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Strengthening Landscape Resilience through Faith-Based Socio-Ecological Infrastructure

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Policy Insights for Resilient Landscapes

This publication is part of a thematic series on socio-ecological production landscapes (SEPLS) — integrated landscape and seascape systems shaped by long-term interactions between people and nature. Across the globe, SEPLS are maintaining biodiversity and supporting local livelihoods, cultural values and sustainable resource management.

Drawing on UNU-IAS research with national and international partners, the series translates scientific evidence into actionable guidance for strengthening landscape resilience, biodiversity conservation, inclusive governance and sustainable livelihoods. It supports policymakers and practitioners in implementing the Kunming–Montreal Global Biodiversity Framework, National Biodiversity Strategies and Action Plans, recommendations of the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the objectives of the Satoyama Initiative.

Executive Summary

Faith-based and community stewardship systems, including Ethiopian church forests, Japanese shrine and temple groves and Indian sacred groves, serve as vital socio-ecological infrastructure. They act as biodiversity refugia, provide ecosystem services, support landscape resilience, and sustain biocultural knowledge, cultural identity and intergenerational learning. Despite their ecological and cultural significance, they remain underrecognized in biodiversity policy. Integrating these systems into biodiversity governance can strengthen resilience, landscape multifunctionality and sustainability transitions.

Policy Recommendations

- Recognize sacred natural sites as faith-based socio-ecological infrastructure.
- Institutionalize sacred natural sites in identification of other effective area-based conservation measures (OECMs) and implementation of National Biodiversity Strategies and Action Plans (NBSAPs).
- Integrate sacred natural sites into spatial planning, ecological networks and restoration strategies.
- Strengthen coordination among environmental, cultural and local governance institutions.
- Support community stewardship, intergenerational knowledge transmission and integrated ecological-cultural monitoring.

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Underrecognized Infrastructure in SEPLS

Socio-ecological production landscapes and seascapes (SEPLS) are dynamic mosaics in which biodiversity, ecosystem services and human livelihoods are closely interconnected (Takeuchi 2010). Despite increasing pressures from land-use change and climate impacts, a significant proportion of biodiversity persists within landscapes governed by culturally embedded systems (IPBES 2019).

Sacred natural sites, defined as areas of land or water with special spiritual significance to communities, represent a globally widespread yet under-recognized form of conservation (Tatay & Merino 2023). Comparable systems are observed globally, reflecting diverse cultural and ecological contexts. In Ethiopia, church forests are forest patches surrounding Ethiopian Orthodox Tewahedo Churches, comprising both planted and remnant natural vegetation and conserved through religious doctrine and institutional protection (Aerts et al. 2016; Sahle et al. 2021). In parallel, indigenous sacred forests and landscapes, such as those in the Sebat Bête Gurage, are governed through indigenous belief systems, ritual practices, taboos and customary institutions, reflecting deep spiritual ecology and long-standing human–nature relationships (Shiferaw et al. 2023).

Similarly, Japanese shrine and temple groves (*chinju no mori*) represent culturally embedded forest systems associated with the Shinto and Buddhist traditions, contributing to biodiversity conservation, ecosystem services and cultural continuity (Melaku & Pastor-Ivars 2024, 2025; Melaku et al. 2026). In parallel, Indian sacred groves function as community-managed biodiversity reservoirs, protected through religious beliefs and customary norms (Bhagwat & Rutte 2006; Ormsby & Bhagwat 2010). Moreover, sacred forests in Africa, Asia, Europe, North America and some Arab countries simultaneously conserve biodiversity, provide ecosystem services and sustain cultural services (Undaharta et al. 2025).

