Annex B 1: Baseline Assessment for the Madi-Marsyangdi sub Landscape (MMSL) for ICCA GSI Phase 2

I. SUMMARY

The Madi-Marsyangdi sub Landscape (MMSL) represents a strategically crucial Indigenous Peoples and Community Conserved Area (ICCA) within the central Himalayan foothills of Nepal's Gandaki Province. This landscape encompasses 346 established Community Forests (CFs) spanning 30,637.42 hectares, managed by 28,379 households representing a population of 153,383 people. The MMSL's exceptional biodiversity—exemplified by the Rainas-Dudhpokhari sub-division hosting approximately 10% of Nepal's total wild species—positions it as a critical conservation priority aligned with the Kunming-Montreal Global Biodiversity Framework (GBF) Targets prioritized under ICCA-GSI Phase 2. Despite this institutional maturity and ecological significance, the landscape faces fundamental constraints that threaten both conservation objectives and community livelihoods. Human-Wildlife Conflict (HWC) represents the most severe barrier, imposing an annual financial burden of 70-80 lakh rupees in compensation payments in Rainas-Dudhpokhari alone. This reactive expenditure creates a perverse economic incentive where wildlife presence constitutes a net liability rather than an asset, driving retaliatory habitat degradation through tree cutting and bamboo removal near settlements. The strategic intervention pathway builds upon proven community-led successes within the landscape—particularly the Ghale Gaun ecotourism model and demonstrated HWC mitigation techniques in Madhya Nepal—to transform conservation from an economic burden into a sustainable livelihood foundation. This baseline assessment synthesizes findings across six sub-divisions (Marsyangdi, Beshisahar, Dordi, Rainas-Dudhpokhari, Sundar Bazar, and Madhya Nepal) to inform targeted investment under the ICCA-GSI Phase 2 framework, directly addressing mandatory GBF Targets 3, 21, 22, and 23.

2. GEOGRAPHIC CONTEXT

2.1. Landscape Definition

The Madi-Marsyangdi Sub Landscape is administratively distributed across seven municipalities within Gandaki Province: Madhya Nepal Municipality, Sundarbazar Municipality, Kwholasothar Rural Municipality, Rainas Municipality, Besishahar Municipality, Dordi Rural Municipality, and Marsyangdi Rural Municipality. The landscape encompasses a total area of approximately 485 square kilometers distributed across 47 administrative wards.

Table 1: *Summary of geographical coverage in Madi-Marsyangdi sub Landscape*

Municipality	Wards	Area (km²)	Population	Households	Forest Cover %
MadhyaNepal	10	111.67	28,500	6,200	45%
Besishahar	11	134.83	35,800	7,800	52%
Kwholasothar	9	94.22	22,300	4,850	58%
Sundarbazar	11	67.87	18,500	3,900	38%
Dordi	5	45.48	11,200	2,450	62%
Marsyangdi	2	23.53	5,800	1,250	55%
Rainas	2	20.05	4,600	980	48%
TOTAL	**47**	**~497**	**126,200**	**27,430**	**51%**

This landscape encompasses diverse ecological zones, from the high hills of the Mahabharat range to the fragile hills of the Siwalik. The landscape covers a total area of approximately 450 square kilometers across 47 wards in multiple municipalities. The landscape selected lies within the Chitwan Annapurna Landscape and include southern part of Annapurna Conservation Area (ACAP) and its buffer zone. The Madi and Marsyangdi Rivers are significant hydrological features of the landscape.

