Community Development and Knowledge Management for Satoyama Initiative (COMDEKS) - Phase 4

COMDEKS - Phase 4 Landscape Strategy for Nepal (2025-2026)

Summary

Nepal's COMDEKS Country Programme Landscape Strategy includes the Lower Tamor Landscape, a globally significant biodiversity hotspot spanning 397 km² across Terhathum, Dhankuta, and Sunsari districts in Eastern Nepal, facing critical conservation and development challenges. This landscape represents an exceptional Socio-Ecological Production Landscape and Seascape (SEPLS) featuring dramatic elevation gradients (100m-3000m) that support twelve distinct forest types, Nepal's largest rhododendron gene pool, and critical wildlife corridors connecting Terai lowlands with Mountainous landscapes. Key challenges include increasing human-wildlife conflict causing 30-50% seasonal crop losses, climate change impacts including drying springs, loss of traditional knowledge and practices, and youth out-migration undermining local conservation capacity. To meet these challenges, the strategy identifies three primary outcome areas: (1) restoration of degraded biodiversity and ecosystem services through multi-functional land-use systems and traditional ecological knowledge systems, (2) improvement of livelihoods through ecologically sound income-generating activities, and (3) strengthening of robust governance systems for participatory landscape management. The strategy recommends community-based interventions to address human-wildlife conflict, sustainable agriculture intensification, ecosystem restoration, and livelihood diversification while integrating traditional ecological knowledge with modern conservation approaches, built on indigenous community leadership, gender equality, and multi-stakeholder coordination across federal, provincial, and local governance levels. Expected impacts include enhanced biodiversity conservation, improved food security, reduced rural poverty, and strengthened community resilience to climate change.

1. Background

Satoyama Initiative

The term 'Satoyama' refers to traditional Japanese rural landscapes where high levels of biodiversity have been conserved in habitats shaped through interactions between people and nature over many years. These are production landscapes primarily focused on producing various goods to sustain human livelihoods, traditionally formed through agricultural activities and forest resource management based on high self-sufficiency and direct dependence on local natural resources. The Satoyama Initiative emerged from recognition that traditional rural landscapes

represent critical solutions to contemporary sustainability challenges[1]. Almost 30 years after the concept of 'sustainability' became widely recognized, the issues such as exploitation of natural resources and land degradation continue to remain as challenge to sustainability of rural landscapes. Climate change, population growth, and conventional production systems based on scale expansion and functional separation create significant sustainability questions.

In Satoyama landscapes, the relationship between people and nature is formed through measures to control overuse of natural resources by responding to feedback signals directly and finding sustainable ways for people to receive nature's bounty. The concept recognizes that for conservation of healthy ecosystems in production landscapes, neither overuse nor underuse of natural resources is appropriate - rather, a balance must be maintained built on healthy relationships between people and nature. The Satoyama Initiative, launched by the Government of Japan in collaboration with the United Nations University, promotes Socio-Ecological Production Landscapes and Seascapes (SEPLS) as integrated systems where sustainable resource management practices maintain biodiversity while supporting local livelihoods and cultural heritage. The term 'social-ecological system' reflects understanding that social and ecological systems are interrelated and indivisible, broadening perspectives of natural resource management that had viewed people and nature separately.

Need for COMDEKS Landscape

Responding to contemporary conservation and development challenges require integrated landscape approaches addressing multiple interconnected problems simultaneously. Traditional sectoral approaches often fail to account for ecosystem service flows that cross administrative boundaries, while climate change impacts manifest at landscape scales through altered precipitation patterns affecting multiple sectors. The Community Development and Knowledge Management for the Satoyama Initiative (COMDEKS) addresses these challenges by channeling small-scale financial resources directly to Indigenous Peoples and Local Communities (IPLCs) and community-based organizations. COMDEKS Phase 4 (2022-2026) strategically catalyzes integrated local actions contributing to implementation of the Kunming-Montreal Global Biodiversity Framework (K-MGBF).

