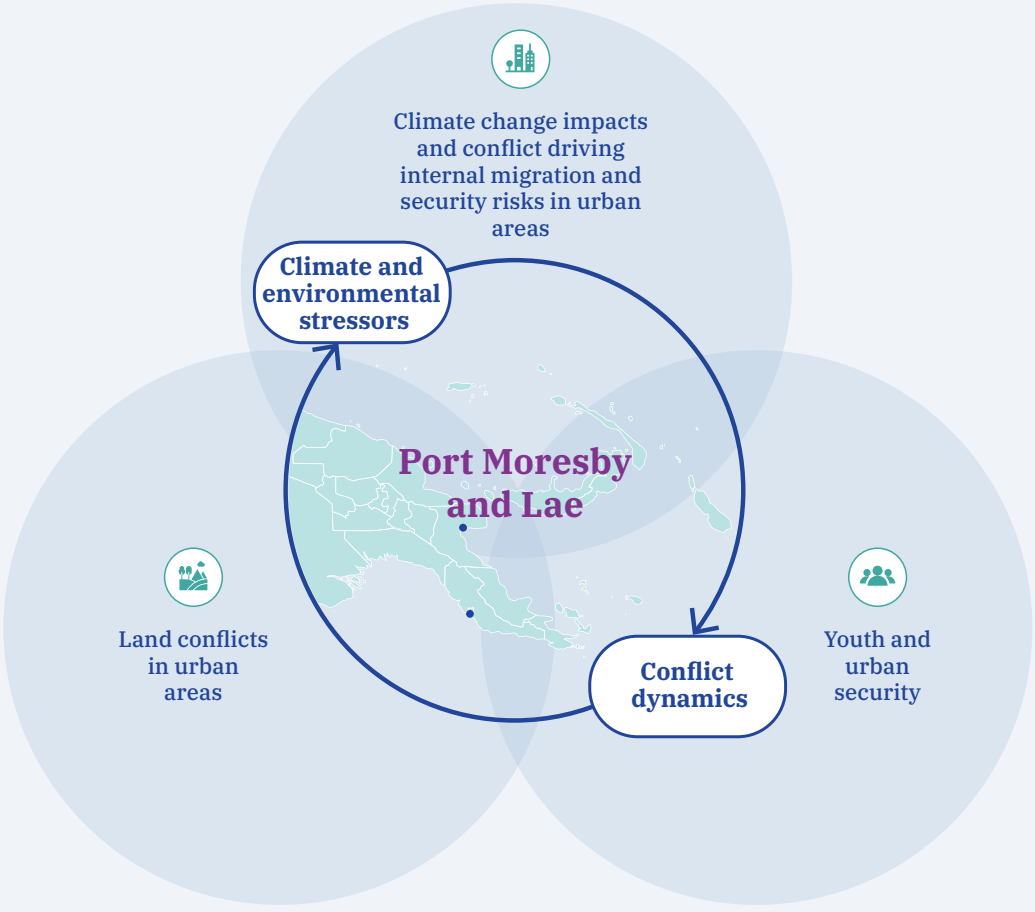

Figure 24: Key climate security pathways in urban areas: Port Moresby and Lae (elaborated by adelphi).

population of NCD at 513,918 inhabitants, and Lae at 224,983 (NSO 2021). This is a 42 per cent increase from the reported 2011 numbers, which indicated that NCD had only 361,222 inhabitants. There were no specific numbers for Lae district in the 2011 census (NSO 2011). In 2022, a study looking at migration to POM and Lae found that most migrants are moving because of better livelihood options, more safety and less violence, better education for their children and other reasons, including access to the better basic services (Kavan & Kopel 2022; Kavan 2022).

Upon arriving in POM and Lae, migrants face significant challenges. They often settle in informal housing or marginal areas where access to basic services such as water and electricity is limited, as is access to jobs and educational opportunities (UN-PNG 2023; Cox et al. 2023). These informal settlements are usually peri-urban,[44] lack basic infrastructure and are also often situated in hazard-prone areas due to poor spatial planning enforcement (Mitchell et al. 2016; World Bank 2021; Ezebilo & Savadogo 2021; Cox et al. 2023). For example, in the case of POM, these settlements tend to develop on the least desired land and hazard-prone areas such as mud flats, steep slopes, flood hazard areas or poor-quality land subject to drought (Mitchell et al. 2016, UN Habitat 2013). This includes informal settlements along the Laloki River near POM, which frequently experience flooding (SPC 2012). In addition, a new growing issue known as "coastal squeeze" is posing risks to urban areas, specifically in POM. This often happens when excessive development occurs in coastal areas, thus making them overcrowded as well as vulnerable to flooding and storm damage (World Bank 2021; Oppenheimer et al. 2019). A risk and vulnerability assessment for POM estimates that up to 15 cm of sea level rise by 2030 in POM would affect land use development within 100 metres of the coast (Kiele et al. 2022).

