

Nature-based Solutions for Climate and Disaster Risk Mitigation in SIPLAS: A Framework for Policy Integration and Innovative Financing

Antonio Jr. Fabela Regis^{1*}, Christopher Allan Ray Pilpa²

¹Department of Climate Change, Indian Institute of Technology Hyderabad, 502285 Kandi, Telangana, India

²School of Political and Social Sciences, University of Melbourne, Victoria 3010, Australia

*Corresponding author: cc21resch16001@iith.ac.in

Abstract

Small island protected areas face compounding pressures from rapid urbanization, constrained land use, biodiversity loss, and intensifying climate and disaster risk, yet scholarship on how to finance and mainstream Nature-based Solutions (NbS) in governance-complex, nationally protected island systems remains limited. This study addresses that gap by examining the integration of NbS into climate and disaster risk management and development planning for the Siargao Island Protected Landscape and Seascape (SIPLAS), Philippines. The study combines five key informant interviews (KIIs) with local actors representing government, civil society, business, and protected area management with a systematic review of twelve national and international policy frameworks and technical toolkits. Results show that NbS initiatives in SIPLAS remain concentrated in four areas: mangrove restoration, coral reef conservation, sustainable tourism as an enabling condition, and community-based conservation, while ecosystem service valuation, blue carbon mechanisms, and standardized monitoring remain underdeveloped. Interview and documentary evidence indicate that the main barriers to scaling NbS are fragmented governance across local government units (LGUs) and the Protected Area Management Board (PAMB), limited and projectized financing pipelines, and the absence of robust metrics to demonstrate ecological and socio-economic returns. The post-Odette USAID SIBOL rapid biodiversity assessment in SIPLAS recorded 325 species of flora and fauna and identified revegetation, stronger environmental enforcement, and landscape-scale restoration planning as priority actions, reinforcing the island's strong ecological basis for NbS expansion. Globally, finance for nature-based solutions reached about US\$200 billion in 2022, but this represented only around one-third of the level needed by 2030, highlighting the structural financing gap confronting local NbS implementation. The paper proposes a four-pronged mainstreaming strategy: policy integration, cross-sectoral collaboration, phased and diversified financing, and robust monitoring and evaluation. The resulting framework offers a replicable model for governance-complex small island communities seeking to translate global NbS commitments into locally actionable and financially sustainable programs.

Keywords: Nature-based Solutions, Financing, Protected Areas, Climate Adaptation, Disaster Risk Mitigation, Siargao Island, Philippines

1. Introduction

Small Island Developing States (SIDS) and island communities within archipelagic nations occupy a paradoxical position in global climate governance: among the most ecologically significant and climate-vulnerable places on Earth, yet among the least equipped to finance and mainstream the very nature-based interventions that could protect them. Urban areas worldwide are increasingly grappling with climate change, biodiversity loss, and heightened disaster risks (Urban et al. 2024, Pörtner et al. 2023), but these pressures intensify acutely in small island settings where land area, financial resources, and institutional capacity are structurally constrained (Lapointe et al. 2020, Hernández-Delgado 2015). SIDS face compounding challenges from rapid urbanization, fragile ecosystems, water insecurity, and catastrophic exposure to storm surges, sea-level rise, and extreme weather events, challenges that are only deepening as climate change accelerates (UNDRR 2022, Scandurra et al. 2017). Despite being at the frontlines of climate impacts, SIDS consistently encounter barriers to adaptation including limited funding, weak institutional frameworks, and insufficient technical capacity (Briguglio 1995, Gheuens et al. 2019, Filho et al. 2020).

These structural vulnerabilities are equally present in small island communities within archipelagic nations such as the Philippines, a nation of over 7,600 islands with highly varied local economies and ecological profiles. One

such case is Siargao Island, located in the southern Philippines on the eastern Pacific-facing coast of Surigao del Norte. Officially designated as the Siargao Island Protected Landscape and Seascape (SIPLAS), the island represents one of the Philippines' most ecologically significant national protected areas. Spanning over 278,000 hectares, SIPLAS encompasses a rich mosaic of mangroves, coral reefs, wetlands, and seagrass meadows that support high biodiversity and provide critical ecosystem services including coastal defense, fisheries productivity, and carbon sequestration (Presidential Proclamation No. 902, 1996). The island's communities depend heavily on these ecosystems for their livelihoods, particularly through small-scale fisheries and ecotourism anchored by internationally recognized destinations such as Cloud 9 and Jellyfish Lake (Celik et al. 2024, Buca 2024, Coles 2022).

Yet rapid tourism-driven development has created mounting environmental pressures. Solid waste collection rates as low as 10% in some municipalities have contributed to ecosystem degradation (Serrona et al. 2022), saltwater intrusion is affecting freshwater supplies, and climate-related disasters are intensifying. Super Typhoon Odette in December 2021 devastated SIPLAS's ecosystems and communities, underscoring the island's deep vulnerability to climate-driven hazards (Cahigas et al. 2022, USAID SIBOL 2023). Conventional gray infrastructure, concrete seawalls, drainage systems, has historically been the default response due to low upfront cost and perceived immediacy, but it frequently proves ecologically disruptive, spatially inefficient, and ultimately maladaptive for island environments where land is scarce and ecosystems are foundational to economic life (Gabriel et al. 2021, Matsumoto 2019, Qi et al. 2019, Firth et al. 2020).

Nature-based Solutions (NbS) is defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN 2020), offers a compelling alternative framework. NbS leverages natural processes to mitigate flooding, reduce urban heat, protect coastlines, and enhance biodiversity while generating co-benefits for livelihoods, food security, and community resilience (Nelson et al. 2020, Dushkova & Haase 2020, Castaldo et al. 2025). For small island communities specifically, NbS such as mangrove restoration, coral reef rehabilitation, and watershed protection have demonstrated cost-effectiveness, multi-functionality, and adaptability to changing climate conditions (Lovelock et al. 2022, Jordan & Fröhle 2022, Hernández-Delgado 2024, Mortensen et al. 2024). NbS also integrate cultural values and traditional ecological knowledge, reinforcing community stewardship and place-based adaptation (Latai-Niusulu et al. 2024, Reid et al. 2024, McNamara et al. 2020, Kiddle et al. 2021).