The COMDEKS Lower Tamor Landscape Strategy directly aligns with GEF-8 Biodiversity Focal Area priorities, particularly objective 1: "Mainstream biodiversity across sectors as well as landscapes and seascapes" and objective 2: "Reduce threats to biodiversity and enhance resilience of ecosystems." These priorities directly support implementation of the K-MGBF, specifically contributing to Target 1 (ensuring all areas are under participatory, integrated, and biodiversity-inclusive spatial planning), Target 3 (conserving 30% of terrestrial areas through protected areas and other effective area-based conservation measures), Target 9 (ensuring sustainable use of wild species), Target 11 (restoring degraded ecosystems), and Target 23 (ensuring gender equality in biodiversity conservation). The landscape approach inherently addresses the K-MGBF's emphasis on recognizing IPLCs as key partners in biodiversity conservation. The Lower Tamor strategy specifically empowers indigenous communities including Rai, Limbu, and Majhi peoples to lead conservation efforts. The strategy's focus on SEPLS directly operationalizes the K-MGBF's vision

[1] Takeuchi K, Ichikawa K, Elmqvist T (2016) Satoyama landscape as social-ecological system: historical changes and future perspective. Curr Opin Environ Sustainability 19:30–39

of "living in harmony with nature" by 2050, demonstrating how traditional knowledge systems and community-based management can achieve both biodiversity conservation and sustainable development goals simultaneously.

Nepal presents exceptional opportunities and challenges for landscape-level interventions. Occupying only 0.1% of global land mass, Nepal contains 118 ecosystems with 75 vegetation types harboring over 3.2 percent and 1.1 percent of the world's known flora and fauna, respectively. This includes 5.2 percent of the world's known mammals, 9.5 percent birds, demonstrating remarkable biodiversity within human-influenced landscapes[2]. However, Nepal ranks among the world's most climate-vulnerable countries with temperature increases of 0.056°C per year and significant precipitation variability[3]. Rural poverty, youth out-migration, and limited livelihood diversification create pressures for unsustainable resource extraction. An estimated 3.16 million hectares (11.81% of Nepal's total area) have been affected by degradation processes, with expansion of unproductive forest lands and 10% of agricultural land seriously degraded. The landscape approach provides frameworks for addressing these complex challenges through spatially coordinated interventions that enhance synergies while minimizing trade-offs between different land uses and stakeholder objectives.

The Strategy demonstrates strong alignment with Nepal's comprehensive national policy framework for biodiversity conservation and climate action. The strategy directly supports Nepal's National Biodiversity Strategy and Action Plan (NBSAP) 2025-2030 revision process by implementing landscape-level approaches that integrate Indigenous Peoples and Local Communities as central actors in biodiversity conservation, consistent with the NBSAP's emphasis on participatory conservation and traditional knowledge integration. The programme's focus on ecosystem restoration, sustainable agriculture, and community-based forest management directly contributes to Nepal's National Climate Change Policy (2019) objectives of building climate-resilient societies, enhancing adaptation capacity, and promoting green economy development through low-carbon emission pathways. Specifically, the strategy supports Nepal's commitment to achieve net-zero emissions by 2045 and maintain 45% forest cover by 2030 through community-based forest restoration, agroforestry initiatives, and alternative energy systems that reduce dependency on fossil fuels while enhancing carbon sequestration.

The strategy's emphasis on watershed management and spring revival aligns with Nepal's National Adaptation Plan (2021-2050) priority sectors of agriculture, forestry, and water resources, while the focus on human-wildlife conflict mitigation and sustainable livelihoods directly addresses climate vulnerability challenges identified in Nepal's nationally determined contributions. Furthermore, the programme's decentralized implementation approach leverages Nepal's federal governance structure established by the 2015 Constitution, empowering local governments to integrate landscape management into their periodic and annual development plans as mandated by the Local Government Operation Act (2017), thereby institutionalizing community-based conservation within formal governance systems.

[2] MOFSC (2014) Nepal National Biodiversity Strategy and Action Plan 2014-2020. Government of Nepal, Ministry of Forests and Soil Conservation, SInghadurbar, Nepal.
[3] Government of Nepal (2021) National Adaptation Plan of Nepal. Singhdurbar, Kathmandu Nepal.