Notwithstanding their ecological and socio-cultural importance, sacred natural sites remain under-recognized and are inconsistently incorporated into biodiversity policy frameworks, particularly in OECM identification, reporting, and NBSAP implementation. In practice, this reflects that areas traditionally preserved through customary governance, spiritual values and community stewardship are often omitted from formal conservation categories, planning procedures or monitoring systems. As a result, a disconnect persists between locally rooted conservation practices and official policy recognition (CBD 2022; Pimm et al. 2026), which limits both the visibility of these sites in national biodiversity strategies and the capacity of policy frameworks to engage with diverse approaches to conservation governance.

Faith-Based Stewardship as Socio-Ecological Infrastructure for Resilience

Faith-based stewardship systems can be conceptualized as socio-ecological infrastructure that emerges from long-term interactions between ecological processes, cultural practices and governance institutions (Takeuchi 2010; Kremen & Merenlender 2018). Unlike conventional infrastructure, which is externally designed and managed, these systems are embedded within social and cultural contexts and maintained through collective norms and practices (Ostrom 2009; Folke et al. 2010).

Sacred natural sites function as socio-ecological infrastructure by sustaining ecological functions, such as biodiversity conservation, vegetation cover and microclimate regulation, while simultaneously reinforcing governance systems that regulate resource use (Bhagwat & Rutte 2006; Melaku & Pastor-Ivars 2024). These functions are co-produced through culturally embedded mechanisms, including ritual practices, taboos and moral accountability, which shape human–nature interactions and conservation outcomes (Ormsby & Bhagwat 2010; Tatay & Merino 2023).

From a socio-ecological perspective these systems enhance resilience, defined as the capacity to absorb disturbances, adapt to change and maintain essential functions (Walker et al. 2004; Folke et al. 2010). Faith-based stewardship contributes to resilience by maintaining slow variables, including cultural norms, institutional continuity and traditional knowledge systems, which stabilize ecological processes over time (Folke et al. 2010; IPBES 2019). These systems also align with the principles of common-pool resource governance, in which shared norms, local legitimacy and collective action sustain resource management (Ostrom 2009). Furthermore, they embody relational values of nature, whereby ecosystems are valued for their cultural, spiritual and identity-based significance (Chan et al. 2016; IPBES 2022).

Evidence from Sacred Forest Systems

1. Biodiversity conservation and ecological integrity
Sacred forests function as essential refuges for biodiversity within fragmented, human-altered landscapes. In Ethiopia (Figures 1 & 2), church forests retain considerable native biodiversity despite their limited size and isolation, functioning as ecological islands amidst agricultural and degraded landscapes (Aerts et al. 2016; Klepeis et al. 2016;

Sahle et al. 2021; Kindu et al. 2022; Teku et al. 2024). They facilitate species survival, conserve genetic diversity and enhance habitat connectivity across degraded environments. In Japan, shrine and temple groves (chinju no mori) contribute to biodiversity conservation and ecological health by safeguarding remaining vegetation and providing habitats for various species, particularly in urban and peri-urban contexts (Melaku et al. 2026).

Similarly, sacred groves and other sacred natural sites in India support high levels of species richness and endemism, often exceeding those of surrounding land uses (Bhagwat & Rutte 2006; Ormsby & Bhagwat 2010). These sites serve as in situ conservation reservoirs, preserving remnant vegetation and ecological functions where natural habitats have undergone significant alteration (Mikusiński et al. 2014). Recent studies also suggest that sacred sites enhance landscape resilience by functioning as ecological stepping stones that facilitate species movement and regeneration across fragmented habitats (Kremen & Merenlender 2018).

2. Ecosystem functioning and services

Sacred forests make multiple contributions to ecological processes and human well-being. They contribute to soil stabilization, water regulation, microclimate moderation and pollination, which are essential for environmental stability and agricultural productivity (Bhagwat & Rutte 2006; Sahle et al. 2021). Emerging evidence further highlights their role in climate mitigation, including carbon sequestration and ecosystem regulation, positioning sacred groves as important nature-based solutions within broader environmental systems (Tolla et al. 2022; Ziblila et al. 2025). Cultural ecosystem services are central, encompassing spiritual values, identity formation and social cohesion, which reinforce stewardship

Figure 1: The church forest in Ethiopia is located within a degraded landscape. Orthophoto mosaic image (Ministry of Agriculture, Ethiopia 2017).