Despite growing global recognition of NbS, their systematic financing and institutionalization in developing country contexts remains understudied, especially those characterized by complex multi-jurisdictional governance like SIPLAS. Public international funding for NbS-based adaptation reached only US\$3.8–8.7 billion in 2018, representing approximately 0.6–1.4% of total climate finance flows (Swann et al. 2021), far below estimated needs. Existing literature on NbS mainstreaming tends to focus on national-scale policy or urban settings in higher-income countries, with limited attention to the institutional complexity of nationally protected small island systems in the Global South.

This paper addresses this gap by (1) analyzing the current landscape of NbS initiatives in SIPLAS through key informant interviews and systematic policy document analysis, (2) identifying practical, evidence-based strategies for integrating NbS into local climate, disaster risk, and development planning frameworks guided by IUCN and CBD standards, and (3) exploring innovative and sustainable financing models for scaling NbS implementation. The study contributes an empirically grounded, governance-sensitive framework applicable to other small island protected areas facing analogous ecological and institutional constraints (as illustrated in Figure 1).

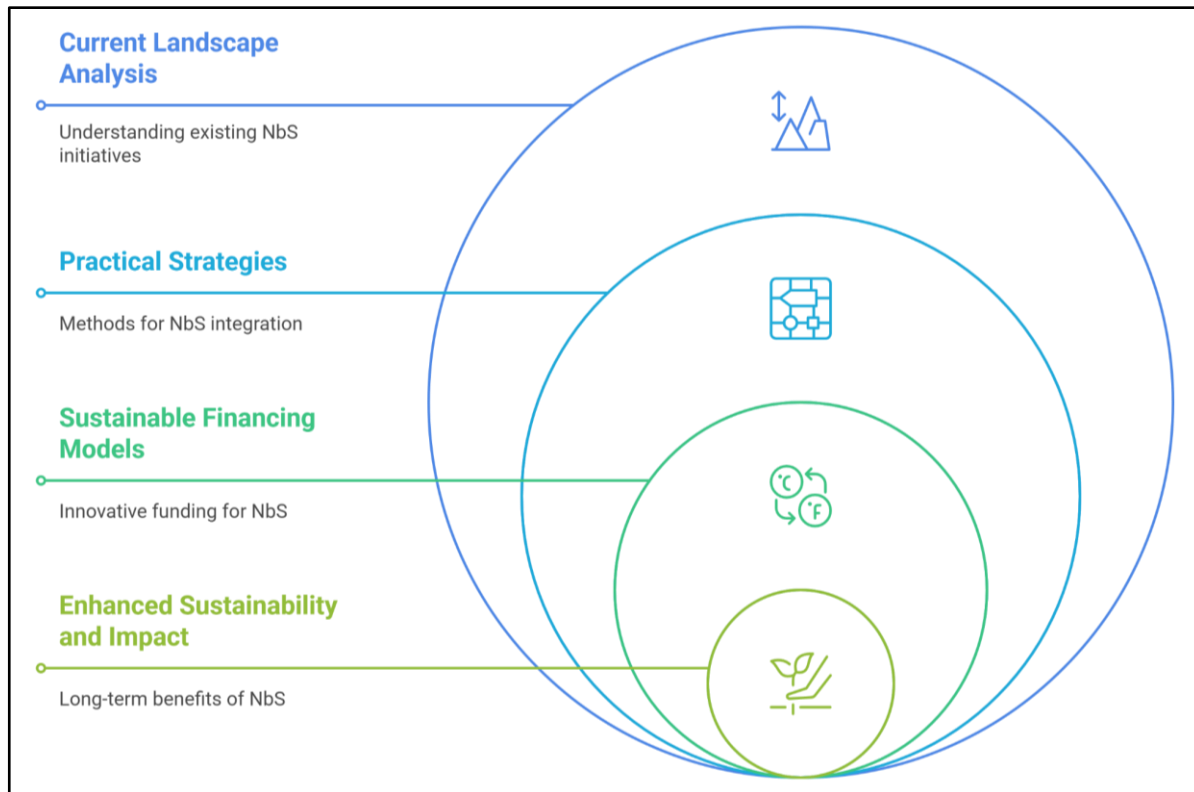


Figure 1. Conceptual Framework for Financing and Mainstreaming Nature-based Solutions (NbS) for Climate Risk Mitigation in SIPLAS. Understanding the general landscape of NbS initiatives, actionable initiatives can be integrated into the climate and disaster risk management and development plans, and the planned interventions can be matched with available fiscal opportunities to enhance their impact and sustainability.

2. Methodology

2.1 Study Area

SIPLAS is a nationally recognized protected landscape and seascape established under Presidential Proclamation No. 902 (1996) and governed under the National Integrated Protected Areas System Act (Republic Act No. 7586, 1992). Spanning 278,914 hectares, it encompasses the municipalities of Del Carmen, Dapa, General Luna, San Isidro, Pilar, Santa Monica, and San Benito in Surigao del Norte, Philippines. SIPLAS is managed by a Protected Area Management Board (PAMB) that operates alongside, but separately from, individual local government units (LGUs), creating a multi-jurisdictional governance environment that significantly shapes NbS planning and implementation. The island's ecological assets, including the Sohoton Lagoon, Del Carmen mangrove forests, and offshore coral reef systems, form the ecological and economic foundation of the study area.

2.2 Research Design

The study employed an exploratory qualitative design combining primary evidence from key informant interviews (KIIs) with secondary evidence from systematic policy and document analysis. This design is appropriate for exploratory, context-specific policy research where generating actionable insights from a governance-complex setting is the primary objective (Yin 2018). Reporting of the interview-based component was strengthened using the Consolidated Criteria for Reporting Qualitative Research (COREQ), a 32-item checklist widely used to improve transparency in qualitative studies based on interviews and focus groups (Tong et al. 2007). Given the study's focus on institutional knowledge and planning-level analysis, qualitative inquiry is well-suited to capturing the nuanced interplay between governance structures, financing landscapes, and NbS implementation realities.