Residents of informal settlements face significant climate risks: In POM, almost 50 per cent of residences are in informal settlements, which renders them highly vulnerable to climate shocks and disaster risk including floods, cyclones, heatwaves and droughts (World Bank 2021). In addition to increased exposure, the inhabitants of these peri-urban informal settlements often also have low levels of adaptive capacity and are vulnerable to evictions or losing their access to land and livelihoods after a disaster (Mitchell et al. 2016). This is particularly worrisome, given the increasing climate risks mentioned above – in particular, the increase of hot days and nights, precipitation increases and both inland and coastal flooding.

The expansion of informal settlement has also led to depletion of sensitive natural ecosystems and increasing coastal erosion. For instance, the increase in seasonal gardening on the hillsides, which has become a common practice in some parts of POM, results in the destruction of vegetation, severe soil erosion and water run-off during periods of heavy rainfall (UNHABITAT 2010). At the same time, ecosystems that are important for coastal protection have been degrading. Existing mangrove forests help buffer coastal areas from flood impacts, but erosion, saltwater intrusion and encroachment of garden plots continue to reduce their coverage, further threatening local fisheries and increasing flood risks (UN Habitat 2013). Coral bleaching events, ocean acidification and degradation of barrier reefs exacerbate these risks, especially in Bootless Bay (Adams et al. 2017).[45]

Beyond climate and disaster risks, migrants are also confronted with significant security risks, including intergroup violence. Many leave rural areas to escape such conflicts, yet these tensions frequently resurface in cities. Evidence from interview partners reveal that disputes originating in regions like the Highlands often spill over into urban environments, resulting in further clashes and cycles of retribution. This pattern of "pay-back" violence, which begins in rural communities, can easily re-emerge in urban contexts (Lakhani & Willman 2014) (see Pathway 3).

Crime is another major security challenge in the informal settlements of POM and Lae. Criminal activities have markedly been on the rise in POM and Lae, although criminal incidents are rarely reported.

44 Peri-urban settlements are usually developed in a scattered and dispersive manner and combine rural and urban characteristics.
45 Projected sea surface temperature increases by a best estimate of 0.74°C in Coral Sea (NCD) in the medium-term under SSP1-2.6 and 1.11°C over the same time period under SSP3-7.0, with roughly the same change in the Huon Gulf (Morobe) (EU 2025).

Even when they are reported, they sometimes get withdrawn or settled through informal resolution mechanisms. In a study conducted in 2023, almost 87 per cent of respondents reported that the level of crime in POM has increased in the last three years, while only 32 per cent reported crimes to the police (Assa et al. 2023). Main crimes include robbery, stealing, murder and prostitution (Melpa & Odhuno 2022).

As in the rest of the country, **IPV and SGBV are also security challenges in POM** (Laki 2022; Kakarere 2024). SGBV strives with the increase in poverty, as people are struggling to survive in a city where there is no subsistence farming and limited sources of income. In Lae, some women reported being violently and verbally abused by their sons when food or money was short. This also led to other harmful activities such as selling drugs, illegal distillation of alcohol and other unlawful activities (Laki 2022).

As mentioned above, **urbanisation is also driving significant social changes in PNG's communities, which are further amplifying risks.** The movement of people to the city from rural areas leads to the development of a new peri-urban class on the fringes of big cities. This leads to decreased social cohesion and weakened cooperative norms within communities, as the immediate family unit becomes more important than the broader community. While this change is occurring in rural areas as well, it is happening at an accelerated pace and to a greater extent in cities such as POM and Lae (see Pathway 4).

Pathway 2: Youth and urban security

Young people represent a particularly vulnerable group in the urban context both as victims and perpetrators of crime. In a 2017 study in POM, 57 per cent of participating youth reported being a victim of crime and 46 per cent reported having been involved in a criminal activity at least once in their lives (Ivaschenko et al. 2017). Those who have less economic security, and particularly those who didn't complete their education, cannot find employment after graduation or are without land are especially at risk (Melpa & Odhuno 2022; Lakhani & Willman 2014). As mentioned above, interview findings reveal a concerning pattern of social disengagement among young men who find themselves caught between traditional cultural values and modern societal expectations. This demographic appears particularly vulnerable as they struggle to find their place in a rapidly changing society and the new urban context, often feeling economically and socially marginalised and excluded.

Research in POM's Morata settlement reveals how unemployment, corruption and government neglect drive youth towards gang involvement and criminal activity. A study of urban crime in the Morata informal settlement – one of the biggest and most crime-affected informal settlements in POM – confirms these patterns. It shows how youth are forced to join gangs and are involved in robbery, stealing, bag-snatching, murder and other criminal activities. It also points to unemployment and lack of economic opportunities, on top of ignored needs by the government as key drivers of criminal activity and vulnerability (Melpa & Odhuno 2022; Lakhani & Willman 2014). The interviewees of the study believed that they deserve equal opportunities and to be part of the country's development, but that they were denied such opportunities due to nepotism and corruption (Melpa & Odhuno 2022). This points to another aggravating factor, namely governance challenges increase the vulnerability of youth (Open Government Partnership 2022). For example in Lae, a significant issue is the lack of funding for essential programmes within the provincial administration such as the Youth Development Council, which is largely neglected by both national and provincial governments, despite an acknowledged awareness of the issues and vulnerabilities linked to the youth population surge throughout the Morobe district (Asera et al 2024; Cox et al 2024).