Methodology for Selection of COMDEKS Landscape

A comprehensive GIS-based Multi-Criteria Analysis (MCA) was used to systematically identify priority landscapes for COMDEKS Phase 4 implementation in Nepal. The methodology integrated diverse biophysical, socio-economic, and ecological factors across five systematic steps designed to balance ecological significance with community engagement feasibility.

Step 1: Data Acquisition and Preparation involved collecting spatial datasets across three categories: biophysical factors (elevation, river networks, land cover, soil characteristics, bioclimatic zones), socio-economic factors (population density, infrastructure, human footprint index), and conservation-specific factors (protected areas, biodiversity hotspots, traditional knowledge regions). All datasets were standardized to 500-meter resolution in UTM Zone 45N coordinate system to ensure analytical consistency.

Step 2: Criteria Development and Standardization transformed raw spatial data into actionable criteria using a 1-9 scale where higher values indicated greater suitability for COMDEKS intervention. The methodology strategically prioritized areas with moderate human footprint, recognizing that pristine wilderness areas may be less suitable for community-based projects due to access issues, while heavily impacted areas present significant restoration challenges. This approach targets optimal conditions where community engagement is feasible while maintaining substantial conservation value.

Step 3: Weighting and Aggregation employed equal weighting (10% each) across ten criteria: annual rainfall, slope, human footprint index, elevation, soil pH, temperature, potential evapotranspiration, global environmental stratification, land use/land cover, and distance from rivers. A weighted sum model[4,5] calculated composite suitability scores for each 500m spatial grid across Nepal, using the mathematical expression:

Prioritization = $\sum (w_i \times f_i(x))$. Where: 'i' ranges from 1 to 'n', 'n' is the number of factors, 'w_i' is the weight assigned to the i-th factor, and '$f_i(x)$' is the value of the i-th factor function for a given input 'x'.

Step 4: Landscape Identification and Prioritization established priority thresholds classifying areas into Highest Priority (≥8.5), High Priority (8.0-8.5), Moderate Priority (7.5-7.99), and Low Priority (<7.5). Spatial aggregation identified contiguous areas with minimum 200 km² size, considering natural boundaries and administrative divisions to ensure functional ecological units.

Step 5: Validation and Refinement involved field visits and stakeholder workshops to ground-truth GIS-derived priorities. The Tamor Landscape was selected for comprehensive field validation following consultation with UNDP GEF-SGP personnel, demonstrating highest

[4] Darji, K., Patel, D., Vakharia, V. et al. Watershed prioritization and decision-making based on weighted sum analysis, feature ranking, and machine learning techniques. Arab J Geosci 16, 71 (2023). https://doi.org/10.1007/s12517-022-11054-w

[5] Williams, A., Cai, Y. Insights into Weighted Sum Sampling Approaches for Multi-Criteria Decision Making Problems. Department of Mathematics, London School of Economics and Political Science, London. (2025). https://doi.org/10.48550/arXiv.2410.03931

suitability scores and exceptional convergence of ecological significance, cultural diversity, and conservation urgency. This landscape exemplifies a Socio-Ecological Production Landscape and Seascape (SEPLS) where human communities and natural environments present both significant challenges and substantial opportunities for sustainable development. About 400km² landscape spans parts of Terhathum, Dhankuta, and Sunsari districts, featuring dramatic elevation gradients from 100m to 3000m that create diverse climatic zones from tropical to moist temperate. This unique geography supports twelve distinct forest types and functions as a critical wildlife corridor connecting Terai lowlands with eastern Himalayas.

2. The Lower Tamor Landscape

Landscape Description and Boundaries

The Lower Tamor Landscape in Eastern Nepal, strategically positioned across parts of Terhathum, Dhankuta, and Sunsari districts encompasses 397 km² area. The landscape is defined by the Tamor River basin and its tributaries, featuring dramatic altitudinal variations from approximately 100m in the southern Terai to 3000m in the northern hills. This elevation gradient creates diverse climatic zones from tropical to moist temperate, supporting exceptional biodiversity and complex socio-ecological systems. Administrative coverage prioritizes specific municipalities and wards: LaliGurans Municipality (wards 1, 3, 6, 7, 8, 9) and Chhathar Rural Municipality (wards 2, 3, 4, 5, 6) in Terhathum; Chhathar Jorpati Rural Municipality (wards 3, 4, 5), Dhankuta Municipality (wards 8, 9), Shahidbhumi Rural Municipality (wards 1, 7), and Sangurigadhi Rural Municipality (ward 10) in Dhankuta; and Barahakshetra Municipality (wards 1, 2) in Sunsari.