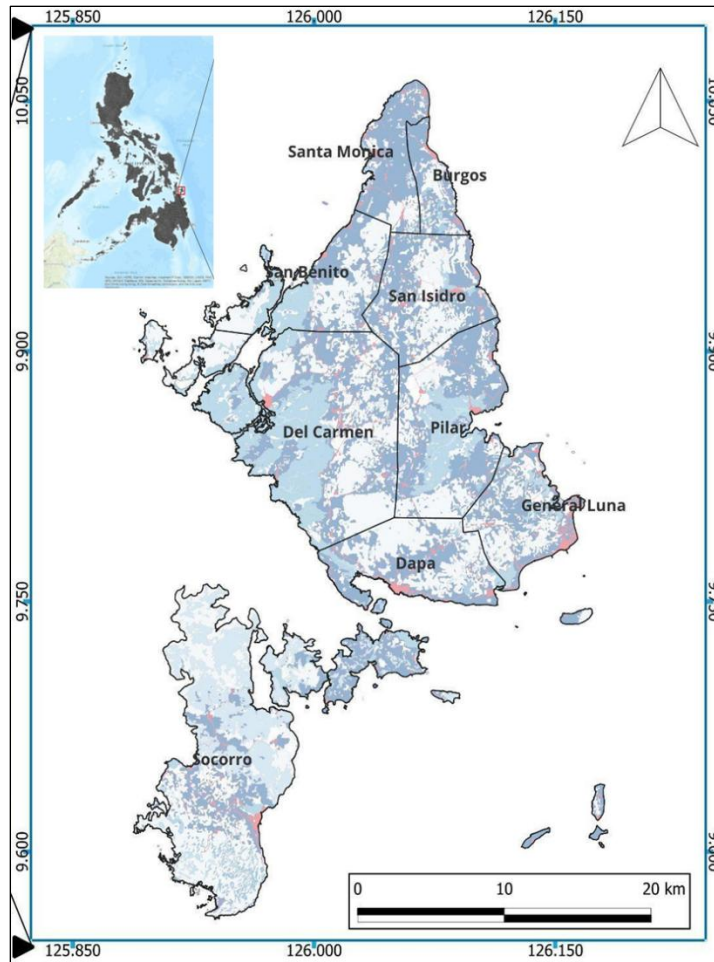


Figure 2. Map location of Siargao Island Protected Landscape and Seascape (SIPLAS) encompassing 9 municipalities (Local Government Units) and the Protected Area Management Board (PAMB) SIPLAS.

2.3 Key Informant Interviews

Five key informant interviews were conducted between 2023 and 2024 with purposively selected local actors representing the main institutional constituencies involved in NbS planning and implementation in SIPLAS: protected area governance, local environmental management, local agriculture, civil society, and private sector interests. Purposive sampling was employed to ensure representation across major governance and stakeholder constituencies implicated in NbS planning. This sample size is consistent with exploratory qualitative research, where depth of perspective and role-based diversity can be more analytically valuable than statistical representativeness (Guest et al 2006). The sample was not designed for generalization but to capture recurrent institutional patterns across diverse governance positions.

Interviews lasted approximately 45 to 75 minutes (averaging approximately 60 minutes) and were conducted in person in English and Filipino, depending on participant preference. With prior informed consent, interviews were audio-recorded, supplemented by detailed field notes, and later transcribed verbatim. Participant transcripts were not formally returned for validation due to logistical constraints; however, key themes were checked iteratively against notes and documentary evidence during analysis. Table 1 presents the interview participants and their institutional roles.

A semi-structured interview guide was organized around four thematic domains: (a) the current state of NbS initiatives in SIPLAS; (b) barriers and enabling conditions for NbS mainstreaming; (c) financing challenges and

opportunities; and (d) institutional coordination and community participation. Coding was carried out manually through inductive thematic analysis following Braun and Clarke (2006). Initial open codes were generated from transcripts and notes, then clustered into broader analytical themes including financing fragmentation, governance overlap, donor dependence, monitoring constraints, and community stewardship. Because coding was conducted by the lead researcher, interpretive bias was addressed through triangulation with legal documents, policy frameworks, and technical reports.

Table 1. Key Informant Interview Participants

Name	Role	Organization	Thematic Expertise
Jelanie Superada	Protected Area Officer	PAMB-SIPLAS	Protected area governance and management
Dr. Jovito Gambong	Municipal Agriculturist	LGU Dapa	Local agricultural systems and food security
Marja Abad	President	Local Business Owners' Association	Private sector, business sustainability
Gina Barquilla	Municipal Environment Officer	Municipality of Del Carmen	Local environmental governance and policy
RJ Magbanua	Project Manager	Katutubong Agham at Teknolohiya Inc. (SIKAT)	Community development and indigenous science

2.4 Data Saturation and Credibility

Thematic saturation was assessed pragmatically across the five interviews. The same three overarching barriers recurred consistently across respondents from different institutional positions: fragmented governance, unstable financing, and weak monitoring systems. This suggests adequate coverage of the governance and financing landscape for the study's analytical objectives (Tong et al. 2007). Credibility was strengthened through cross-source triangulation, using policy documents and technical reports to confirm or nuance themes emerging from the interviews.

2.5 Policy and Document Analysis

Twelve national and international policy frameworks, legal instruments, technical reports, and finance-oriented guidance documents were systematically reviewed (Table 2). Documents were selected based on: (1) direct relevance to NbS design, governance, financing, or monitoring; (2) applicability to the Philippine and protected-area planning context; and (3) alignment with major global climate, biodiversity, and disaster risk governance frameworks (Paris Agreement, Sendai Framework, Kunming-Montreal Global Biodiversity Framework). Document review followed a four-step workflow: identification, screening, thematic extraction, and triangulation with KII findings. Key content was extracted under four analytic domains: governance, financing, implementation barriers, and monitoring/metrics. This analytic chain informed the Results, Strategy, and Financing sections.