Figure 2: Illustrative church forest in Ethiopia (Mesfin Sahle, 2015).

through relational human–nature connections (Chan et al. 2016; IPBES 2022; Shiferaw et al. 2023; Melaku & Pastor-Ivars 2024). These cultural dimensions underpin long-term conservation by embedding ecological management within belief systems and social norms.

In both rural and urban contexts, sacred forests also support climate regulation and environmental quality. Evidence from urban sacred natural sites demonstrates their contribution to urban biodiversity, microclimate regulation and human well-being, highlighting their role as multifunctional green infrastructure (Tolla et al. 2013; Ormsby 2021; Sahle et al. 2021; Melaku et al. 2026). Collectively, these systems deliver multifunctional contributions to people, reinforcing ecosystem functioning and enhancing socio-ecological resilience.

3. Governance systems and institutional dynamics

Sacred natural sites are governed by culturally embedded institutions that regulate access and resource use through ritual authority, taboos and customary norms (Tatay & Merino 2023). In Ethiopia, church forests are managed under the stewardship of the Ethiopian Orthodox Tewahedo Church, with religious leadership and community norms helping to sustain long-term conservation outcomes. Evidence shows that participatory governance enhances inclusiveness and effectiveness (Aerts et al. 2016; Sahle et al. 2021; Debie 2026). In contrast, indigenous sacred forests are governed by customary institutions and intergenerational knowledge systems that reinforce community stewardship (Shiferaw et al. 2023). In some contexts, formerly indigenous sacred forests and community forests have gradually transformed into church forests, reflecting a shift in spiritual authority and community trust toward church-based stewardship systems. This transformation illustrates how conservation legitimacy can persist through evolving religious and institutional arrangements while maintaining ecological functions and community stewardship traditions.

Empirical evidence further demonstrates that sacred forest governance operates through a complex interplay of cultural legitimacy, institutional arrangements and stakeholder engagement, involving religious institutions, communities and public authorities (Melaku & Pastor-Ivars 2024). These systems embody locally overseen governance rooted in belief systems (Ormsby & Bhagwat 2010; Jonas et al. 2018). They frequently encounter challenges such as jurisdictional ambiguity and limited policy support, thereby perpetuating a persistent governance gap. They are consistent with principles

of common-pool resource management and produce self-reinforcing feedback loops between cultural values and ecological integrity (Ostrom 2009; Folke et al. 2010).

4. Resilience functions, vulnerabilities and emerging risks
Sacred forests contribute to resilience by maintaining ecological functions and governance systems amid environmental change. Their persistence within transformed landscapes reflects the role of slowly changing factors, particularly cultural and institutional continuity, in stabilizing socio-ecological systems (Walker et al. 2004; Folke et al. 2010). These systems sustain biodiversity and ecological processes, buffer environmental variability and support adaptive governance (Kremen & Merenlender 2018).

However, despite these strengths, sacred forest systems face increasing pressures. Ecological vulnerabilities, including isolation and edge effects, limit regeneration capacity and increase susceptibility to degradation (Aerts et al. 2016; Klepeis et al. 2016). Socio-cultural changes, including the erosion of traditional beliefs and the weakening of customary institutions, further threaten the continuity of stewardship (Bhagwat & Rutte 2006; Ormsby & Bhagwat 2010).

Governance challenges — such as institutional fragmentation, unclear management mandates and limited policy recognition — exacerbate these risks and contribute to a persistent gap between local practices and formal conservation frameworks (Jonas et al. 2018; Tatay & Merino 2023). In urban contexts, land-use change, development pressures and declining community engagement intensify these threats, undermining both ecological integrity and cultural functions (Ormsby 2021; Melaku & Pastor-Ivars 2025).