Urban youth are also particularly vulnerable to the impacts of climate change as they lack necessary skills and resilience factors to cope with climate shocks. Almost 60 per cent of youth are either unemployed or employed in the informal sector, with less than 7 per cent employed in formal waged jobs (Timothy 2021). Despite that, young people have been shown to be key in addressing climate change. They are sometimes among the first to observe the devastating effects of climate change on their immediate environment, such as the washing away of coastlines and the unpredictability of weather patterns, and take action to address them. For example, in 2023, youth in Sumkar district

partnered with members of parliament to establish a District Youth Development Council (DYDC) focused on climate governance and youth development (Wohwiehembe n.d.). However, even when young people come up with practical solutions for the climate crisis, their perspectives often fail to reach national-level policy discussions (UNDP 2021).

Pathway 3: Land conflicts in urban areas

POM and Lae face complex land-related security challenges rooted in their colonial histories and exacerbated by rapid urbanisation. As urban populations continue to grow, the competition for land intensifies, leading to a range of issues from informal settlements to land grabbing.

Land-related security challenges in POM and Lae are rooted in their colonial history. In POM, British colonial administrators before 1949 were considering urban in-migration as a temporary problem that didn't need addressing or proper planning at the time. Australian civil servants were given free housing and other benefits to incentivise them to come and work in PNG, while indigenous people were considered temporary visitors who would eventually return to their land (Kopel & Wenogo 2023). Thus, urbanisation and urban planning were absent from early development policies, leading to the sprawling of informal settlements on the outskirts of the city. Massive population growth until now further aggravated these issues (Laki 2022). In contrast, Lae was part of the German Kaiser-Wilhelmsland territory. In the late 19th century, Christian missionaries and the Deutsche Neuguinea-Kompagnie arrived, acquiring much of the land in Lae in 1900 – a move with lasting impacts not only on the socio-political dynamics within and around the city but also on land disputes between communities. The 1920s gold discovery in Morobe made Lae attractive for investors and business partners (Cox et al. 2023). This, in addition to the rapid urban growth of the city, increased the pressure on land for housing as well as for infrastructure, commercial and industrial development.

Increasing demographic pressures and lack of urban planning provided fertile ground for land conflicts in urban and peri-urban areas. One key challenge is the unregulated selling and leasing of land to developers. Usually, these land sales are done informally and without following due procedures (Laki 2022; Kopel & Wenogo 2023). When landowners engage in these informal land sales, they often create disputes within families and clans over land rights. For example, in the Motu Koita area in POM, specific problems of land sales without consultation with family members resulted in disputes that ended up in the village courts for resolution. The demand for land and the need for cash are key driving factors in the increase of conflicts (Laki 2022).

Land grabbing is another key challenge in urban areas such as POM and Lae. While comprehensive studies of land grabbing in POM and Lae are missing, newspaper articles and interview partners point to a number of problems, including illegal squatting of migrants on state land and businesses and developers grabbing land when traditional landowners and developers fail to reach a formal or informal agreement (EMTV 2015; Post Courrier 2018; RPNGC 2024; Post Courrier 2023). This is also linked to a number of governance problems, including the misuse of existing legal instruments such as the illegal alienation of land under the "lease-leaseback scheme"[46] from traditional landowners to private businesses (see box Land Reform Attempts: A History of Challenges and Conflicts) and the challenges that come with customary land ownership – for example, when landowners lack the formal requirements to prove their ownership of the land (Jones 2012; McDonnel 2017).

Widespread illegal squatting is connected to land grabbing, leading to several security-relevant challenges. First, illegal squatters are vulnerable to evictions or losing their access to land and livelihoods, in particular after a disaster (Mitchell et al. 2016). For example, in POM, the government has increased mass evictions without resettlement plans, leading to huge social and economic impacts as tenants lose their housing, workers lose jobs based on informal income-generation activities in settlements and children cannot attend school (Kopel & Wenogo 2023). Second, some experts and interview partners also warn that squatting is becoming an increasing security challenge in urban areas because it entrenches ethnic tensions

46 The lease-leaseback scheme was halted in 2011 due to the widespread abuses associated with its implementation and lack of informed consent from the customary landowners. It was discontinued later in the year when the Commission of Inquiry found that many of the leases were granted without following due process (Filer 2017). More details on the lease-leaseback scheme can be found under Pathway 2.

that can lead to violence (Yala 2006). This happens when illegal squatters reside on customary land and organise themselves based on their cultural identity, thus converging land disputes with deep-seated historical tensions and increasing the likelihood of violent conflict (Yala 2006; Kopel & Wenogo 2023). Violent incidents include the destruction of property, harm to women and children and killings (Laki 2022). This is also linked to wider negative stereotypes of settlers as solely responsible for the city's problems through forceful and illegal taking of land, propagation of intergroup violence and undermining law and order. These perceptions have shifted public opinion against migrants and facilitated violent police raids and evictions while violating migrants' human rights in the process (Kopel & Wenogo 2023).