Table 2. Policy Frameworks, Legal Documents, and Technical Toolkits Reviewed

Reference Document	Key Guidelines	Role in Analysis
1. IUCN Global Standard for NbS (2020)	8 criteria and 28 indicators for NbS verification, design, and scaling	Primary framework for NbS assessment and strategy development
2. CBD Voluntary Guidelines for EbA and Eco-DRR (2019)	Stepwise guidance on ecosystem-based adaptation with sectoral integration	Informed NbS implementation best practices

3. Sendai Framework for Disaster Risk Reduction 2015–2030	Four priorities: understanding risk, strengthening governance, investing in resilience, building back better	Aligned NbS with disaster risk management goals
4. UNDP NbS for NDCs Toolkit (2019)	100+ tools for mainstreaming NbS into national climate commitments	Informed policy integration and NDC alignment recommendations
5. UNDP Seven-Step Pathway for NbS in NDCs	Structured methodology for NbS-NDC integration	Structured policy coherence recommendations
6. UNEP State of Finance for Nature Report Series	Tracks public and private NbS finance flows, identifies funding gaps	Informed financing mechanism analysis
7. UNDRR/UNU-EHS NbS for Comprehensive DRM Toolkit (2023)	Integrates NbS into disaster risk management planning	Informed disaster risk integration recommendations
8. Philippine Biodiversity Strategy and Action Plan (PBSAP) 2015–2028	9 strategic priorities, 113 conservation actions	Contextualized NbS within national biodiversity policy
9. Republic Act No. 7586 – NIPAS Act (1992)	Legal framework for protected area governance in the Philippines	Provided legal basis for governance recommendations
10. Presidential Proclamation No. 902 (1996)	Establishes SIPLAS covering 278,914 hectares	Defined legal status and jurisdictional framework
11. USAID SIBOL Green Assessment – SIPLAS Stage 2 (2023)	Post-typhoon rapid biodiversity assessment of SIPLAS	Provided empirical data on ecosystem damage and NbS context
12. Earth Security Blended Finance Playbook for NbS (2021)	Strategic frameworks for blending public and private NbS finance	Informed blended finance model recommendations

2.6 Research Limitations

This study is exploratory in nature and has several limitations. The interview sample is intentionally small and reflects institutional diversity rather than statistical representativeness. The analysis relies primarily on qualitative evidence and policy review rather than primary ecological valuation, carbon accounting, or hazard modeling. Because coding was conducted by the lead researcher without a second independent coder, the potential for interpretive bias was mitigated through triangulation with documentary evidence rather than inter-rater reliability testing. The proposed financing architecture, while grounded in international practice and local governance realities, should be further tested through ecosystem service valuation, legal feasibility assessment, and investment-grade project preparation.

3. Results

Current Landscape of NbS Initiatives in SIPLAS

Thematic analysis of KII data, triangulated with policy document review, identified four active categories of NbS-related activity in SIPLAS: mangrove restoration, coral reef conservation, sustainable tourism as an enabling condition, and community-based conservation. These initiatives were consistently described by KII participants as operating in relative isolation from one another, lacking an overarching coordination framework, and constrained by fragmented governance, limited financing pipelines, and the absence of ecosystem valuation systems.

One PAMB respondent described the island's situation as follows: 'Projects are happening, but they are often area-based and funding-based. Once the project ends, continuity becomes difficult unless another institution carries it forward.' A local government respondent similarly noted that 'planning is still separated by office and by municipality; the environment, tourism, and disaster units do not always work from one framework.' These views were consistent with documentary evidence showing that SIPLAS governance is distributed across multiple LGUs, a protected area board, and sector-specific planning mandates (USAID SIBOL 2023).



Figure 3. The current Landscape of NbS initiatives in SIPLAS has been limited to localized habitat conservation and protection, sustainable tourism, and community-based conservation.

3.1 Mangrove Restoration

Mangrove restoration is the most well-established NbS category in SIPLAS, concentrated in the municipality of Del Carmen, which hosts one of the largest continuous mangrove forests in the Philippines. Mangroves provide irreplaceable ecosystem services: functioning as natural barriers against coastal erosion and storm surges, sequestering carbon at rates up to four times higher per unit area than many terrestrial forests (Arkema et al. 2023), supporting fisheries by serving as breeding and nursery grounds for marine species (Worthington & Spalding, 2018), and generating ecotourism revenues. The USAID SIBOL (2023) post-Odette rapid biodiversity assessment documented significant mangrove damage and identified revegetation as a priority action, underscoring both the protective role of mangroves and the urgency of continued restoration.

Current restoration activities focus on replanting degraded areas, community nursery management, and ecosystem health monitoring. However, KII respondents from PAMB and the Del Carmen environment office noted that restoration programs remain project-based and donor-dependent, with no permanent funding mechanism ensuring continuity. A municipal environment respondent noted: 'Mangrove work is visible because communities and partners can mobilize around it, but sustaining monitoring and maintenance is harder when there is no regular budget line.' Blue carbon market mechanisms, which could provide a sustainable revenue stream, have not yet been operationalized in SIPLAS, representing a critical missed opportunity (Lovelock et al. 2022).

3.2 Coral Reef Conservation

Coral reefs are the second major NbS category in SIPLAS, providing critical wave attenuation — healthy reefs can reduce wave energy by up to 97%, significantly lowering storm surge and coastal flooding risk (Stovall et al, 2022). Reef systems support SIPLAS's biodiversity-based tourism economy and are fundamental to the productivity of local fisheries, underpinning food security and livelihoods across island communities. The USAID Sustainable Interventions for Biodiversity, Oceans, and Landscapes (SIBOL) program has been the most significant institutional actor in coral reef conservation in SIPLAS, conducting post-Odette rapid biodiversity assessments, supporting coral transplantation, reef monitoring, and marine protected area (MPA) establishment (USAID SIBOL, 2023).

KII respondents acknowledged the SIBOL program's contributions but identified its project-bound nature as a core limitation: institutional knowledge, monitoring systems, and conservation momentum are at risk of discontinuity once external funding ends. Establishing locally managed MPAs with sustainable co-management arrangements between LGUs, PAMB, and fishing communities was identified across multiple KIIs as the most viable pathway for long-term reef governance.

3.3 Sustainable Tourism as an Enabling Condition

This study treats sustainable tourism not as an NbS in the strict definitional sense, but as a critical enabling condition through which healthy ecosystems can generate the revenue streams necessary to sustain NbS investment. SIPLAS's tourism economy is directly dependent on the ecological integrity of its natural assets (Celik et al 2024, Buca 2024), making ecosystem degradation an existential economic risk. The Comprehensive Tourism Master Plan (CTMP) developed by the Tourism Infrastructure and Enterprise Zone Authority (TIEZA) explicitly references the need for sustainable practices that preserve the environment and provide authentic visitor experiences (Palafox Associates, 2021). The Sendai Framework for Disaster Risk Reduction (2015–2030) further highlights the importance of integrating disaster risk considerations into tourism infrastructure planning (UNWTO, 2023).