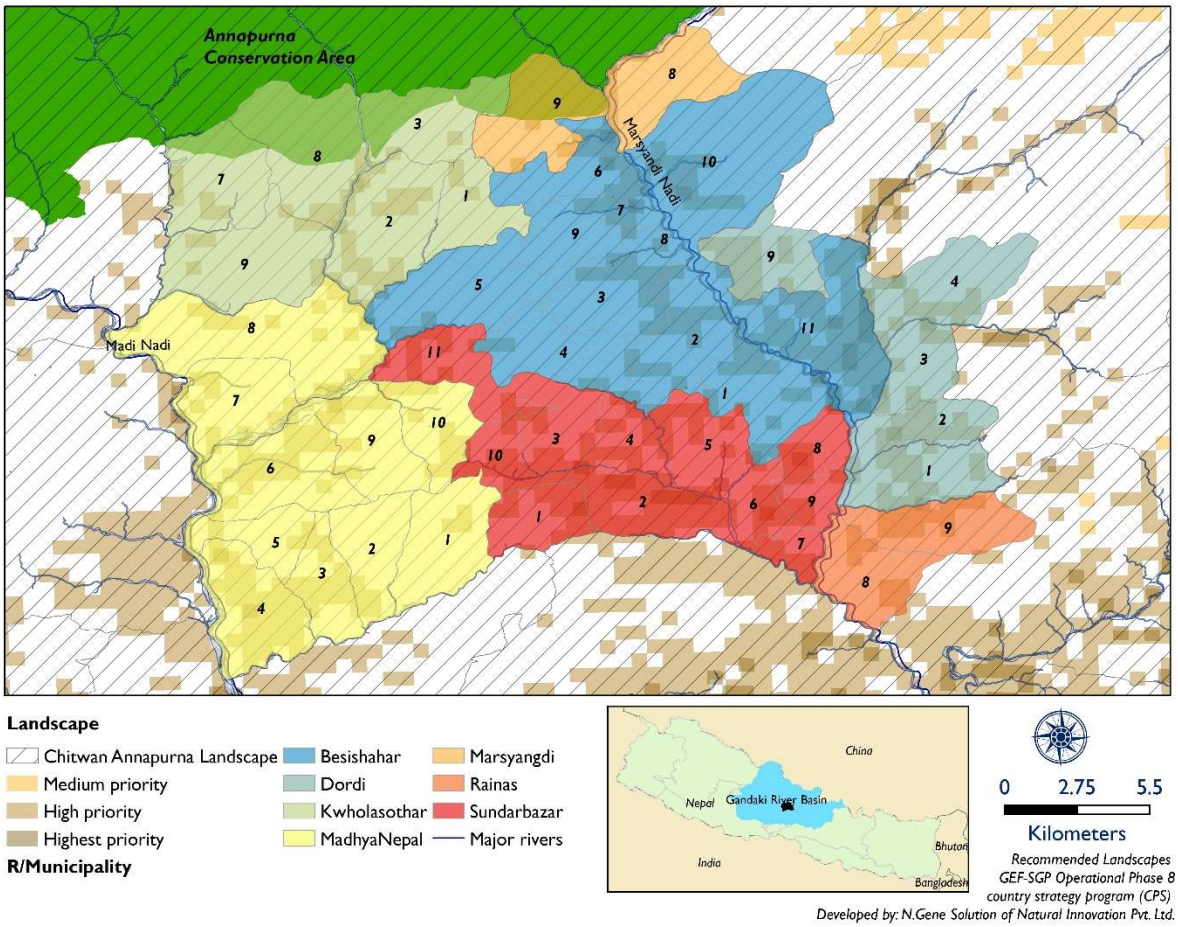

***Figure 1**: Map of Madi-Marsyangdi Landscape*

2.2. Topographic and Ecological Zonation

The MMSL exhibits dramatic vertical zonation ranges from approximately 370 to 2570m, a defining characteristic that fundamentally shapes ecological distribution, species movement corridors, and economic activities. Lower elevations, particularly concentrated in Madhya Nepal Municipality, are dominated by commercially valuable *Sal* (*Shorea robusta*) forests, and *Pine* (*Pinus roxburghii*) which generate substantial revenue through regulated timber extraction and resin collection. These lowland forests transition systematically into mid-elevation medicinal plant belts featuring high-value Non-Timber Forest Products (NTFPs) including *Chiraito* (*Swertia chirayita*), *Lauth Sallo* (*Taxus wallichiana*), and *Titepati* (*Artemisia indica*). This elevational gradient functions as

an ecological highway, facilitating adaptive species range shifts in response to climate variability—a critical natural resilience mechanism that must be maintained through strategic habitat corridor management. The gradient also creates distinct livelihood niches: lowland communities focus on *Sal*-based forestry and intensive agriculture, while mid-elevation settlements capitalize on medicinal plant harvesting and traditional agroforestry systems.

Table 2: *Ecological Assets and Priority Economic Focus*

Sub-Division	Key Ecological Asset	Dominant Economic Opportunity	Critical Challenge/Constraint
Beshisahar	Scientific management model, Biodiversity Hotspots (Marsyangdi-Meme Pokhari)	High-Value Crops (Timur, Macadamia, Satuwa), Integrated Livestock-crop	HWC, Need for Market Linkage Development
Sundar Bazar	Critical Water Provision (Kirenche Khola), Pollination Services	Honeybee keeping, Intensive Agriculture, Eco-tourism (Ward No. 2)	Critical Low Forest Area/HH (0.46 ha), Provincial/Local Governance Coordination Gap
Rainas-Dudhpokhari	Highest Biodiversity Concentration (10% Nepal species), Pangolin Habitat	Conservation-based tourism, Wildlife protection initiatives	Severe Financial Burden of HWC (70-80 lakhs), Illegal Wildlife Trade
Dordi	Traditional Industry Hub, Wild Honey Production	Traditional Industries (Lokta, Duna-tapari), Homestay Tourism	Crop Damage from Wildlife, Market Saturation Risk for Traditional Products
Madhya Nepal	Largest CF count, Saal/Medicinal Plant Zonation, Commercial Beekeeping Policy	Systematic Commercial Beekeeping, Agro-Biodiversity (Millet/raithane crops)	Climate Threats to Water, Market Failure in Intensive Agriculture (Bholretaar)

Hydrologically, the MMSL serves as a primary water tower for downstream populations. The landscape is defined by five major river systems: the Madi, Marsyangdi, Midim, Birdi, and Pisti rivers. These systems provide indispensable provisioning services (irrigation water, drinking water) and regulating services (flood control, sediment regulation). However, their stability is increasingly threatened by upstream land use changes and intensifying climate impacts, necessitating urgent watershed protection interventions aligned with GBF Target 3 objectives.