Policy Recommendations

Strengthening resilience in SEPLS requires policy frameworks to shift priorities from short-term productivity to long-term multifunctionality, stability and adaptive governance. Evidence from agroforestry systems demonstrates that resilience emerges from the interaction of ecological regulation, livelihood diversification and institutional stewardship (Folke et al. 2010; Sahle et al. 2023). To translate these insights into practice, the following policy recommendations offer implementation-ready guidance for decision-makers.

1. Recognize sacred natural sites as socio-ecological infrastructure.
National and sub-national governments, where applicable, should formally recognize sacred natural sites within biodiversity, land-use and climate adaptation policies as essential socio-ecological infrastructure that underpins resilience, ecosystem services and cultural continuity. This can be operationalized by incorporating sacred natural sites into national conservation inventories, land-use classifications and ecosystem restoration strategies.

2. Institutionalize OECM identification and NBSAP integration.
Ministries responsible for the environment and biodiversity should integrate sacred natural sites into OECM identification and reporting and into NBSAP implementation processes to align community-based conservation systems with national and global biodiversity targets. Practical actions include developing national criteria for recognizing faith-based conservation systems, supporting participatory mapping and incorporating Indigenous and local knowledge (ILK) into biodiversity planning and monitoring.

3. Integrate sacred natural sites into spatial planning, ecological networks and restoration strategies.
Municipal authorities and landscape planners should incorporate sacred forests into ecological corridor design, urban green infrastructure and landscape restoration planning to strengthen connectivity, ecological regeneration capacity and multifunctionality across SEPLS. Spatial planning frameworks should recognize sacred natural sites as biodiversity refugia and ecological stepping stones within fragmented landscapes. They should also support ecological revitalization measures — including assisted natural regeneration, enrichment planting of native species, restoration of surrounding buffer landscapes and sustainable management of ecosystem service pressures. These measures can enhance both ecological integrity and long-term community stewardship capacity.

4. Strengthen governance and institutional coordination.
Governments should establish mechanisms for cross-sectoral coordination between environment, culture, forestry and local governance institutions to address fragmentation and improve policy coherence. Supporting locally legitimate governance systems, including religious institutions, Indigenous governance structures and community stewardship organizations, is essential for sustaining long-term conservation outcomes.

5. Support community-based stewardship and intergenerational knowledge transmission.
Governments, civil society organizations, and research institutions should enhance community-based stewardship systems that maintain sacred natural sites through locally rooted norms, customary regulations, faith-based duties and

collective management practices. This includes supporting elders, religious leaders, local custodians, youth groups and community organizations in transmitting ecological knowledge, cultural values and stewardship practices across generations. Educational programmes, community learning platforms, documentation of local ecological knowledge and youth engagement initiatives can help to maintain biocultural continuity while reinforcing long-term conservation responsibility within SEPLS.

6. Develop participatory monitoring frameworks. Monitoring systems should integrate ecological, cultural and governance indicators to capture the multifunctional contributions of sacred natural sites. Policymakers and research institutions should support participatory monitoring approaches that combine scientific methods with ILK to strengthen adaptive management and long-term stewardship.

Conclusion

Faith-based and community stewardship systems exemplify how culturally embedded governance can effectively support biodiversity and ecosystem services across SEPLS. Sacred natural sites serve as resilient socio-ecological infrastructure, connecting ecological integrity with cultural values, local institutions and long-term stewardship practices. Nonetheless, their ongoing effectiveness is contingent upon systematic integration within formal policy frameworks. Incorporating these systems into OECM identification and NBSAP implementation processes is vital to bridging the divide between locally grounded conservation efforts and global biodiversity commitments. Promoting a transition towards governance pluralism, which acknowledges diverse institutions, knowledge systems and value frameworks, is imperative for enhancing resilience, inclusiveness and sustainability within SEPLS.

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