KII participants from business and local government sectors highlighted a missing institutional link between tourism revenues and ecosystem restoration financing. A business-sector respondent observed: 'Tourism benefits from the environment every day, but there is no clear system yet that channels that benefit back into restoration at the scale needed.' This finding suggests that tourism-linked user fees, conservation levies, and environmental compliance mechanisms may be among the most realistic early financing measures for SIPLAS, provided they are governed transparently with reinvestment rules clearly established.

3.4 Community-Based Conservation

Community-based conservation (CBC) constitutes the fourth pillar of SIPLAS's NbS landscape. CBC programs engage local communities in participatory planning, citizen science, capacity building, and natural resource stewardship, ensuring NbS interventions are contextually responsive and generate local ownership (Brooks et al, 2013). In the Philippines, the Global Environment Facility Small Grants Programme (GEF SGP-7) recently awarded PHP 100 million to 23 community-based organizations across priority landscapes and seascapes including SIPLAS, with a focus on biodiversity conservation, ecosystem rehabilitation, and climate-resilient agribusiness (UNDP Philippines, 2025).

KII respondents from the NGO and PAMB sectors emphasized that community-based approaches are particularly important in SIPLAS given its governance complexity, involving multiple LGUs, an indigenous peoples community, a PAMB, and a Siargao Islands Development Authority (SIDA). However, respondents also noted that CBC programs are frequently under-resourced and siloed from formal development planning processes, limiting their integration into the island's broader resilience agenda.

3.5 Local Ecological Evidence and Priority Interventions

The post-Odette rapid biodiversity assessment undertaken under the USAID SIBOL activity provides an important empirical anchor for SIPLAS. The assessment recorded 325 species of flora and fauna, including 194 plants, 69 birds, 19 amphibians, 15 reptiles, and 28 mammals, and recommended revegetation, stronger environmental enforcement, and landscape-scale restoration planning as priority responses (USAID SIBOL, 2023). This is significant because it confirms that SIPLAS is not only institutionally relevant as a governance case; it is also ecologically rich enough to justify strategic investment in NbS as a climate and biodiversity intervention.

3.6 Triangulated Barriers to Mainstreaming

Three recurrent barriers emerged from the triangulation of KII findings and documentary evidence.

Table 3. Triangulated Barriers to NbS Mainstreaming in SIPLAS

Barrier	KII Evidence	Documentary Evidence	Implication
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Financing fragmentation	Respondents described donor dependence, project discontinuity, and lack of regular budget lines for restoration	NbS finance globally reached ~US\$200 billion in 2022 but remains ~one-third of what is needed by 2030 (UNEP 2024b, Swann et al. 2021)	SIPLAS reflects a wider structural NbS finance gap and needs diversified, durable revenue sources
Governance overlap	Respondents highlighted disconnected planning across offices, LGUs, and the PAMB	SIPLAS governance spans multiple LGUs and a PAMB under protected area law and Presidential Proclamation No. 902	A formal coordination platform is required to bridge jurisdictional fragmentation
Weak metrics and evidence	Respondents cited difficulty proving NbS benefits and sustaining investor confidence without data	Finance frameworks emphasize monitoring, evidence, and credible metrics as prerequisites for scaling (IUCN 2020, UNEP 2024a, UNDRR and UNU-EHS 2023)	Monitoring systems must be established before advanced finance instruments can mature

3.7 Key Barriers and Gaps

Synthesis of KII findings and policy document analysis identified in Figure 4, the three overarching barriers to NbS mainstreaming in SIPLAS:

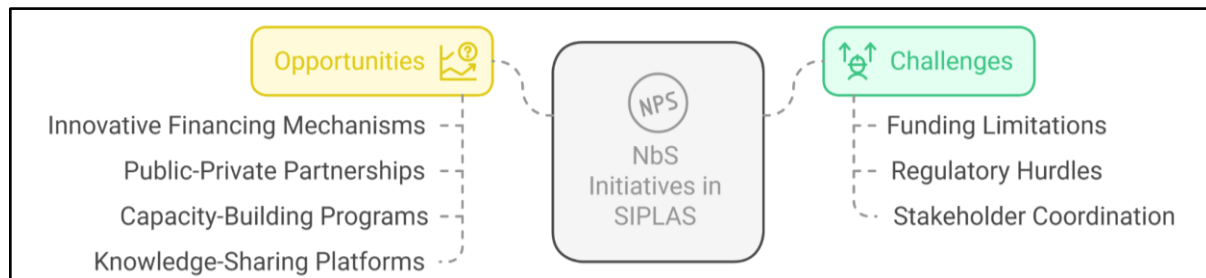


Figure 4. Challenges and Opportunities in NbS Initiatives. Regulatory barriers also pose significant challenges, including complex permitting processes, a lack of supportive policies, and insufficient integration of NbS into existing regulatory frameworks.

Financing Gap: Across all five KIIs, inadequate and fragmented financing was identified as the primary barrier to NbS scaling. Internationally, public funding for NbS-based adaptation represented only 0.6–1.4% of total climate finance flows in 2018 (Swann et al. 2021), and this deficit is acutely felt in a place like SIPLAS where the absence of national-level ecosystem service valuation or carbon market frameworks leaves local actors without access to emerging green finance instruments.

Governance Fragmentation: SIPLAS's multi-jurisdictional structure — seven LGUs, a PAMB, and SIDA operating under overlapping legal mandates — creates significant coordination challenges. KII respondents from both government and civil society sectors described a pattern of siloed planning and implementation, where NbS projects initiated under one jurisdiction lack mechanisms for knowledge transfer or scaling across the island. The local government code's primacy over individual LGU domains, intersecting with PAMB's protected area mandate under Republic Act No. 7586, creates a governance architecture in which integrated NbS mainstreaming requires explicit political alignment that is currently absent.

Measurement and Evidence Gap: The absence of standardized metrics for quantifying NbS benefits — in terms of both ecological outcomes and socio-economic co-benefits — was consistently cited across KIIs as a barrier to

both policy integration and private financing. Without robust data on ecosystem service values, risk reduction outcomes, and carbon stocks, NbS projects in SIPLAS cannot be credibly packaged for institutional investors, insurance schemes, or results-based climate finance mechanisms.

