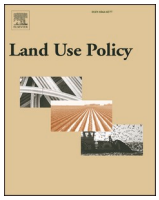
Land Use Policy 162 (2026) 107884

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol



Restoring South Asian Forests: Key lessons, research gaps and the way forward

ARTICLE INFO

Keywords:
Forest and landscape restoration
Forest dependence
Multifunctional landscapes
Rural livelihood
UN Decade on Ecosystem Restoration

ABSTRACT

South Asia, home to over two billion people, is the world's most populous and densely inhabited region. Its forests play vital roles in carbon storage, biodiversity conservation, water regulation, and rural livelihoods but face mounting pressures from population growth, agriculture, urbanization, and climate change. Heavy dependence on fuelwood further accelerates degradation. In response, countries across the region have initiated ambitious restoration programs aligned with global commitments and the UN Decade on Ecosystem Restoration. Here, we synthesized the articles published in the Special Issue (SI) titled – Restoring South Asian Forests, covering India, Nepal, Bangladesh and Pakistan. The regional and country-level case studies presented in this SI underscore critical lessons. Nepal's 65-year restoration experience highlights the value of decentralization, community engagement, and recognition of forest multifunctionality. Post-2015 earthquake recovery demonstrates that natural regeneration often outperforms costly artificial interventions. In India, individual-led initiatives, like Padmashree Jadav Payeng's Brahmaputra sandbar forest, illustrate how sustained, science-guided efforts can deliver outsized ecological and societal benefits. Research from Bangladesh and Pakistan further stresses the importance of secure land tenure, inclusive governance, and community participation for lasting restoration success. Despite progress, knowledge gaps persist regarding long-term ecological and socio-economic effects and the comparative effectiveness of restoration approaches. Advancing restoration in South Asia will require integrated, participatory, and landscape-level strategies that merge indigenous knowledge, science, and advanced monitoring to deliver enduring biodiversity, carbon, and livelihood co-benefits.

1. Introduction

South Asia, including India, Nepal, Bangladesh, Pakistan, Sri Lanka, Bhutan, the Maldives, and Afghanistan, hosts a rich diversity of forest ecosystems, ranging from tropical rainforests and mangroves to temperate and alpine forests in the Himalayan region (Reddy et al., 2018; Laumonier et al., 2022; Fig. 1). This region also includes four major biodiversity hotspots: the Himalayas, the Western Ghats and Sri Lanka, Indo-Burma, and Sundaland. These forests are characterized by high levels of endemism, with numerous species found nowhere else on Earth. They play a vital role in providing essential ecosystem services such as carbon sequestration, biodiversity conservation, soil and water regulation, and climate moderation (Kumar and Scheiter, 2019). In addition, they support the livelihoods of millions of rural communities by supplying timber, non-timber forest products, fodder, and medicinal plants (Lal, 2023).

Although Bhutan stands out as one of the few carbon-negative countries in the world due to its extensive forest cover, the Maldives—owing to its small-island geography—has limited forest resources. Meanwhile, Afghanistan, as a relatively recent inclusion in the South Asian region, continues to face challenges in establishing effective forest management systems. Nevertheless, forestry across South Asia has historically combined state-managed forests with community-based management practices, with countries such as Nepal and Bhutan pioneering decentralized governance models that empower local communities in forest stewardship (Poffenberger, 2000).

Despite their immense ecological and socio-economic importance, forests in South Asia face severe and escalating pressures (Appanah, 2016). Rapid population growth, agricultural expansion, urbanization, and infrastructure development have driven extensive forest degradation and fragmentation (Curtis et al., 2018; Sims et al., 2025). Unsustainable logging, fuelwood collection, overgrazing, and encroachment have further diminished forest quality, leading to biodiversity loss, soil erosion, and reduced carbon storage capacity (Karki et al., 2018). Climate change exacerbates these threats by increasing the frequency and intensity of droughts, floods, and pest outbreaks, challenging the resilience of forest ecosystems (Shaw et al., 2022). High dependence on forests for livelihoods and energy, particularly in rural and mountainous areas, adds complexity, as conservation objectives must be balanced with human needs (Choksi et al., 2023; Fischer et al., 2023, 2025).