In addition to these conflicts, **unregulated growth together with massive infrastructure and commercial developments have created environmental challenges.** In POM, for example, the unregulated development infrastructure in Taurama has damaged environmental preservation areas and depleted much of the coastal area, including mangroves, reefs and the marine environment. Inadequate waste management systems have led to increased land-based pollution that further stress these ecosystems. As for Lae, waste management challenges, including the unregulated burning of waste, are also posing significant risks to the environment. Developments and settlements are also increasingly occurring in areas that are prone to shoreline erosion (Leger et al. 2017).

Recommendations and Entry points

The government of PNG has exerted significant efforts in recognising environmental sustainability and climate change as key pillars of the PNG Vision 2050 development framework. In order to achieve this vision, PNG must address a complex set of climate-related security issues that threaten its development, stability and the well-being of its people. This section outlines key recommendations aimed at enhancing PNG's resilience to climate-related security risks, promoting sustainable development and fostering peace and stability. They are relevant for all actors in PNG working on issues related to development, climate change, environment, conflict and peace including **the government, international organisations, multilateral and bilateral donors and civil society**. Each recommendation is further elaborated with a context and geography-specific example. The examples are not comprehensive but are meant to concretise the points made. The recommendations are based on a comprehensive assessment of the country's unique geographical, environmental and socio-economic context, and they are designed to address the interconnected challenges identified in the six climate security pathways. By implementing these strategies, actors can work towards a more secure, resilient and sustainable future for all of PNG's citizens.

LEGEND

■ The government	● International organisations	▲ Multilateral and bilateral donors	○ Civil society

1. ADDRESSING CLIMATE- AND ENVIRONMENT-RELATED SECURITY RISKS THROUGH INTEGRATED APPROACHES

To effectively address the interconnected challenges outlined in the six climate and environmental security pathways, it is crucial to combine peacebuilding with climate change adaptation and sustainable development. These integrated approaches will not only enhance community resilience to both conflict and climate change but also contribute to sustainable livelihoods and overall development.

- **Develop and implement integrated peacebuilding, development and adaptation plans at the community level, ensuring they serve as a foundation for follow-up actions. For example:**

  Where to target: Highlands and coastal communities (e.g., Hela, Southern Highlands, Bougainville), where climate impacts, resource conflicts and SARV are all present.

  Whom to target: Village leaders, women's groups, youth organisations, and church representatives.

  How: Facilitate community visioning workshops that bring together diverse groups to co-design local action plans addressing land disputes, community reconciliation and disaster preparedness. Ensure the plans include clear responsibilities, timelines and mechanisms for regular review and adaptation.

■ ● ○

- **Increase awareness and provide trainings on climate change, linking it directly to peacebuilding efforts – for example, around SARV prevention and natural resource management. For example:**

  Where to target: The Highlands and Bougainville where climate impacts are often misinterpreted as sorcery, fuelling violence.

  Whom to target: Teachers, community leaders, church leaders, local police, and youth.

  How: Develop training modules that explain climate change in local languages and use real community examples on how to peacefully mitigate, cope and adapt to climate impacts. Integrate sessions on non-violent conflict resolution and SARV prevention, and deliver them in schools, churches and community halls. Engage survivors and respected elders as co-facilitators.

● ○

- **Promote climate-resilient agriculture by combining traditional knowledge with the introduction of new, better-adapted crops that are likely to remain viable under future climate scenarios. For example:**

  Where to target: Flood- and drought-prone areas in Morobe and East Sepik.

  Whom to target: Local farmers (especially women), agricultural extension workers, large-scale agricultural plot owners, and village elders.

  How: establish community networks to organise traditional agricultural knowledge sharing techniques and set up demonstration plots where farmers can trial drought-and-flood-resistant varieties alongside traditional crops, and host field days to exchange knowledge on soil conservation, agroforestry and water management. Involve youth in documenting and sharing results via radio and WhatsApp groups.

■ ● ▲ ○

• **Ensure that women are equally participating in integrated climate security programming that is used to empower and strengthen their role in decision-making and natural-resource management. For example:** **Where to target:** Forest communities (e.g., Western Province, West and East Sepik) and urban settlements in Lae and Port Moresby. **Whom to target:** Women's associations, market vendors, female elder leaders and female youth leaders. **How:** establish women's advisory groups for local climate adaptation and peacebuilding projects, provide leadership training, and ensure women's voices are included in land-use planning, disaster response and resource management committees. Highlight successful women-led initiatives in community meetings and media. Ensure that women are meaningfully represented in dispute resolution.	
• **Implement conflict-sensitive climate-proofing measures for critical infrastructure and services, including roads, health posts and educational facilities, particularly in conflict-affected and remote areas that have seen little development. For example:** **Where to target:** Remote Highlands and coastal communities (e.g., rural Bougainville, Enga, and isolated atolls). **Whom to target:** Local construction teams, village health committees, school boards, and youth groups. **How:** Use participatory mapping to identify infrastructure most at risk from both climate hazards and conflict (e.g. schools and health posts). Prioritise upgrades using local labour, climate-resilient materials, and include conflict-prevention features such as community watch groups or safe spaces in school/health facility designs.	