4. Discussion

The findings suggest that the main constraint on NbS mainstreaming in SIPLAS is not the absence of suitable ecosystems or local environmental awareness, but the difficulty of converting existing conservation activity into a coordinated and finance-ready planning framework. SIPLAS already contains high-value ecosystems, a visible restoration agenda, and institutional actors with direct stakes in ecosystem integrity. What remains underdeveloped is the governance architecture needed to align these actors and the evidentiary architecture needed to justify sustained investment.

Much of the existing NbS literature focuses on cities, national adaptation policy, or generic coastal resilience settings, whereas SIPLAS illustrates the specific challenge of a protected area that is simultaneously ecological, administrative, and economic. NbS must here be negotiated across local governments, protected area mandates, tourism interests, and community actors. The novelty of this paper lies in demonstrating how these overlapping governance conditions affect not only implementation, but also the feasibility of different financing mechanisms at different stages of institutional development.

Financing choices must also be treated critically rather than aspirationally. Tourism can enable ecosystem reinvestment, but it can equally intensify waste generation, water demand, land conversion, and shoreline pressure if environmental safeguards and carrying-capacity limits are not enforced. Tourism-linked NbS finance is therefore conditionally beneficial — not inherently beneficial — and depends on transparent governance, clearly defined reinvestment rules, and regulatory enforcement. Similarly, carbon and PES mechanisms can unlock new revenue streams, but they carry risks of elite capture, insecure tenure effects, and high transaction costs if benefit-sharing arrangements are poorly designed from the outset.

The blue carbon agenda is particularly relevant but still emerging for SIPLAS. The Philippines formally launched its National Blue Carbon Action Partnership in 2025, signaling growing policy momentum for carbon-linked coastal ecosystem protection (World Economic Forum, 2025). However, local readiness in SIPLAS for blue carbon finance still depends on stronger carbon accounting, tenure clarity, ecological verification, and governance capacity. This means blue carbon should be understood as a medium- to long-term financing pathway rather than an immediately available instrument. International experience from mangrove blue carbon projects in Indonesia, Viet Nam, and Kenya similarly shows that project development timelines are typically multi-year and require significant upfront institutional investment (Lovelock et al, 2022).

Comparative island experience also offers instructive lessons. Bali's legislative framework for tourism-environment integration demonstrates the value of explicit policy mandates linking tourism management to ecosystem conservation, even while acknowledging that implementation gaps remain (Hernández-Delgado 2024). The Maldives' experience with marine spatial planning and MPA governance offers lessons for aligning legal frameworks across jurisdictional boundaries — a particularly relevant challenge for SIPLAS's multi-LGU structure. The key differentiator for SIPLAS is that its governance complexity, involving PAMB, multiple LGUs, SIDA, and indigenous peoples' interests, demands an explicit inter-institutional coordination mechanism rather than reliance on any single planning authority.

5. Strategies for Mainstreaming NbS into Climate and Disaster Risk Management

Drawing on KII findings, IUCN Global Standard criteria (IUCN, 2020), CBD Voluntary Guidelines (Secretariat of the Convention on Biological Diversity, 2019), and the UNDRR/UNU-EHS NbS toolkit (UNDRR and UNU-EHS, 2023), four interlinked strategic pillars are proposed for mainstreaming NbS in SIPLAS. Figure 5 illustrates these four pillars and their relationships.

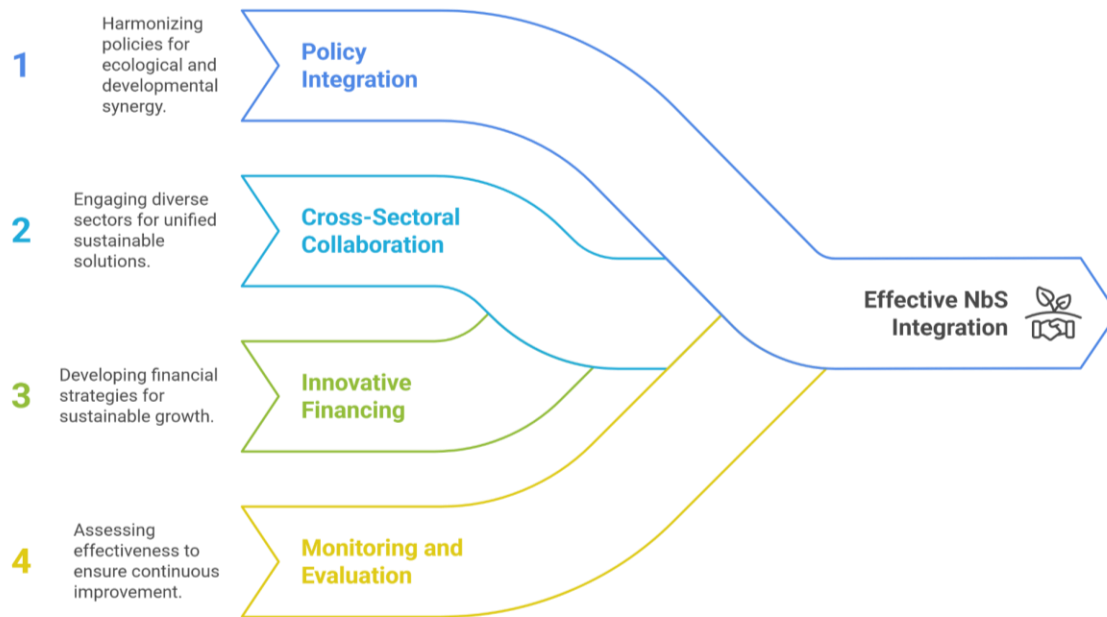


Figure 5. Practical strategies for integrating effective NbS into climate and disaster risk management, outlining the four essential pillars: Policy Integration, Cross-Sectoral Collaboration, Innovative Financing, and Monitoring and Evaluation to address common barriers of siloed governance, budget constraints, and evidence gaps.

5.1 Policy Integration

Policy integration is the foundational pillar for institutionalizing NbS in SIPLAS. Currently, NbS principles are largely absent from local planning instruments, with ecological considerations subordinated to infrastructure-led development. Specific interventions recommended include: (a) mandating NbS assessments as a prerequisite for coastal infrastructure approvals; (b) establishing coastal setback and habitat conservation zones in LGU land use plans; (c) integrating NbS into SIPLAS Climate and Disaster Risk Assessments and local contingency plans; (d) embedding NbS performance indicators into PAMB annual management assessments; and (e) aligning SIPLAS-level plans with the PBSAP 2015–2028 and the Philippines' Nationally Determined Contribution (NDC) to the Paris Agreement, which includes ecosystem-based adaptation commitments. The UNDP's seven-step pathway for mainstreaming NbS into NDCs provides a directly applicable structured methodology for this alignment (UNDP, 2019).