In response to these challenges, South Asian countries have initiated large-scale afforestation and restoration programs over the past decade (Appanah, 2016). Regional and global commitments—including the Bonn Challenge, the UN Decade on Ecosystem Restoration (2021–2030), and the Sustainable Development Goals—have catalyzed national actions (Vincent et al., 2021; Katila et al., 2024). Programs such as India's Green India Mission, Pakistan's Billion Trees Afforestation Project, Nepal's community forest initiatives, and Bangladesh's hill forest

https://doi.org/10.1016/j.landusepol.2025.107884

Available online 8 December 2025

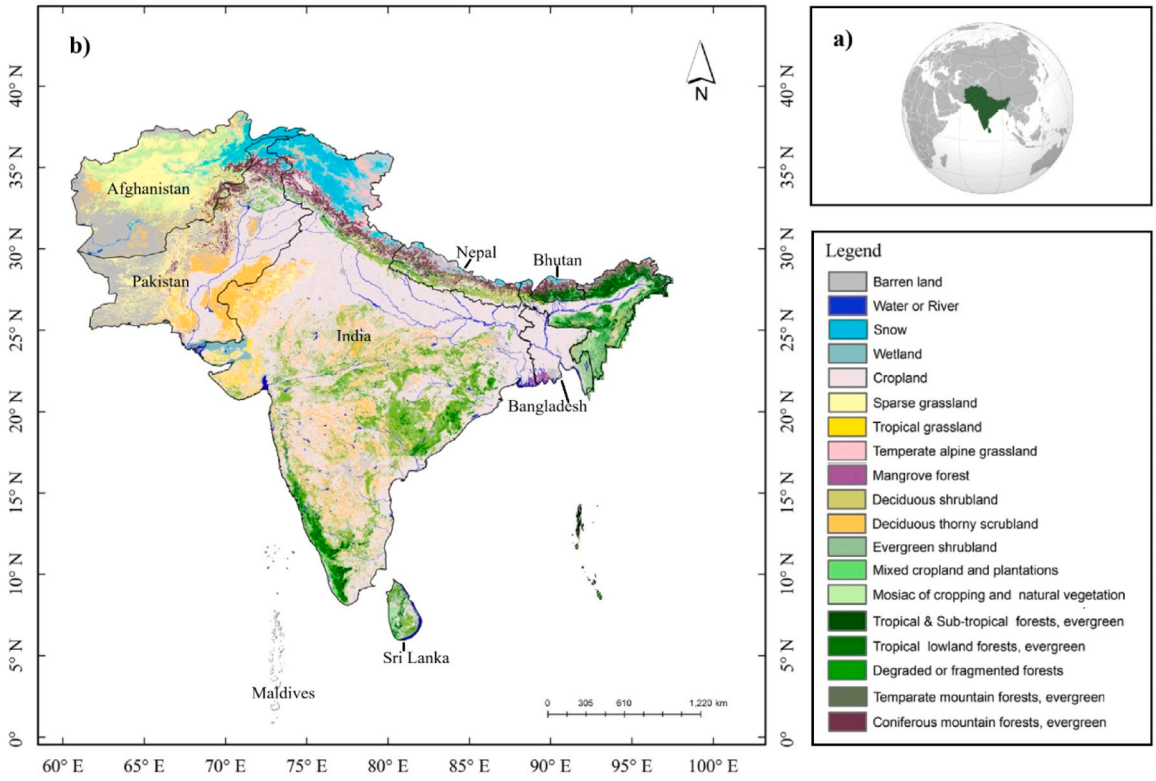


Fig. 1. South Asia in the global context (a) and the map of South Asia with major forest and vegetation types (b) derived from the Global Land Cover 2000 Project (https://forobs.jrc.ec.europa.eu/glc2000).

restoration efforts exemplify attempts to restore degraded landscapes while simultaneously supporting local livelihoods (Laudari et al., 2022; Ullah et al., 2022; Ahammad et al., 2023; Gopalakrishna et al., 2024). Recent strategies increasingly emphasize landscape-level restoration, integrating ecological, social, and economic objectives (Chazdon and Brancalion, 2019; Ota et al., 2021). There is growing recognition of the importance of native species, participatory approaches, and multi-stakeholder governance to ensure the long-term sustainability of restoration initiatives (Chazdon et al., 2020; Ota et al., 2020). Advanced technologies, including remote sensing and GIS-based monitoring, are also being leveraged to track outcomes and guide policy interventions (Pandey et al., 2022).