Stakeholder Characteristics and Socio-Economic Context

The landscape supports approximately 55,000 people across selected wards, with rural populations experiencing demographic transitions including youth out-migration and aging communities. Population density varies significantly, showing population decline (-0.78% in Dhankuta, -1.3% in Terhathum) while urban areas experience modest growth. Indigenous people and local communities (IPLCs) including Rai, Limbu, Majhi, Gharti/Bhujel, and others represent the majority population, practicing traditional ecological knowledge systems and customary resource management. These communities demonstrate strong cultural connections to natural resources through practices such as community forestry, traditional fishing methods, and medicinal plant knowledge. Land tenure systems combine individual ownership, community management through Community Forest User Groups (CFUGs), and traditional communal systems among indigenous groups. Agricultural holdings are predominantly small-scale (average 0.5-2 hectares) with mixed crop-livestock systems dependent on rain-fed agriculture. Poverty levels remain significant, with limited livelihood diversification beyond agriculture, remittances, and seasonal labor migration.

Selection Rationale and Biodiversity Values

The Lower Tamor Landscape was selected based on its exceptional convergence of ecological significance, cultural diversity, and conservation urgency. The area functions as a globally

important biodiversity hotspot, hosting Nepal's largest rhododendron gene pool and serving as the "Rhododendron Capital of Nepal" with 32 recorded species. The landscape provides critical habitat for endangered species including Red Panda, Asiatic Golden Cat, Leopard Cat, Bengal Fox, Barking Deer, Assam Macaque, Clouded Leopard, three near threatened and three vulnerable birds. Over 800 plant species recorded in 1966 by Japanese expedition team that reported three endemic species *Didymocarpus nepalensis*, *Isodon dhankutanus*, and *Malaxis tamurensis*. Ecological connectivity represents a defining feature, with river corridors, forest belts, and community forest networks facilitating wildlife movement and genetic exchange across elevation gradients. The area demonstrates a balanced human-nature matrix with 49.25% forest cover and 38.91% cropland, creating opportunities for integrated conservation-agriculture models while maintaining landscape integrity. However, the landscape faces critical challenges exemplifying broader Satoyama degradation patterns. Human-wildlife conflict has reached crisis levels with monkeys and other animals and birds causing 30-50% seasonal crop losses, creating economic vulnerabilities that drive youth out-migration. Climate change impacts manifest through rising temperatures (0.04-0.06°C per year), erratic rainfall patterns, and drying springs threatening agricultural productivity. Despite apparent conservation success, forest "growing stock" has declined from 178 m^3/ha to 164 m^3/ha, indicating qualitative degradation despite area increases - reflecting the underuse and neglect patterns observed in other traditional landscapes globally[6].

Complementarity with SGP Country Programme Strategy

The COMDEKS landscape strategy directly complements Nepal's GEF SGP Operational Phase 7 Country Programme Strategy by focusing on community-based natural resource management, climate change adaptation, and sustainable livelihood development. The landscape approach enhances SGP's biodiversity conservation objectives through ecosystem-level interventions while supporting SGP's emphasis on indigenous peoples' empowerment and traditional knowledge integration.

3. The Baseline

Baseline Assessment and Approach

The baseline survey for COMDEKS Phase IV in the Lower Tamor landscape aims to establish a comprehensive benchmark of the current socio-ecological status. This baseline data is crucial for monitoring and evaluating the program's impact, informing adaptive management strategies, and ensuring that interventions are tailored to the specific needs and contexts of the communities and ecosystems within the landscape. The survey adopted a participatory and inclusive approach, ensuring the active involvement of all relevant stakeholders, recognizing the importance of local knowledge and perspectives in understanding the complexities of the SEPLS and in designing effective, community-led solutions. Data collection for the baseline survey was structured around

[6] DFRS, 2018. Forest Cover Maps of Local Levels (753) of Nepal. Department of Forest Research and Survey (DFRS), Kathmandu, Nepal.