5.2 Cross-Sectoral Collaboration

No single LGU or agency has the authority, capacity, or resources to mainstream NbS across SIPLAS alone. A formal, standing multi-stakeholder NbS coordination platform should be established to convene PAMB, relevant LGUs, DENR offices, the Department of Tourism, academic institutions, the private sector, indigenous communities, and civil society organizations. This platform should fulfill four functions: (1) joint risk mapping and vulnerability assessment; (2) data sharing and NbS knowledge management; (3) collaborative resource mobilization including joint proposal development for climate and conservation funds; and (4) policy coherence review to ensure NbS commitments are reflected consistently across planning instruments. Crucially, indigenous communities and their traditional ecological knowledge must be formally incorporated, as their contextual understanding of SIPLAS ecosystems is directly relevant to NbS design and long-term stewardship (Latai-Niusulu et al. 2024; Reid et al. 2024, McNamara et al. 2020).

5.3 Monitoring and Evaluation

A rigorous, multi-scale monitoring and evaluation (M&E) system is a prerequisite for both adaptive management and financing access. Without credible evidence of NbS outcomes, SIPLAS cannot attract results-based financing, institutional investment, or insurance-linked instruments. The M&E framework proposed for SIPLAS should incorporate three tiers of indicators: (1) ecological indicators — mangrove cover and canopy condition, coral reef health indices, shoreline stability, seagrass meadow extent; (2) resilience indicators — reduced flood exposure in coastal communities, early warning system coverage, post-disaster ecosystem recovery rates; and (3) socio-economic indicators — fisheries productivity, ecotourism revenues attributable to NbS-protected ecosystems, livelihood diversification among NbS-engaged communities.

Community-based monitoring, in which local residents and indigenous community members contribute to ecological data collection alongside scientific protocols, enhances both data coverage and community ownership of NbS outcomes (McNamara et al, 2020). Digital tools such as the Komunidad platform — already introduced in Siargao for localized climate risk analysis and early warning — could be expanded to integrate NbS monitoring data. Periodic independent evaluations should assess how well NbS interventions are reducing climate and disaster risks, with findings feeding into adaptive management cycles.

6. Phased Financing Architecture for NbS in SIPLAS

The following mechanisms are presented as a phased and prioritized financing architecture rather than equally feasible alternatives. Feasibility varies significantly across instruments depending on institutional readiness, monitoring maturity, and the scale of NbS project pipelines. Financing is the most critical and most difficult challenge for NbS in SIPLAS. The following five mechanisms, as shown in Figure 6, identified through synthesis of KII findings, document analysis, and international best practice, are presented as a complementary, layered financing architecture rather than mutually exclusive options.

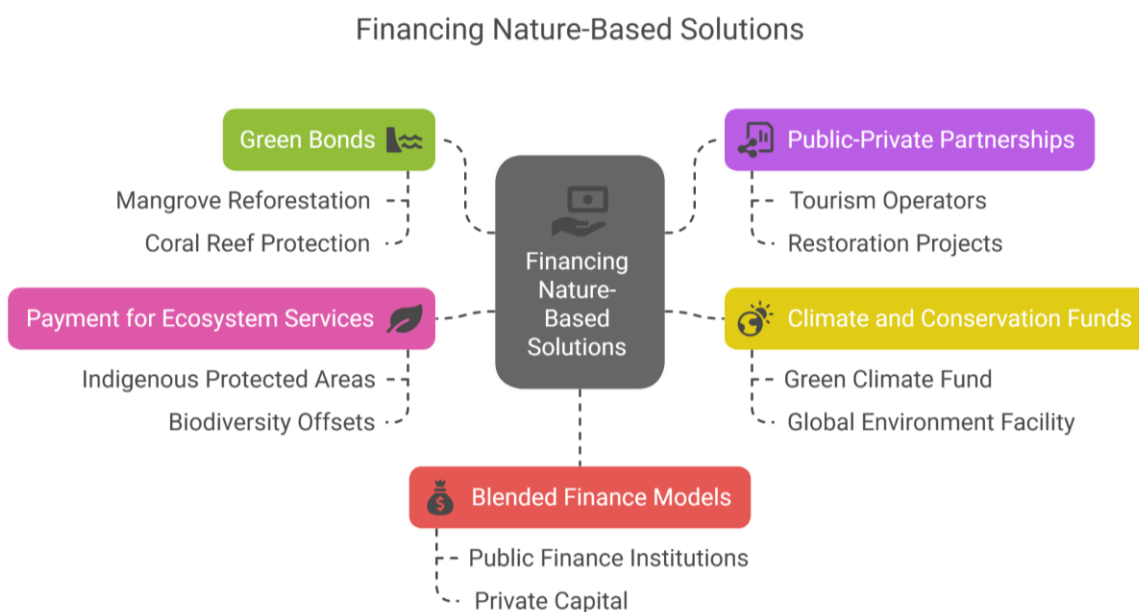


Figure 6. Synergistic approach to financing mechanisms for Nature-Based Solutions (NbS) in five main categories: Green Bonds (e.g. funding for mangrove reforestation and coral reef protection), Payment for Ecosystem Services (such as support for indigenous protected areas and biodiversity offsets), Blended Finance Models (involving both public finance institutions and private capital), Public-Private Partnerships (including tourism operators and restoration projects), and Climate and Conservation Funds (such as the Green Climate Fund and Global Environment Facility).

6.1 Short-Term Priorities (1–2 Years)

The most feasible near-term financing pathways build on current institutional arrangements and existing support mechanisms.

Climate and Conservation Funds. The Philippines has access to multilateral and grant-based mechanisms including the Green Climate Fund, the Adaptation Fund, and GEF-linked programs. Current USAID SIBOL biodiversity programming in SIPLAS provides an institutional foothold for developing larger, more coordinated proposals (USAID SIBOL, 2023). The Adaptation Gap Report underscores the critical shortfall in adaptation finance, highlighting the need for increased multilateral funding to bridge the gap between available resources and estimated annual needs of US\$187 billion to US\$359 billion (Meraj & Hashimoto, 2025).