3. GEOLOGICAL PROFILE

3.1. Tectonic Framework and Landscape Instability

The Madi-Marsyandi Landscape (MMSL) is situated within the highly unstable Lesser Himalayan Sequence (LHS) of the Central Himalayas, an area characterized by a complex profile of older metamorphic and sedimentary rocks. This lithostratigraphic composition fundamentally governs the local slope stability and erosion patterns within the mid-hill region. The deepest and oldest component of this structure is the Crystalline Rock (Cr) unit, often referred to as the basement. This formation consists primarily of high-grade metamorphic rocks, including Gneisses, Schists, and Granites, which are the hardest in the sequence and often form the base of the highest hills in the LHS. Similarly resistant to erosion is the Ranimatta Formation, found in the middle to upper LHS, which is defined by a thick sequence of massive Quartzites. The hardness of these quartzites

often leads to the formation of steep, rugged topography and structural cliffs along the major river gorges.

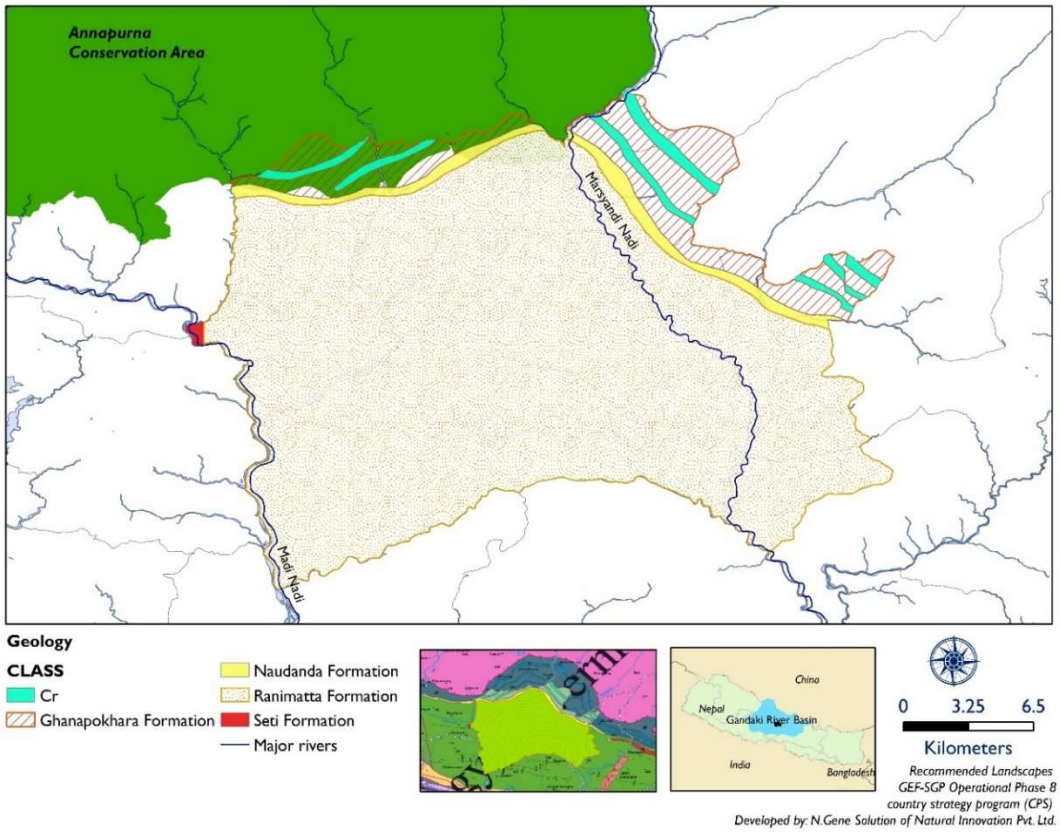

***Figure 2**: Geology of Madi-Marsyandi sub Landscape*

Interspersed with these resistant units are formations dominated by soluble or easily weathered rock types. The Ghana Pokhara Formation, located in the middle LHS, is characterized by Dolomitic Limestones and Quartzites. While the rock itself can be massive, the presence of dolomitic limestone makes this formation susceptible to karstification, where water dissolves the rock, leading to complex internal drainage and localized instability. Further up in the sequence, near the tectonic boundary with the Higher Himalaya, lies the Seti Formation, which is composed of a mix of Calcareous rocks (limestones and marbles) alongside dark Slates or Phyllites, also influencing local hydrology and fracturing near major contacts. The most crucial unit concerning geohazards is the Naudanda Formation, which sits lower in the Lesser Himalayan Sequence. Unlike the hard quartzites and massive limestones, the Naudanda Formation is predominantly composed of fine-grained, intensely foliated Phyllites and Slates with interbeds of thin quartzite. Because of its soft, layered nature, the Naudanda Formation is highly susceptible to weathering when saturated by monsoon rains, making it the major contributor to landslides and mass wasting within the mid-hill sections of the MMSL. All of these distinct geological units—from the ancient Cr basement to the Naudanda, Ghana Pokhara, Ranimatta, and Seti formations—are contained within the Lesser Himalayan Sequence. This entire structural package is bounded by the Main Boundary Thrust (MBT) to the south and the Main Central Thrust (MCT) to the north. The Main Central Thrust (MCT) represents the most critical tectonic lineament, just north to the selected