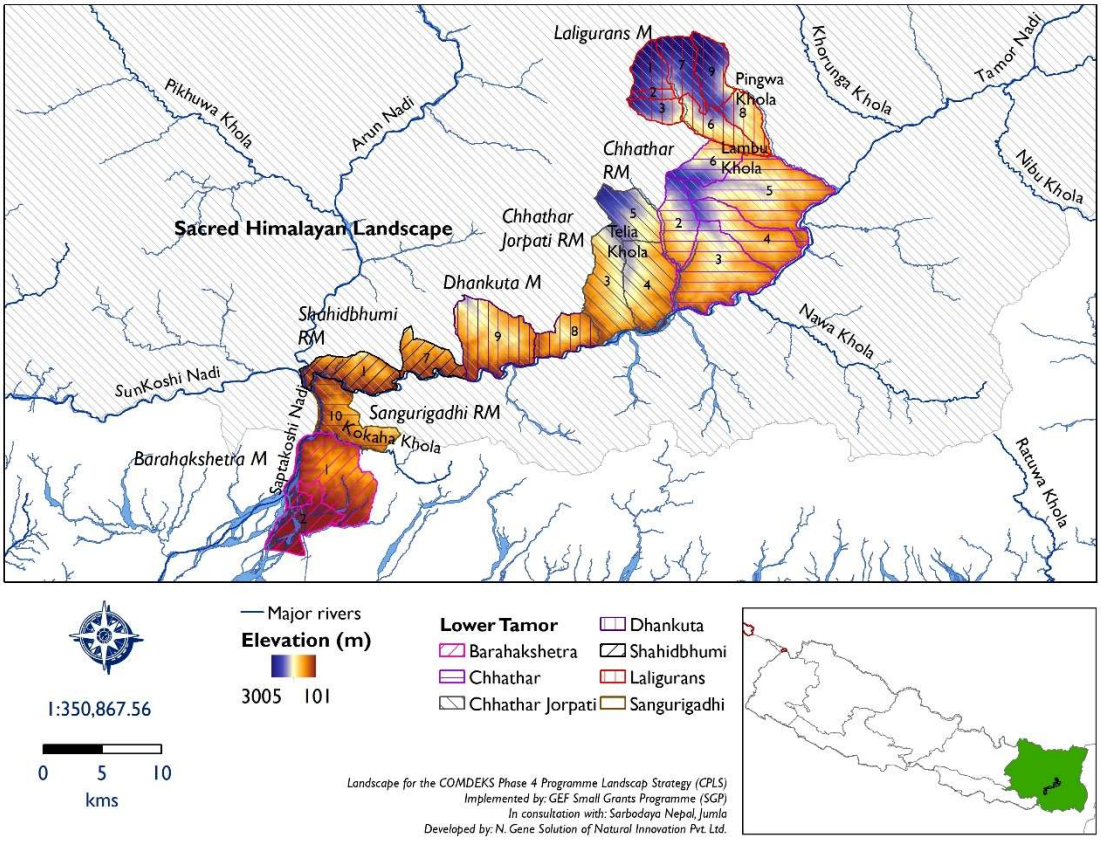

Figure 1: Elevation gradient of the Lower Tamor Landscape

five indicators proposed by the Satoyama Initiative[7], reflecting the core components of socio-ecological production landscapes:

- Indicator 1 (I1): Landscape Diversity and Ecosystem Integrity – Measures the variety of ecosystems and habitats within the landscape and their overall health and resilience.
- Indicator 2 (I2): Biodiversity and Sustainable Management – Assesses the richness of biological life and the extent to which natural resources are managed sustainably.
- Indicator 3 (I3): Knowledge Integration and Transfer – Evaluates the extent to which traditional and modern knowledge are combined and shared for sustainable land management.
- Indicator 4 (I4): Livelihood and Well-being – Reflects the economic and social welfare of the communities, including access to resources and quality of life.
- Indicator 5 (I5): Governance and Social Equity – Examines the effectiveness of local institutions, community participation, and fairness in decision-making processes.