2. ENHANCING YOUTH ENGAGEMENT AND ALTERNATIVE LIVELIHOODS

Engaging youth and providing them with alternative livelihood options is crucial in reducing their likelihood to get involved in conflicts and criminal activities. By focusing on climate-resilient livelihoods and leadership development, PNG can harness the potential of its youth for building social cohesion and a more secure, resilient and sustainable future.

• **Establish vocational training centres in villages and cities, focusing on climate-resilient livelihoods in both agricultural and non-agricultural sectors. For example:** **Where to target:** Urban centres like Lae and Port Moresby, and rural areas in the Highlands where youth unemployment and climate vulnerability are high. **Whom to target:** Out-of-school youth, young women, and youth from communities affected by displacement or conflict, young urban migrants. **How:** Set up vocational centres offering training in non-agricultural trades such as carpentry, electrical work, and eco-tourism as well as climate-smart agriculture. Partner with local businesses and NGOs to provide apprenticeships and job placements for graduates. Ensure courses are accessible to young women and those with disabilities.	
• **Implement youth leadership programmes that include both women and men, emphasising environmental stewardship, conflict resolution skills and inclusion in decision-making processes. For example:** **Where to target:** Secondary schools and youth groups in Bougainville, Morobe, and the Highlands. **Whom to target:** Mixed-gender youth groups, student leaders, and young people from communities with histories of conflict or SARV. **How:** Run peer-led workshops on environmental protection, climate change, mediation and non-violent communication. Establish youth advisory councils linked to local government, ensuring equal representation of young women and men in community decision-making forums. Include traditional structures such as Haus Man to advance leadership programs in an informal setting.	
• **Develop and support concrete projects that provide immediate employment opportunities for youth in climate adaptation and community resilience-building activities. For example:** **Where to target:** Flood-prone urban areas in Lae and Port Moresby. **Whom to target:** Unemployed youth, especially those at risk of joining gangs or being recruited into violence. **How:** Launch "green jobs" initiatives such as mangrove replanting, community clean-up campaigns, building flood defences, and maintaining water infrastructure. Offer stipends, certificates, and pathways to further employment or entrepreneurship for participants. Involve local elders and women's groups to provide mentorship and support.	

- **Address underlying social issues by creating programmes that tackle feelings of marginalisation, changing cultural norms, drug use, trauma and align youth aspirations with sustainable development goals. For example:**

  Where to target: High-risk urban neighbourhoods in Lae and Port Moresby, and rural communities with high rates of displacement or violence.

  Whom to target: Marginalised youth, including former offenders, survivors of trauma, and those affected by SARV or displacement. Parents, teachers, church and community leaders.

  How: Set up youth centres or leverage traditional structures to offer counselling, sports, arts, and life skills training. Integrate discussions on mental health, substance abuse prevention, gender equality, and positive masculinity. Bring in role models and peer educators to inspire youth, and link activities to broader development initiatives such as community resilience plans.

3. ADDRESSING SORCERY ACCUSATION-RELATED VIOLENCE

Given the strong link between environmental changes, disasters and SARV, targeted interventions are necessary to address these interconnections and this pervasive form of violence.

- **Integrate SARV education and awareness programmes with climate change education, starting from the school level. For example:**

  Where to target: Primary and secondary schools in the Highlands where SARV and climate-induced disasters are most prevalent.

  Whom to target: Teachers, school administrators, students, and parents.

  How: Develop curriculum modules that explain how environmental changes (like drought or crop failure) are caused by climate factors, not sorcery. Use interactive methods—such as drama, storytelling, and local case studies—to challenge SARV beliefs and promote scientific understanding. Involve local climate experts and survivors in delivering sessions.

- **Strengthen protection mechanisms for SARV victims, including safe houses and legal support. For example:**

  Where to target: Urban and rural communities with high SARV incidence such as the Highlands region.

  Whom to target: Women, men and children at risk, local police, church groups, and legal aid providers.

  How: Expand networks of safe houses run by women's organisations and churches, ensuring they are discreet and accessible. Train police and legal aid workers on SARV-specific protection protocols. Provide transportation, counselling, and legal assistance for victims to pursue justice and if possible, reintegration into communities.

- **Engage traditional leaders, churches and community-based organisations in SARV prevention efforts. For example:**

  Where to target: Villages and settlements in the Highlands and Bougainville, where traditional authority is strong.

  Whom to target: Chiefs, elders, church leaders, women's groups, and youth leaders.

  How: Facilitate community dialogues and workshops led by respected local figures, focusing on peaceful conflict resolution, debunking SARV myths, and promoting climate literacy. Encourage churches to address SARV in sermons and support mediation efforts.

- **Conduct further research to understand the complex dynamics between climate change, disasters and SARV to inform evidence-based interventions. For example:**

  Where to target: Research institutions in PNG and collaboration with international partners in affected provinces.

  Whom to target: Local researchers, academic institutions, NGOs, survivors, and community representatives.