Despite notable progress, significant challenges remain. Secure land and forest tenure, meaningful community participation, institutional coordination, and adequate funding are critical determinants of restoration success (Chazdon et al., 2021). Balancing conservation objectives with socio-economic needs, especially for forest-dependent communities, remains a persistent challenge (Mukul and Quazi, 2009). Nevertheless, the expanding body of scientific research, combined with supportive policies and community engagement, presents opportunities for scaling up restoration efforts (Chazdon et al., 2015; Mansourian, 2020). Integrating ecosystem services, biodiversity conservation, and climate mitigation into restoration strategies can generate multiple co-benefits, enhancing both ecological resilience and human well-being across South Asia (Chazdon, 2008).

Forest and land degradation continue to threaten ecosystems, biodiversity, and human well-being globally. Even with ambitious international initiatives such as the Bonn Challenge and the UN Decade on Ecosystem Restoration, a significant gap persists between restoration commitments and on-the-ground outcomes (Fagan et al., 2020). This disconnect often stems from a limited understanding of the institutional, socio-economic, and ecological factors that influence restoration success (Ahammad et al., 2023; Sarkar and Mukul, 2024). Experiences from South Asia illustrate both the challenges involved and the potential pathways for bridging this gap, offering valuable lessons for achieving resilient and multifunctional landscapes.

2. Lessons from country-level case studies on forest restoration in South Asia

The country-focused papers in this Special Issue collectively reveal that restoration outcomes hinge on governance design, ecological context and social inclusion. Laudari et al. (2022) critically examined Nepal's 65-year experience in forest restoration, revealing that early efforts—driven by centralized planning and a narrow ecological focus—yielded mixed results. From the mid-1980s onward, however, the adoption of decentralized governance, local stewardship, multi-stakeholder partnerships, and recognition of forests' multi-functionality markedly improved restoration outcomes. Nepal's trajectory highlights that forest restoration is not merely a technical or ecological endeavor; it is a socio-political process requiring community engagement, policy coherence, and adaptive, multi-scale approaches. These lessons offer a roadmap for translating global restoration pledges into resilient landscapes.

The 2015 Gorkha earthquake in Nepal further underscored the challenges of ecosystem restoration. Thousands of landslides stripped vast areas of vegetation, raising the critical question: what is more effective—artificial, government-led restoration or natural regeneration? Pandey et al. (2022) combined remote sensing and fiscal analysis to evaluate vegetation recovery and found that self-ecological restoration far outperformed artificial interventions. Over 90 % of the recovery occurred naturally within protected areas, while artificial restoration accounted for less than 10 % despite substantial public expenditure. The study emphasizes that supporting natural recovery processes—through protection, patience, and enabling policies—can achieve more resilient outcomes than costly engineered solutions. Nepal's post-Gorkha experience provides a pragmatic blueprint for aligning ecological recovery with fiscal prudence and long-term sustainability. These insights

reinforce the growing global emphasis on passive restoration as a cost-effective climate solution.

Inspirational examples from India underscore the transformative potential of individual and community-led initiatives. Over three decades, Padmashree Jadav Payeng converted barren sandbars along the Brahmaputra into thriving forests, significantly enhancing biodiversity, wildlife habitat, and carbon storage. Scientific assessment by Goswami et al. (2024) documents a 31.9 % increase in forest cover, substantial biomass accumulation, and significant carbon sequestration. Such efforts demonstrate that even small-scale, dedicated interventions—when guided by science and supported by policy incentives—can yield outsized ecological and societal benefits.

In the western Himalaya, Negi et al. (2022) highlight that site-specific planting of native species, such as *Quercus leucotrichophora*, can provide multiple co-benefits, including carbon sequestration, soil conservation, biodiversity enhancement, and livelihood support for local communities. Such evidence-based Himalayan case studies underscore that integrating ecological science with community stewardship is essential for securing biodiversity and maintaining biosphere integrity while translating global restoration commitments into meaningful local outcomes.