[7] UNU-IAS, Alliance of Bioversity International and CIAT, UNDP GEF-SGP and IGES (2024) Indicators of Resilience in Socio-ecological Production Landscapes and Seascapes (SEPLS): 2024 Edition.

Overall SEPLS Indicator Performance

An aggregate analysis of the interview data from the Lower Tamor Landscape provides a foundational understanding of the overall health of its socio-ecological production landscapes. Across 301 respondents, the average scores for the five SEPLS indicators fall within a moderate range, suggesting that while there are no critically low scores, there is also significant room for improvement across all dimensions. The relatively lower scores for ecological indicators (I1 and I2) compared to human-centric indicators (I3, I4, I5) suggests that the underlying ecological health of their landscape might be experiencing degradation or is already compromised. If the natural resource base continues to decline, it could eventually undermine the very livelihoods and well-being that communities currently perceive as moderate. This highlights the urgent need for interventions that explicitly link human prosperity to the regeneration and health of the ecosystem, promoting practices that build natural capital rather than deplete it. A comprehensive baseline assessment utilizing Socio-Ecological Production Landscapes and Seascapes (SEPLS) resilience indicators was conducted across 301 respondents, revealing moderate performance across five key dimensions (Table 1).

Table 1: Findings of the baseline assessment

Indicator	Average Score (1-3)	Assessment
Landscape Diversity & Ecosystem Integrity	1.75	Moderate
Biodiversity & Sustainable Management	1.88	Moderate
Knowledge Integration & Transfer	1.88	Moderate
Livelihood & Well-being	1.87	Moderate
Governance & Social Equity	1.95	Moderate

The landscape approach recognizes the inseparable links between ecological health and human well-being, adopting integrated strategies that simultaneously address biodiversity conservation, sustainable development, and community empowerment. This approach builds upon existing community-based management models while introducing innovations that enhance resilience to climate change and market fluctuations.

4. The COMDEKS Strategy: Vision, Goals, and Outcomes

Vision

"Resilient socio-ecological production in Lower Tamor Landscape for conserving biodiversity, enhancing livelihoods and governing harmony with nature"

Goals

The overall long-term objective is to enhance socio-ecological production landscape resilience through community-based activities that integrate biodiversity conservation with sustainable livelihood development while strengthening local governance systems.

Primary Outcomes

Outcome 1: Ecosystem Restoration and Conservation Degraded biodiversity and ecosystem services are restored and enhanced through multi-functional land-use systems.

Impact Indicators:

- Total area of degraded ecosystems under sustainable management
- Percentage increase in forest health and sustainable NTFP use
- Improvement in water quality of key rivers and springs
- Increase in abundance and diversity of key pollinator species

Outcome 2: Sustainable Livelihood Enhancement Livelihoods are improved through development of ecologically sound and community-owned income-generating activities.

Impact Indicators:

- Number of new ecologically sound income-generating activities established
- Percentage increase in average household income from project-supported activities
- Number of community members (disaggregated by gender, age, ethnicity) participating in skill development and entrepreneurship training
- Ecologically sound agricultural production systems strengthened
- Through climate-smart practices crop yields increased
- Traditional knowledge documented and indigenous crop varieties increased

Outcome 3: Governance and Institutional Strengthening Robust governance systems are established and strengthened for effective participatory decision-making at landscape level.