  How: Fund participatory research projects that document SARV cases following climate disasters (e.g., floods, droughts). Use interviews, focus groups, and surveys to capture local perspectives and identify risk factors. Share findings with policymakers and practitioners to design better-targeted prevention and response strategies.

4. ENHANCING DISASTER RISK MANAGEMENT AND DISPLACEMENT RESPONSES

The frequency and intensity of disasters in PNG are expected to increase due to climate change, posing significant challenges to communities and government systems. Improving disaster risk management and responses to climate-induced displacement is therefore critical not only to reduce vulnerability but also to prevent conflict and maintain social stability in affected areas.

- **Develop and implement comprehensive disaster risk management plans at provincial and local levels. For example:**

  Where to target: Provinces highly exposed to disasters, such as East Sepik (floods), Enga (landslides), and coastal Bougainville (storms and sea-level rise).

  Whom to target: Provincial disaster committees, local government, village leaders, police forces and school administrators.

  How: Facilitate participatory planning workshops to map hazards, identify vulnerable groups, and develop early warning and evacuation protocols. Integrate local knowledge and lessons from recent disasters (e.g., the 2024 Enga landslide) and ensure regular drills in schools and communities.

- **Develop solutions for managing climate-induced displacement that address land access, resource sharing and social integration in receiving communities to prevent tensions. For example:**

  Where to target: Highlands and coastal areas where internal displacement is rising, such as communities in the Highlands and Bougainville.

  Whom to target: Displaced families, host community leaders, customary landowners, and youth groups.

  How: Set up community mediation panels to negotiate land access and resource-sharing agreements. Develop integration programmes—such as shared gardening plots or joint youth activities—to build trust and reduce competition between newcomers and host communities.

- **Ensure equitable and conflict-sensitive disaster preparedness, response and aid distribution. For example:**

  Where to target: Disaster-prone areas with a history of violence where aid distribution can be politicised or spark disputes.

  Whom to target: Local government, humanitarian agencies, women's groups, and church networks.

  How: Map vulnerable groups before disasters occur and establish transparent criteria for aid distribution. Involve women and marginalised groups in planning and monitoring and use community radio to communicate aid processes and grievance mechanisms.

- **Empower women's participation and leadership in disaster risk reduction and address their specific protection needs. For example:**

  Where to target: Disaster-prone rural areas (e.g., East Sepik, Western Province, Southern Highlands Province, Enga) and urban settlements with high displacement rates.

  Whom to target: Women's associations, female community health workers, and women leaders.

  How: Train women as disaster response team leaders and first responders. Create safe spaces for women and girls in evacuation centres and provide hygiene kits and trauma support. Ensure women are represented on disaster committees and in decision-making on resettlement and aid.

- **Develop conflict-sensitive strategies for sustainable resettlement of displaced populations, with a focus on land access and livelihood opportunities. For example:**

  Where to target: Coastal regions where resettlement is already occurring, such as Bougainville.

  Whom to target: Displaced persons, host landowners, local business owners, women's associations and church leaders.

  How: Facilitate participatory land-use planning for new settlements ensuring the inclusion of host and resettled communities. Support livelihoods through start-up grants, vocational training, and community-led infrastructure projects. Monitor social dynamics, foster social cohesion and provide mediation support if tensions arise.

5. IMPROVING SUSTAINABLE NATURAL RESOURCE MANAGEMENT

PNG's rich natural resources, including its forests, minerals, oil, gas and marine ecosystems, are central to both its economic development and the livelihoods of its people. The management of these resources is often at the heart of complex conflicts that intertwine issues of identity, social relationships and economic interests. Implementing sustainable natural resource management practices is crucial for preserving PNG's biodiversity, supporting climate-resilient livelihoods and preventing resource-related conflicts. This requires balancing economic development needs with environmental conservation, strengthening land rights and resource governance and ensuring equitable benefit-sharing from resource extraction activities.

- **Support community-based natural resource management initiatives that include conflict management mechanisms and capacities, particularly for land, forests and fisheries. For example:**

  Where to target: Forest-dependent communities in East Sepik and Western Province, and coastal fishing villages in Milne Bay and Manus.

  Whom to target: Customary landowners, traditional leaders, women's groups, and youth.

  How: Establish community forest and fisheries management committees with clear rules for resource use, benefit-sharing, and conflict resolution. Provide training in sustainable harvesting techniques and facilitate regular meetings to mediate disputes. Link these initiatives to provincial government and NGOs for technical support and monitoring.

- **Address land conflicts through a combination of traditional dispute resolution mechanisms and formal legal processes. For example:**

  Where to target: Highlands provinces and areas of major resource development (e.g., mining areas).

  Whom to target: Traditional leaderes, land mediators, women's representatives, and local government.

  How: Set up joint mediation panels that bring together respected elders and trained legal mediators. Document and register customary land boundaries using participatory mapping, and ensure outcomes are recognised by all stakeholders. Provide legal literacy workshops so communities understand both customary and statutory land rights.