area of the MMSL. This major boundary fault separates the Lesser Himalayan metamorphic rocks (phyllites, quartzites) from the overlying High Himalayan Crystalline Sequence (high-grade gneisses and migmatites). The MCT zone is characterized by intense shearing, fracturing, and inherent instability, making it the primary driver of deep-seated landslides and accelerated erosion throughout the landscape. Infrastructure projects and community settlements located within or adjacent to the MCT zone face continuous geological hazards that must be addressed through bio-engineered slope stabilization interventions. The intense shearing, fracturing, and tectonic deformation that occurs along these two major thrust zones is the fundamental underlying reason for the extreme geohazard and slope instability profile observed throughout the MMSL.

3.2. Implications for Conservation and Development

The geological reality of the MMSL mandates that all conservation and development interventions incorporate geotechnical considerations. The fractured nature of rocks along the MCT and MBT zones amplifies the destructive effects of high-intensity monsoon rainfall, making conventional engineering solutions (concrete retaining walls) both prohibitively expensive and ecologically inappropriate. Instead, the project must prioritize bio-engineered slope stabilization using deep-rooted native species that can physically bind fractured rock surfaces while providing economic returns through NTFP production. The high sediment load generated by the geological instability creates both challenges and opportunities. While sediment transport threatens downstream water quality and increases flood risk, strategic sediment management interventions, including check dams and riparian buffer restoration, can simultaneously stabilize slopes, protect water sources, and create productive agroforestry zones. This integrated approach transforms a geological liability into a conservation and livelihood opportunity. Critical landslide zones, including the massive active landslide at Puwa ko Bhir near Puwakhola and the unstable slopes in Kwholasothar-7, require immediate emergency stabilization. These sites threaten both designated Community Forest areas and human settlements, representing acute risks to the CFs that constitute the MMSL's conservation foundation.

IV. COMMUNITY GOVERNANCE AND INSTITUTIONAL FOUNDATION

4.1. Community Forestry Framework and Resource Distribution

The institutional maturity of the MMSL represents its most significant strategic asset for implementing ICCA-GSI Phase 2 interventions. The landscape features 346 established Community Forests collectively managed by Community Forest User Groups (CFUGs), providing a stable governance foundation that eliminates the need for costly initial institutional establishment phases. This institutional coverage positions the MMSL as a pre-existing Territory of Life (ICCA) requiring enhanced management effectiveness rather than *de novo* establishment. However, resource distribution across the landscape exhibits extreme heterogeneity, necessitating sub-division-specific management strategies. The average forest coverage per household across the MMSL is approximately 1.08 hectares, but this aggregate figure masks critical disparities that fundamentally shape local resource management behavior and conservation priorities. The data reveal that resource scarcity is a more potent driver of innovation than resource abundance. Sundar Bazar, with the lowest ratio at 0.46 hectares per household, faces acute pressure that compels communities toward non-extractive, high-value

ecosystem service provision (water purification, pollination services) rather than timber extraction. This scarcity-driven innovation provides a compelling rationale for replicating low-impact, high-return economic models such as community-based ecotourism in similarly constrained areas. Conversely, Marsyangdi sub-division, with 2.72 hectares per household, demonstrates significantly lower utilization pressure and potentially greater capacity for large-scale silvicultural interventions, biodiversity refuge establishment, and carbon sequestration initiatives aligned with GEF Core Indicator 6.1 targets.

Table 3: *Community Forestry Status and Resource Pressure across MMSL Sub-Divisions*

Sub-Division	No. of CFs	Area (ha)	No. of Households	Forest Area per HH (ha)
Marsyangdi	26	5,648.85	2,077	2.72
Beshisahar	68	6,187.55	6,298	0.98
Dordi	42	4,873.71	3,859	1.26
Rainas-Dudhpokhari	74	5,508.07	6,552	0.84
Sundar Bazar	54	1,664.66	3,655	0.46
Madhya Nepal	82	6,754.58	5,938	1.14
Total MMSL	**346**	**30,637.42**	**28,379**	**1.08**

4.2. Indigenous Peoples and Traditional Ecological Knowledge

The MMSL is inhabited by diverse Indigenous Peoples and local communities (IPLCs) whose Traditional Ecological Knowledge (TEK) forms the foundation of sustainable resource management. The landscape encompasses significant cultural diversity, including Gurung, Newar, and Kumal communities, whose traditional practices have maintained ecosystem integrity across generations. The demonstrated capacity of Women CFUGs in Rainas represents a critical project asset. These groups have successfully implemented effective silviculture practices, reversing forest degradation through techniques combining local knowledge with technical support. This proven capacity provides an established mechanism for fulfilling GBF Target 23 commitments on gender equality while simultaneously achieving measurable ecological improvements across the CFs. The conservation of 22 varieties of indigenous (*raithane*) millet in Madhya Nepal demonstrates active, living TEK that serves as an established climate adaptation strategy. These drought-resistant varieties provide food security against abnormal rainfall patterns while preserving crucial genetic diversity, a direct contribution to GBF Target 21 on traditional knowledge integration. The high documented willingness of Rainas communities to participate in Pangolin conservation provides an immediate, high-impact entry point for co-designing anti-poaching and community based habitat protection measures. This community support validates the potential for flagship species conservation to drive broader landscape-level protection while generating tangible benefits that offset HWC costs.