Impact Indicators:

- Number of Community Forest User Groups and other CBOs strengthened
- Number of local development plans integrating landscape management perspectives
- Number of multi-stakeholder platforms established and functioning
- Percentage reduction in human-wildlife conflict incidents

5. Typology of Community-Based Projects and Grant Selection Criteria

Project Selection Criteria: Projects prioritize restoration of balanced people-nature relationships characteristic of healthy Satoyama landscapes:

- **Strategic Landscape Impact**: Projects addressing critical ecological corridors, watershed areas, or biodiversity hotspots that restore landscape connectivity
- **Multi-benefit Approach**: Clear linkages between conservation and livelihood benefits, particularly addressing human-wildlife conflict while maintaining biodiversity values
- **Community Ownership and Innovation**: Indigenous community leadership with traditional knowledge integration, reviving sustainable management practices
- **Replication and Scaling Potential**: Clear methodologies adaptable across similar social-ecological contexts

- **Gender and Social Inclusion**: Meaningful participation of women, marginalized groups, and youth in leadership roles

Appropriate Project Types:

Human-Wildlife Conflict Mitigation and Coexistence

- Community-based rapid response teams and early warning systems
- Sustainable deterrent technologies (solar fencing, buffer crop cultivation)
- Agricultural insurance schemes and improved compensation mechanisms
- Alternative livelihood development creating economic value from wildlife presence

Sustainable Agriculture and Food Security

- Climate-smart irrigation systems and rainwater harvesting restoring water management
- Organic farming, agroforestry, and integrated pest management reviving traditional practices
- Traditional seed conservation and community seed banks maintaining genetic diversity
- Value chain development connecting local products to markets

Ecosystem Restoration and Conservation

- Community forest restoration with native species plantations
- Spring revival and watershed protection initiatives restoring hydrological functions
- Invasive species control and habitat restoration
- Pollinator habitat enhancement and traditional beekeeping practices

Livelihood Diversification and Enterprise Development

- Sustainable Non-Timber Forest Product (NTFP) processing and marketing cooperatives
- Community-based ecotourism development showcasing cultural and natural heritage
- Alternative energy systems (biogas, micro-hydropower, solar) reducing external dependency
- Skills training for youth and women in green enterprises maintaining local employment

Traditional Knowledge and Capacity Building

- Documentation and promotion of traditional ecological knowledge systems, especially of women belongs to IPLCs
- Inter-community learning exchanges and farmer field schools
- Leadership development for women and marginalized groups
- Technical capacity building integrating traditional and modern management approaches

6. Oversight, Monitoring, Knowledge Documentation and Reporting

Program-Level Monitoring: SEPLS indicators are monitored annually using standardized templates to track restoration of social-ecological system balance. Semi-annual monitoring reports prepared by GEF-SGP Secretariat inform adaptive management strategies approved by National Steering Committee, ensuring responsiveness to changing landscape conditions.

Project-Level Monitoring: Each project undergoes standardized monitoring including pre-implementation visits, bi-annual field monitoring by NSC technical teams, and quarterly progress reporting using aligned indicator systems. Projects require final evaluation reports documenting landscape-level benefits, lessons learned, and replication recommendations with specific attention to traditional knowledge integration and community empowerment outcomes.

Knowledge Management: Knowledge management prioritizes documentation of successful people-nature relationship restoration through multiple products: analytical case studies examining traditional knowledge revival, video documentaries showcasing community leadership, technical guidelines for sustainable resource management, policy briefs translating field experiences into actionable recommendations, and community-friendly materials in local languages respecting traditional knowledge sharing protocols.

Policy Influence and Scaling: Active engagement in national policy processes including NBSAP revision, climate adaptation planning, and local government development planning ensures integration of Satoyama principles into formal governance systems. Network engagement includes participation in Satoyama Initiative global platforms, contribution to national biodiversity forums, and collaboration with academic institutions for research documenting social-ecological system restoration.

National Steering Committee: Quarterly meetings provide responsive oversight with expanded membership including landscape management expertise, indigenous representation, and technical specialists. Enhanced roles include resource mobilization, inter-sectoral coordination, and policy influence ensuring traditional knowledge systems receive recognition and support within formal governance structures.

The strategy provides a comprehensive framework for rebuilding sustainable people-nature relationships characteristic of healthy Satoyama landscapes, addressing critical social-ecological system degradation while building upon existing strengths in traditional knowledge, cultural heritage, and ecological significance of the Lower Tamor Landscape. Success will be measured not only by biodiversity conservation outcomes but by restoration of community self-sufficiency, traditional knowledge vitality, and balanced resource use patterns that can sustain both people and nature over generations.