- **Ensure that extractive industry projects (mining, oil, gas) adhere to environmental and social safeguards, with equitable benefit-sharing mechanisms. For example:**

  Where to target: Mining and gas project areas in Western Province, Hela, and Gulf Province.

  Whom to target: company and private sector representatives, local landowner associations, women's and youth groups.

  How: Establish multi-stakeholder monitoring committees for each project, with transparent reporting on environmental impacts and benefit distribution. Require companies to conduct regular community consultations and publish environmental and social audits. Support training for landowner representatives to negotiate fair benefit-sharing agreements.

- **Start conflict-sensitive engagement processes with artisanal miners to improve social and environmental standards and provide alternative livelihood options. For example:**

  Where to target: Artisanal mining hotspots in Bougainville and Enga province.

  Whom to target: Small-scale miners, local business owners, youth, and women involved in artisanal mining.

  How: Facilitate dialogue between miners, local authorities, and environmental experts to develop codes of conduct and safer mining practices. Provide training on mercury-free gold extraction and support access to microcredit for alternative livelihoods such as agro-processing or eco-tourism.

- **Empower women's participation and leadership in natural resource management. For example:**

  Where to target: Forest and fisheries communities in Manus, Milne Bay, and East Sepik.

  Whom to target: Women's associations, young women, and women involved in resource-based enterprises.

  How: Offer leadership and business training, and support women-led enterprises in value-added processing of forest and marine products. Highlight women's success stories through local radio and community events to inspire wider participation.

6. BUILDING URBAN RESILIENCE

Already today, urban areas are emerging as climate-security hotspots where climate change vulnerability and insecurity amplify each other. Building urban resilience and effectively managing migration flows are therefore critical to ensure sustainable urban development, reduce vulnerabilities to climate impacts in cities and prevent urban conflicts.

- **Develop inclusive and conflict-sensitive urban planning strategies that link climate change adaptation, peacebuilding and livelihoods. For example:**

  Where to target: Rapidly growing cities like Port Moresby and Lae, especially in new peri-urban areas and informal settlements.

  Whom to target: Urban planners, local government, youth and women's groups, traditional leaders, and private sector representatives.

  How: Facilitate participatory urban planning workshops that bring together diverse stakeholders to co-design neighbourhood plans. Integrate disaster risk mapping, green spaces, and community markets into urban development. Ensure plans include mechanisms for peaceful dispute resolution and create pathways for informal residents to access land tenure and services.

- **Improve basic services and infrastructure in informal settlements, with a focus on marginalised areas and climate-resilient design. For example:**

  Where to target: Informal settlements in Port Moresby and Lae, which are most vulnerable to flooding, drought, and poor sanitation.

  Whom to target: Settlement residents, women's and youth associations, local engineers, and health workers.

  How: Upgrade water, sanitation, and drainage systems using climate-resilient materials and designs. Prioritise community-led construction and maintenance initiatives and provide training for local youth in climate-proof building techniques. Establish community committees to oversee infrastructure and ensure equitable access for all residents.

- **Create violence and crime prevention programmes, particularly involving young people. For example:**

  Where to target: High-risk urban neighbourhoods in Port Moresby and Lae and provincial capitals such as Mendi and Tari, where youth unemployment and crime rates are high.

  Whom to target: Youth at risk, local police, schools, and churches.

  How: Launch youth clubs and safe spaces that offer sports, arts, and vocational training, alongside mentoring in conflict resolution and leadership. Partner with local police to run community policing initiatives and with NGOs to deliver trauma counselling and substance abuse prevention. Celebrate positive youth role models through local media and events.

- **Develop conflict-sensitive strategies and conflict resolution mechanisms to address land conflicts, especially around land grabbing and squatting. For example:**

  Where to target: Peri-urban areas and informal settlements on the edges of Port Moresby and Lae where land disputes are most acute.

  Whom to target: Customary landowners, squatters, local government, and legal aid organisations.

  How: Establish community mediation panels that include both landowners and settlers, supported by neutral facilitators. Offer legal literacy workshops on land rights and dispute resolution, and pilot negotiated agreements that allow for secure tenure and basic service provision while longer-term solutions are pursued.

7. IMPROVING GOVERNANCE AND LAW ENFORCEMENT

Weak governance and inadequate law enforcement have been persistent challenges in PNG, undermining efforts to address both climate change impacts and security issues. Addressing these challenges is essential for implementing effective climate adaptation strategies, managing natural resources sustainably and maintaining peace and security.

- **Strengthen the police force by establishing police posts in rural areas and enhancing community policing initiatives. For example:**

  Where to target: Remote areas of the Highlands where state presence is weakest and both climate and conflict risks are acute.

  Whom to target: Engage local youth, women and respected community figures for example, as auxiliary police or community policing volunteers and local police personnel.

  How: For example, establish mobile police posts in areas prone to land disputes or SARV, and link these with local peace committees. For example, in Hela, a mobile police post could rotate between high-risk villages, building trust and providing rapid response to both climate emergencies and violent incidents.