Bangladesh's commitment to restoring 0.75 million hectares of degraded forestland under the Bonn Challenge exemplifies ambitious national restoration goals. However, Ahammad et al. (2023) show that effective restoration in the Chittagong Hill Tracts (CHT) requires attention beyond increasing tree cover. Past efforts often neglected biodiversity, ecological functionality, and long-term community engagement. Unresolved land and forest tenure issues further limited participation, particularly among ethnic communities reliant on these forests for their livelihoods. The study emphasizes that secure land rights, inclusive governance, and site-specific strategies are critical to achieving both ecological integrity and social equity. As Bangladesh advances its forest and landscape restoration agenda, integrating community rights and ecological science must remain central to achieving resilient and inclusive outcomes.

Pakistan's Billion Trees Afforestation Project (BTAP) demonstrates the intersection of large-scale restoration and community livelihoods. In Khyber Pakhtunkhwa, community-based participation in landscape co-management not only enhanced forest cover but also improved employment, crop productivity, livestock rearing, and access to timber and fuelwood. Yet, Ullah et al. (2022) highlight that social barriers—including elite dominance, land scarcity, low literacy, and negative perceptions—can constrain participation. The study underscores that successful restoration requires more than tree planting; it demands addressing socio-economic barriers, building local confidence, and fostering inclusive governance. Scaling up restoration initiatives must therefore prioritize community engagement as a core strategy for achieving both ecological recovery and sustainable livelihood outcomes. Addressing these structural inequities is therefore integral to scaling restoration equitably across the region.

3. Prevailing research gaps

Despite significant progress and valuable insights from restoration initiatives across South Asia, several research gaps persist in understanding and implementing effective forest and landscape restoration. While studies from Nepal, India, Bangladesh, and Pakistan have highlighted the importance of community engagement, decentralized governance, and ecological science, there remains a limited understanding of how these socio-ecological factors interact across different spatial, institutional, and ecological contexts (Ahammad et al., 2023). Comparative, cross-country analyses that systematically evaluate how governance models, tenure arrangements, and ecological characteristics influence restoration outcomes are notably scarce (Banin et al., 2022). Addressing this gap is critical for identifying context-specific yet scalable restoration strategies that balance ecological integrity with local livelihoods (Roy and Fleischman, 2022).

A second key research gap concerns the long-term ecological monitoring of restoration interventions (Banin et al., 2022). Many studies—such as those examining Nepal's post-Gorkha earthquake recovery or India's community-driven forest restoration—demonstrate impressive short-term outcomes, yet few track ecological succession, biodiversity recovery, or carbon dynamics over extended timescales. There is a need for longitudinal, data-driven research that integrates remote sensing, field ecology, and socio-economic monitoring to assess the durability and resilience of restored landscapes (Florentine et al., 2023). Without such evidence, restoration success remains difficult to evaluate beyond initial vegetation recovery metrics.

Furthermore, restoration science in South Asia often prioritizes biophysical and policy dimensions while underexploring socio-cultural, gendered, and institutional aspects. For instance, while community participation is widely acknowledged as essential, the nuances of power relations, local knowledge systems, and intra-community equity are less systematically studied (Katila et al., 2024). Understanding how social hierarchies, gender roles, and customary institutions shape participation and benefit-sharing could provide deeper insights into why certain restoration models succeed or fail (Adams et al., 2016).

Finally, economic and policy research gaps persist in quantifying the trade-offs and synergies between restoration investments, ecosystem service flows, and livelihood outcomes (Mukul et al., 2016). Few studies rigorously evaluate the cost-effectiveness of natural regeneration versus engineered restoration or assess how fiscal policies and incentive mechanisms influence local engagement and ecological outcomes (Chazdon and Brancalion, 2019). Developing interdisciplinary frameworks that combine ecological economics, governance studies, and environmental science would help translate restoration pledges into economically viable and socially just programs (Mansourian, 2020).