V. BIODIVERSITY ASSETS AND ECOSYSTEM SERVICES

5.1. Species Richness and Conservation Significance

The MMSL serves as a critical ecological corridor connecting lowland *Sal* forests with high-altitude ecosystems of the Annapurna Conservation Area Project (ACAP), forming the northern boundary. This connectivity maintains elevational migration routes for climate-sensitive species

and genetic flow across fragmented habitats. The Rainas-Dudhpokhari sub-division hosts approximately 10% of Nepal's total wild species, confirming the MMSL's status as a high-priority biodiversity landscape. Flagship species include Red Panda (*Ailurus fulgens*), Himalayan Black Bear (*Ursus thibetanus*), Common Leopard (*Panthera pardus*), Himalayan Monal (*Lophophorus impejanus*), and critically, confirmed habitat for the Indian Pangolin (*Manis crassicaudata*)—one of the world's most illegally traded mammals. Recent assessments document three rescue incidents, multiple photographic records, and three confirmed burrows, providing an immediate flagship species for mobilizing targeted habitat protection. The MMSL encompasses six distinct ecosystem types: (1) Lowland Sal-Dominated Broadleaf Forests (300-1,200m) harboring Common Leopard, and Pangolin; (2) Mid-Montane Mixed Broadleaf Forests (1,200-2,500m) supporting Himalayan Black Bear and declining indicator bird species; (3) Temperate Oak-Rhododendron Forests (>2,000m) adjacent to ACAP boundaries harboring Red Panda; (4) Riverine ecosystems supporting endemic fish species; (5) Sacred Groves functioning as genetic refugia; (6) ACAP Buffer Zone Interface requiring coordinated management for wildlife corridors. Despite species richness, the landscape exhibits concerning ecological stress signals: declining populations of indicator birds (*Gauthali, Sarute*) and vultures suggest underlying chronic stressors, while emergence of new reptile species (*krait, cobra*) indicates rapid ecological perturbation. This necessitates dual conservation strategy: flagship species protection complemented by broader landscape health monitoring through Citizen Science models engaging CFUGs in systematic data collection.

5.2. Ecosystem Services Valuation

The MMSL's forests generate diverse provisioning services including high-value NTFPs: *Satuwa* (*Paris polyphylla*) commanding premium international prices, Macadamia nuts representing emerging agroforestry opportunity, and *Timur* (Szechuan pepper) providing reliable income through low-impact harvesting. Wild honey production, centralized in Dordi and formalized in Madhya Nepal through commercial beekeeping frameworks, demonstrates institutional readiness for scaling apiculture-based livelihoods. Regulating services represent the most critical functions supporting regional stability. Sundar Bazar's Community Forests function as "water towers" protecting *Kirenche Khola* system providing drinking water for thousands of households facing acute resource scarcity. Pollination services from honeybee populations support large-scale mustard production, generating positive externalities far exceeding direct honey harvest value. This creates compelling rationale for developing Landscape-Level Payment for Ecosystem Services (PES) Framework monetizing and rewarding CFUGs maintaining forest cover essential for water security and pollination.

VI. BARRIERS TO SUSTAINABLE MANAGEMENT

6.1. Human-Wildlife Conflict

HWC represents the fundamental barrier to conservation acceptance and sustainable development. The financial dimension is catastrophic: 70-80 lakh rupees distributed annually solely for wildlife damage compensation in Rainas-Dudhpokhari. This massive reactive expenditure represents opportunity cost that could otherwise fund proactive conservation programs generating economic returns rather than merely compensating losses. The current compensation system creates perverse incentives: wildlife presence imposes net costs without

proportional benefits, making conservation an economic liability. Crop damage from monkeys, spotted deer, porcupines, combined with livestock predation by leopards, drives the rational but ecologically detrimental response of cutting trees and removing bamboo near settlements. This retaliatory habitat degradation creates negative feedback: localized destruction intensifies resource competition and habitat fragmentation, potentially increasing future HWC incidents. The OP 8 strategy's central theory of change must pivot on shifting financial liability toward proactive preventative strategies transforming wildlife coexistence from cost center to economic opportunity through ecotourism, conservation payments, and habitat-based livelihood models.