Tourism-Linked User Fees and Conservation Levies. Environmental fees on tourism operators and accommodation providers can create dedicated local financing for NbS that are administratively simpler than bond issuance or carbon crediting. These mechanisms can create visible local reinvestment loops — provided governance arrangements are transparent and reinvestment rules are clearly defined to prevent revenue diversion.

Pilot Payment for Ecosystem Services (PES). PES schemes compensate landowners or communities for managing ecosystems in ways that generate measurable services such as clean water, carbon sequestration, and coastal protection. PES in SIPLAS could be structured around blue carbon, fisheries, and watershed service streams. Arrangements should begin as tightly scoped pilots to work out benefit-sharing, governance, and monitoring challenges before scaling. Australia's Indigenous Protected Areas model provides a relevant precedent for integrating indigenous governance into PES design with positive socio-economic outcomes (Earth Security 2021). Critically, equity safeguards must ensure that benefits reach vulnerable fishing and farming households rather than accruing to land-controlling interests.

6.2 Medium-Term Priorities (3–5 Years)

Once planning coordination and monitoring systems are more mature, SIPLAS can pursue more structured instruments.

Public-Private Partnerships (PPPs). Tourism operators, resort developers, and surf industry businesses have a direct financial interest in maintaining the ecological assets that sustain visitor demand. PPPs structured around shared investment in NbS — for example, tourism operators co-financing mangrove restoration in areas adjacent to their operations, or businesses contributing to reef monitoring programs — align private sector incentives with conservation goals. The DENR's Project Transform initiative provides an existing institutional framework through which PPP arrangements for NbS could be structured and scaled in SIPLAS.

Blended Finance. Blended finance — combining public capital (grants, concessional loans, guarantees) with private investment — is well-suited to contexts like SIPLAS where private investors perceive NbS as too uncertain without public risk-sharing. Only 5% of blended finance transactions over the past 15 years have focused on nature, underscoring both the scale of the opportunity and the institutional difficulty (Earth Security 2021). For SIPLAS, blended finance could be structured through a dedicated island-level NbS fund combining GCF or Adaptation Fund grants with local government budget allocations and private sector contributions, with a development finance institution providing technical assistance and credit enhancement (Brears 2022).

6.3 Long-Term Priorities (5+ Years)

The most sophisticated instruments should be approached only after SIPLAS has stronger governance coherence, project aggregation capacity, and verified performance metrics.

Green Bonds. Green bonds should be understood as a long-term option for SIPLAS rather than an immediately deployable mechanism. The Philippines has already demonstrated national capacity in sustainable debt issuance through a US\$1 billion ESG tranche, JPY 70.1 billion sustainability Samurai bonds, and a US\$750 million ESG tranche issued in 2022 (Bureau of the Treasury Philippines 2022). However, translating this national momentum into a SIPLAS-linked green bond pipeline would require verified NbS metrics, aggregation of projects to an

investable scale, clear institutional ownership, and the ability to justify transaction costs. Project proposals must align with internationally recognized frameworks such as the UNDRR NbS toolkit for disaster risk management to meet green bond certification criteria (UNDRR and UNU-EHS, 2023).

Blue Carbon and Carbon-Linked Instruments. National blue carbon policy momentum is growing — the Philippines launched its National Blue Carbon Action Partnership in 2025, emphasizing mangrove and seagrass ecosystem protection (World Economic Forum, 2025). For SIPLAS, this creates a real but medium- to long-term opportunity that depends on stronger local carbon accounting, tenure arrangements, ecological verification, and benefit-sharing systems. Concessional loans and partial credit guarantees from institutions such as the Asian Development Bank or International Finance Corporation can help de-risk NbS investments to attract commercial banks and institutional investors, particularly for projects with demonstrable revenue streams (Brears 2022).

7. Implications for Research and Practice

For research, the SIPLAS case demonstrates that NbS mainstreaming in island protected areas should be analyzed not only as an ecological restoration challenge, but as a governance and financial systems challenge. The paper extends existing NbS literature by showing how multi-jurisdictional governance structures in a protected island setting directly shape the feasibility of different financing mechanisms — a dimension underrepresented in current NbS scholarship focused on cities or national-level policy.

For policy, the case shows that projectized conservation activity can provide an important foundation, but cannot substitute for mainstreaming unless institutions are connected through a common planning and evidence framework. The most immediate policy priority for SIPLAS is not designing the most sophisticated financing instrument, but creating the governance coherence and monitoring systems that would make any instrument function.

For practice, the key lesson is sequencing: local actors should first build planning coherence, community legitimacy, and monitoring capacity before attempting capital-market instruments such as green bonds or carbon crediting. This sequencing logic is broadly applicable to governance-complex small island protected areas beyond SIPLAS, including comparable settings in the Pacific, Caribbean, and Southeast Asia.

8. Conclusion

This paper examined how Nature-based Solutions can be mainstreamed and financed in the Siargao Island Protected Landscape and Seascape, a nationally protected and governance-complex small island system in the Philippines. The analysis showed that SIPLAS already possesses strong ecological assets and active conservation-related interventions, but these remain fragmented across institutions, dependent on short project cycles, and weakly integrated into formal planning. The major barriers are therefore governance fragmentation, unstable financing, and weak evidence systems — not a lack of ecological opportunity.

To address these constraints, this paper proposed a four-pronged mainstreaming framework centered on policy integration, cross-sectoral collaboration, phased financing diversification, and robust monitoring and evaluation. Financing options were organized into a phased architecture distinguishing what is immediately feasible from what requires institutional development: climate and conservation grants, user fees, and pilot PES schemes in the near term; PPPs and blended finance in the medium term; and green bonds and blue carbon-linked instruments in the longer term. This sequencing is critical as it helps practitioners and policymakers distinguish what is conceptually attractive from what is institutionally actionable.

This study is exploratory in nature, and its framework should be understood as a directional pathway rather than a prescriptive investment plan. Future work should deepen the empirical basis through ecosystem service valuation, blue carbon accounting, hazard and risk modeling, legal feasibility assessment, and participatory design of benefit-sharing systems. Even so, the governance-sensitive, phased, and evidence-grounded framework developed here offers a credible and transferable model for governance-complex small island protected areas seeking to move from fragmented conservation activity toward integrated and finance-ready NbS programming.

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