- **Implement leadership programmes for local and provincial government officials, focusing on climate-sensitive conflict resolution and resource management. For example:**

  Where to target: Provincial capitals (e.g., Mendi, Buka, Lae) and district centres, as well as select rural Local Level Governments (LLGs) with histories of resource conflict.

  Whom to target: Local government officers, ward councillors, and traditional leaders – ensure women and young leaders are included.

  How: workshops on mediation, climate adaptation, and resource-sharing, using real local case studies (such as land disputes or benefit-sharing from mining projects). Partner with academic institutions and NGOs with peacebuilding expertise.

- **Improve the court system at both provincial and village levels to better address land conflicts and SARV cases. For example:**

  Where to target: Areas with high rates of land disputes and SARV, such as the Highlands.

  Whom to target: Village courts, land mediators, and local women's groups.

  How: Provide specialised training on climate-related land issues and SARV for village court officials. Pilot "mobile court" sessions that travel to remote communities after climate disasters or violent incidents, ensuring timely and context-sensitive justice.

- **Develop and strengthen preventative measures for land conflicts such as participatory and inclusive land use planning, as well as community-based dispute resolution mechanisms. For example:**

  Where to target: Areas competition for land is rising due to both climate change and resource development. For example:

  Whom to target: Customary landowners, youth, women, local government and company representatives (in resource development areas).

  How: Facilitate inclusive land-use mapping and planning workshops, using participatory tools like community mapping and storytelling. Establish or support local land mediation committees that include women and young people, and ensure their decisions are recognised by local authorities.

- **Promote women's involvement in community policing and auxiliary police roles. For example:**

  Where to target: Urban settlements (e.g., Port Moresby, Lae) and rural communities with high rates of gender-based violence and SARV.

  Whom to target: Local women's associations, churches, and youth groups.

  How: Launch a recruitment campaign for women auxiliary police, provide gender-sensitive training, and create peer support networks for women in policing. Highlight success stories – such as women-led mediation in SARV cases, to encourage participation and shift community attitudes.

8. ENHANCING DATA COLLECTION AND ANALYSIS FOR EVIDENCE-BASED INTERVENTIONS

To effectively address climate- and environment-related security risks, it is crucial to have a solid foundation of data and analysis. Improved data collection and monitoring systems will enable more targeted and effective interventions, allow for better tracking of progress and facilitate adaptive management of climate security strategies.

- **Establish a comprehensive system for collecting and analysing data on displacement, SARV incidents and climate- and environment-related conflicts. For example:**

  Where to target: Focus initial piloting in high-risk areas for both climate impacts (like landslides and drought) and security risks (including SARV and displacement) for example in the Highlands.

  Whom to target: Work with local governments, churches, peacebuilding organisations, and women's groups, who are both key informants and particularly at risk.

  How: Develop a district-level, multi-stakeholder reporting system that integrates climate, disaster, and conflict data. For example, train local youth or church leaders as community data collectors to report incidents via mobile platforms, feeding into a centralised dashboard managed by the provincial government. Partner with local academic and research institutions.

• **Conduct regular climate and environmental security assessments at the local level, incorporating both environmental and social factors. For example:** **Where to target:** Local areas where climate change interacts with other social, demographic, environmental and political pressures increasing conflict risks. **Whom to target:** Engage local government, traditional leaders, NGOs, women's associations and youth. **How:** Facilitate participatory risk mapping workshops every two years, bringing together diverse community representatives to identify changing risks and hotspots. Use these assessments to inform local climate change adaptation and peacebuilding plans.	
• **Build local institutions and researchers' capacities to explore the links between climate change, environmental challenges and conflict dynamics. For example:** **Where to target:** Research centres in PNG, and local NGOs operating in climate-affected regions such as the Highlands and Bougainville. **Whom to target:** Young researchers, local government staff, and civil society leaders—especially women and youth, who are often underrepresented in research. **How:** Organise annual training workshops and fellowships on climate-security analysis, using real PNG case studies (e.g., SARV after disasters, conflicts over natural resources). Support joint research projects pairing local researchers with international experts, and create a national online platform to share climate-security data, research findings, and policy briefs. Encourage participatory research methods that involve affected communities directly, ensuring findings are relevant and actionable.	
• **Support exchange between different countries in the region on climate-related security risks – in particular on lessons learned on how to best address them. For example:** **Where to target:** Facilitate exchanges between PNG and countries facing similar climate-security challenges, especially regarding displacement, resource conflicts, and SARV such as Solomon Islands, Vanuatu, and Fiji. **Whom to target:** Government officials, researchers, women's and youth leaders, and community-based organisations. **How:** Organise regional workshops (virtual and/or in-person) where countries share case studies and best practices on climate-security interventions. Set up peer-to-peer learning visits, for example, PNG officials and community leaders visiting Solomon Islands to observe community-based early warning systems, or hosting regional webinars on SARV prevention. Establish a Pacific climate-security knowledge hub for ongoing exchange of research, tools, and policy solutions	

These recommendations offer overarching guidance as well as illustrative, actionable examples of steps PNG can make towards addressing its climate- and environment-related security risks, building resilience in its communities and fostering sustainable development in the face of environmental challenges.

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