6.2. Governance Fragmentation and Market Failure

Lack of effective vertical coordination between provincial and local governmental bodies constitutes critical institutional bottleneck, producing demonstrably poor outcomes exemplified by misalignment in Sundar Bazar's fruit plantation initiatives. Resolving this systemic gap is prerequisite for long-term project sustainability. Without policy integration and shared planning, successful local projects cannot secure necessary public funding or regulatory support for scaling. Economic efforts are constrained by classic market failure. The Bholretaar commercial agriculture hub generates substantial output yet producers cannot realize proportional benefits due to inadequate market infrastructure, price volatility, and lack of processing facilities. Investment must focus on vertical value chain completion—processing facilities, cold storage, quality standards, producer cooperatives—rather than merely increasing production volume.

6.3. Climate Change and Geological Hazards

Abnormal rainfall patterns disrupt traditional agricultural systems, necessitating immediate adaptation through drought-resistant *raithane* millet promotion. Increased crop diseases suggest changing temperature and humidity regimes creating new challenges. Overlaying climatic threats are severe geological hazards including massive active landslides at Puwa ko Bhir and Kwholasothar-7 posing immediate risks to CF areas and settlements, requiring emergency stabilization and long-term risk management integrating bio-engineered solutions.

VII. STRATEGIC INTERVENTION PATHWAYS

7.1. Component 1: HWC Mitigation and Habitat Security

Habitat Modification and Resilient Agroforestry: Systematically scale planting of monkey-resistant tree species (*Chiuri, Bar, Pipal, Chilaune*) in critical human-wildlife interface zones across Rainas and Madhya Nepal. These species reduce foraging incentives while maintaining essential canopy cover for watershed protection and carbon sequestration, transforming retaliatory tree-cutting into conservation practice.

Pangolin Flagship Initiative and Community Monitoring: Elevate Indian Pangolin as flagship species for Rainas corridor. Establish community-based wildlife monitoring network utilizing Citizen Science model generating real-time data on species behavior, habitat use, and threats, informing early warning systems and increasing local coexistence capacity. This directly

contributes to GBF Target 3 by enhancing management effectiveness across area hosting 10% of Nepal's species.

Multipurpose Conservation Infrastructure: Establish multipurpose conservation ponds providing stable alternative water sources for wildlife, reducing settlement incursions while serving multiple functions: HWC mitigation, aquatic biodiversity support, irrigation provision, and integrated aquaculture-based livelihood opportunities.

7.2. Component 2: ICCA-Led Economic Diversification

Community-Owned Ecotourism Replication: Replicate Ghale Gaun homestay model in Dordi (leveraging traditional industries) and Sundar Bazar Ward 2 (leveraging Newar/Kumal heritage). This low-impact strategy monetizes cultural assets, directly incentivizing environmental stewardship while providing viable pathways for resource-scarce areas, capitalizing on authentic experiences rather than requiring heavy capital investment.

NTFP and Agro-Biodiversity Value Chain Development: Complete value chains for high-value products through technical training, processing infrastructure grants (drying, grading, packaging), and formal market linkages for *Satuwa*, *Timur*, and systematic beekeeping. Fully fund promotion of 22 indigenous *raithane* millet varieties strengthening TEK and building climate adaptive capacity, directly fulfilling GBF Target 21 requirements.

Women-Led Enterprise Development: Direct strategic support toward scaling Women CFUGs' proven roles through specialized training in silviculture, NTFP processing, and enterprise management, alongside preferential small grant access for women-led cooperatives. This addresses GBF Target 23 while linking gender equity to measurable ecological improvements.

7.3. Component 3: Institutional Strengthening and Policy Mainstreaming

Inter-Governmental Coordination Mechanism: Establish formal mandatory platform bringing together provincial/local government representatives, CFUG federations, and technical agencies to align planning cycles, budget allocation, and program implementation, resolving systemic coordination failures and ensuring ICCA priorities are mainstreamed into regional development plans.

ICCA Self-Strengthening Process: Initiate mandatory process utilizing Resilience and Security Index (RSI) tool establishing validated baseline score for socio-ecological health and governance of 30,637-hectare CF estate, enabling data-driven adaptive management. RSI assessment serves as required baseline for ICCA-GSI Phase 2 Indicator 11 and tracking framework for all four mandatory GBF Targets.

Payment for Ecosystem Services Framework: Develop Landscape-Level PES mechanism focusing initially on *Kirenche Khola* water system in Sundar Bazar, institutionalizing long-term financial rewards for CFUGs maintaining forest cover essential for water security, creating self-

sustaining conservation financing addressing acute resource scarcity while ensuring critical regulating services.

VIII. TARGETTED OUTCOMES: ACHIEVE ICCA-GSI PHASE 2 INDICATORS

8.1. Global Biodiversity Framework Indicators

GBF Target 3 (Conservation and Protection)

Approximately 3,064 hectares (10% of 30,637.42-hectare CF estate) will be placed under enhanced management through ICCA Self-Strengthening Process. This strategic 10% represents highest-priority zones including confirmed Indian Pangolin habitat in Rainas, critical Red Panda corridors in upper Marsyangdi, and sacred groves functioning as biodiversity stepping stones.

Table 4: *Priority Species for Conservation*

Species	Status	Primary Habitat	Major Threats	Conservation Action
Indian Pangolin	Endangered	Lowland Sal forests	Illegal trade, habitat loss	Flagship protection, community monitoring, anti-poaching
Red Panda	Endangered	Upper temperate/ACAP buffer	Fragmentation, climate change	Corridor protection, bamboo conservation
Himalayan Black Bear	Vulnerable	Mid-montane to upper forests	HWC, habitat degradation	Habitat modification, HWC mitigation
Common Leopard	Vulnerable	All forest zones	HWC, retaliatory killing	Coexistence programs, livestock insurance
Himalayan Monal	Least Concern	Upper forests/ACAP buffer	Habitat loss, disturbance	Habitat protection, sacred grove conservation
Vulture species	Critically Endangered	All zones	Veterinary drug poisoning	Diclofenac ban enforcement, safe feeding

GBF Target 21 (Traditional Knowledge and Sustainability)

Scale 22 indigenous *raithane* millet varieties (*Kodo*, *Kaguno*, *Jhangar*) traditionally cultivated in Madhya Nepal Wards 4-5 representing climate-resilient food security strategy. Formalize traditional silviculture practices demonstrated by Women CFUGs through technical documentation and training curricula. Promote traditional agroforestry systems integrating *Chiuri* for oil/soap production, *Timur* for spice, and fodder trees maintaining forest structure while generating income.

Support wild honey (cleft honey) harvesting in Dordi using traditional cliff-hunting techniques through safety equipment and market linkages. Support traditional craft industries including *Duna-tapari* production, Lokta paper making, and musical instrument crafting through technical upgrading and brand development. Transition medicinal plant collection to managed sustainable extraction based on traditional ecological calendars.

Document TEK through video ethnography and community knowledge banks. Establish elder-youth mentorship programs pairing experienced Women CFUG members (60+) with young

women (18-30) in structured silviculture apprenticeships. Integrate local ecological knowledge into school-based biodiversity education modules.

Table 5: *Ethnicity, Traditional Knowledge, and Resource Use in MMSL*

Ethnic Group	Settlement Areas	Traditional Livelihoods	Key TEK Practices	Sacred Sites	ACAP Interface Role
Gurung	Ghale Gaun, Bhujung, upper Marsyangdi	Transhumant pastoralism, millet cultivation, honey hunting	*Ghyangdi* weaving, log hive beekeeping, veterinary medicinal plants	*Lhakhang* monasteries, *Chorten* stupas, sacred caves	Primary ecotourism hosts, ACAP buffer stewards
Newar	Sundar Bazar Ward 2, Beshisahar	Trade, agriculture, crafts	*Jatra* festival ecology, traditional stone/wood architecture	Akalamai religious forest, *Ganesh* shrines	Urban-rural linkage, market networks
Kumal	Sundar Bazar (riverine), lower Madi	Pottery, fishing, gold panning	River ecology knowledge, clay assessment, fishing calendars respecting breeding	River confluence (*sangam*), clay deposits	Riparian ecosystem monitors, artisan crafts
Tamang	Dordi, Rainas mid-hills	Agriculture, Lokta paper, Buddhist practices	Lokta sustainable harvesting, traditional fire management	Sacred groves (*ban devta*), meditation caves	NTFP sustainable harvesters, fire management
Brahmin/ Chhetri	All sub-divisions (mixed)	Agriculture, animal husbandry, government service	Ayurvedic medicinal plants, *raithane* crop conservation	*Devsthan* deity groves, *Peepal-Bar* sacred trees	Agricultural innovation, formal governance interface

GBF Target 22 (Participation in Decision-Making)

IPLCs in Decision-Making: Community co-design of HWC mitigation strategies engaging affected households in selecting and siting interventions ensuring cultural appropriateness and local ownership. Develop Pangolin, Vulture and other small animal conservation protocols through participatory workshops integrating local knowledge of behavior, habitat preferences, and threat dynamics with scientific monitoring.

National Strategic Documents Incorporating ICCAs: Support explicit integration of MMSL ICCA priorities into Gandaki Province Biodiversity Conservation Strategy, Climate Change Adaptation Plan, and Land Use Planning Framework, ensuring provincial budget allocations, regulatory enforcement, and development planning recognize CFs as essential conservation infrastructure.

Management Plans Updated: Systematically revise all 346 CFOPs to incorporate: (1) Wildlife corridor protection identifying and securing habitat connectivity zones for priority species movements toward ACAP boundaries; (2) Climate adaptation measures including drought-resistant crops, water source protection, and landslide risk management informed by geological

vulnerability mapping; (3) Gender-responsive governance specifying minimum 40% women's representation in executive committees and explicit recognition of Women CFUGs' technical expertise.

GBF Target 23 (Gender Equality and Women's Empowerment)

Women-Led Projects: Minimum 40% of enterprise development grants allocated to women-led cooperatives and Women CFUGs, with preferential scoring for enterprises demonstrating explicit women's economic empowerment strategies. Women-led initiatives receive enhanced technical support including mushroom and NTFPs cultivation in CFs, business planning, financial literacy, and mentorship from successful women entrepreneurs. Priority sectors include NTFP processing, ecotourism services, and nursery operations.

Women Representatives Receiving Capacity Strengthening: Provide comprehensive capacity strengthening to 1,800 women across multiple domains: (1) Advanced silviculture training with formal certification recognized by District Forest Offices; (2) NTFP processing and quality control enabling value addition through drying, grading, packaging, and brand development; (3) Enterprise management covering bookkeeping, cooperative governance, marketing, and negotiation skills; (4) Biodiversity monitoring training in Citizen Science protocols enabling women to serve as community-based para-ecologists. Formal certification recognizes women's expertise and positions them for leadership in forest governance and natural resource management institutions.

7.2. Socio-Economic Benefit Indicators

SEI 1: Direct Beneficiaries with Improved Livelihoods (Gender Disaggregated) - Target 3,500 households (12% of 28,379 total), including ecotourism enterprises (400 households in replication sites), NTFP cooperatives (ca. 300 households for *Timur*, *Satuwa*, honey), systematic beekeeping (200 households in Madhya Nepal/Dordi), and households receiving HWC mitigation benefits (1,300 households in Rainas/Dordi high-conflict zones). Gender disaggregation tracks women-headed households (estimated 35% of beneficiaries) ensuring equitable distribution.

SEI 2: Youth Beneficiaries (Gender Disaggregated) - Target 800 youth (18-35 years) through (1) Enterprise development providing seed capital, technical training, and mentorship for youth-led startups in ecotourism, digital marketing, and innovative processing; (2) Biodiversity monitoring training youth as Citizen Scientists using mobile applications, camera traps, and community-based research partnerships; (3) Technical training offering formal certification in agroforestry, silviculture, NTFP processing, and eco-guide services enhancing employability. Ensure gender parity with minimum 45% participation by young women.

SEI 3: Indirect Beneficiaries (Gender Disaggregated) - MMSL population benefits through (1) Enhanced water security for downstream communities through improved watershed protection, particularly Sundar Bazar's 3,655 households relying on *Kirenche Khola*; (2) Reduced HWC through landscape-level habitat modification; (3) Improved pollination services supporting

mustard production across 2,000+ hectares; (4) Climate resilience from scaled *raithane* millet cultivation; (5) Cultural/spiritual benefits from enhanced sacred grove protection.

SEI 4: Increase in Livelihoods (Quantified Economic and Food Security Outcomes):

HWC Compensation Cost Reduction: Achieve 50% reduction from 70-80 lakhs annually to 35-40 lakhs in Rainas-Dudhpokhari. Redirect 35-40 lakh savings toward: (1) Community enterprise development fund providing small grants (50,000-200,000 rupees) for NTFP processing equipment, ecotourism infrastructure, and cooperative working capital; (2) Technical capacity building programs; (3) Habitat modification interventions addressing root causes rather than compensating damages.

Household Income Increase: Direct beneficiary households achieve average 25% income increase through diversified portfolios: (1) NTFP value chains from *Timur* (NPR300-400/kg), *Satuwa* (NPR 3,000-4,000/kg), wild honey (NPR 400-600/kg), mushrooms (NPR 400-800/kg); (2) Ecotourism homestays during 6-month season; (3) Agroforestry systems providing sustained income from fodder sales, fruit production, and tree-mushroom system.

Enhanced Food Security: Increased *raithane* crop production and diversity improves household food security through: (1) Extended food availability with drought-resistant millets providing staples during monsoon failures; (2) Nutritional diversity with traditional varieties providing higher micronutrient content; (3) Reduced market dependency with household grain self-sufficiency increasing from 6-7 months to 9-10 months annually; (4) Seed sovereignty through community seed banks eliminating external dependency and preserving climate-adapted genetic diversity.

IX. CONCLUSION AND SUSTAINABILITY PATHWAY

The Madi-Marsyangdi Landscape presents a unique synthesis of mature community-based resource management (346 CFs over 30,637 ha), exceptional biodiversity value (10% of Nepal's species), and demonstrated models for economic transformation (Ghale Gaun ecotourism, Women CFUG silviculture). The strategic intervention pathway transforms conservation from a net liability into a sustainable economic asset by: (1) redirecting reactive compensation expenditures toward proactive habitat modification and flagship species protection; (2) completing critical value chains for NTFPs and cultural tourism that generate returns exceeding HWC costs; and (3) establishing institutional mechanisms (Inter-Governmental Coordination, PES Framework) that ensure long-term sustainability beyond project timelines. Project sustainability will be anchored through institutionalizing a "learning loop"—the continuous use of ecological and economic data from RSI assessments and Citizen Science monitoring to adaptively adjust strategies. The development of a Landscape-Level PES Framework for critical regulating services (e.g. *Kirenche Khola* water system) will create self-sustaining conservation financing that rewards CFUGs for maintaining forest cover essential for regional stability. This comprehensive, adaptive, and community-owned approach positions the MMSL as a globally recognized model for Community-Based Natural Resource Management in challenging Himalayan environments, delivering substantial and measurable Global Environmental Benefits aligned with all four mandatory GBF Targets under ICCA-GSI Phase 2.