4. The way forward

Forest restoration in South Asia now stands at a decisive crossroads, shifting from fragmented interventions to integrated, evidence-based landscape recovery. The diverse experiences of forest and landscape restoration across the region underscore that successful ecological recovery requires more than technical interventions—it demands integrated approaches that bridge science, policy, and community action. Evidence from Nepal, India, Bangladesh, and Pakistan highlights that restoration outcomes are most sustainable when ecological principles are coupled with inclusive governance, secure land rights, and active local participation. Moving forward, the region must adopt adaptive, science-based restoration frameworks that are responsive to socio-ecological complexity, grounded in empirical evidence, and co-created with local stakeholders (Bhattrai et al., 2021).

A critical step involves strengthening the science–policy–practice interface. Despite a growing body of research demonstrating the benefits of community-led restoration, natural regeneration, and biodiversity-based approaches, these insights are not always reflected in national forest policies or restoration programs (Banin et al., 2022). Governments and regional bodies need mechanisms that systematically integrate scientific findings into planning, budgeting, and implementation processes. Establishing transdisciplinary platforms that bring together scientists, policymakers, local communities, and civil society can help ensure that research informs decision-making and that policies remain grounded in on-the-ground realities (UNCCD, 2022).

Equally important is the institutionalization of long-term monitoring and evaluation systems. Restoration should be treated as an iterative, learning-based process, where ecological data, social feedback, and economic outcomes guide continuous adaptation (Ota et al., 2021). Investments in capacity building, data infrastructure, and open-access information systems can enhance transparency, accountability, and regional learning (Mansourian, 2020). Adopting standardized monitoring protocols and open data sharing, such as through FAO's FLR

mechanism, can promote transparency and comparability. Strengthening collaborations among research institutions, government agencies, and community organizations will be vital for scaling successful models and sharing lessons across borders (Chazdon et al., 2021).

Furthermore, restoration policies must explicitly recognize and value ecosystem services—such as carbon sequestration, soil stabilization, and biodiversity conservation—within national development agendas (Stanturf et al., 2015). Aligning restoration initiatives with climate adaptation, disaster risk reduction, and livelihood enhancement objectives can attract broader political and financial support (Garrett et al., 2022). Innovative financing mechanisms, including payments for ecosystem services, carbon credits, and green bonds, can further incentivize sustainable restoration while ensuring equitable benefit distribution (Choksi et al., 2023).

Ultimately, the way forward lies in fostering a culture of co-production—where scientific knowledge, local experience, and policy innovation converge to build resilient landscapes and empowered communities. Translating restoration science into actionable policy and practice will not only help achieve global commitments such as the Bonn Challenge and the UN Decade on Ecosystem Restoration but also secure the ecological foundations of sustainable development across South Asia. If underpinned by evidence, inclusivity and long-term vision, South Asia's restoration movement can redefine how densely populated regions balance human prosperity with ecological regeneration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Adams, C., Rodrigues, S.T., Calmon, M., Kumar, C., 2016. Impacts of large-scale forest restoration on socioeconomic status and local livelihoods: what we know and do not know. Biotropica 48, 731–744.

Ahammad, R., Hossain, M.K., Sobhan, I., Hasan, R., Biswas, S.R., Mukul, S.A., 2023. Social-ecological and institutional factors affecting forest and landscape restoration in the Chittagong Hill Tracts of Bangladesh. Land Use Policy 125, 106478.

Appanah, S., 2016. Forest Landscape Restoration in Asia-Pacific Forests. FAO and RECOFTC, Bangkok, Thailand.

Banin, L.F., Raine, E.H., Rowland, L.M., Chazdon, R.L., Smith, S.W., et al., 2022. The road to recovery: a synthesis of outcomes from ecosystem restoration in tropical and sub-tropical Asian forests. Philos. Trans. R. Soc. B 378, 20210090.

Bhattrai, S., Pant, B., Laudari, H.K., Rai, R., Mukul, S.A., 2021. Strategic pathways to scale up forest and landscape restoration: Insights from Nepal's Tarai. Sustainability 13, 5237.

Chazdon, R.L., 2008. Beyond deforestation: restoring forests and ecosystem services on degraded lands. Science 320, 1458–1460.

Chazdon, R.L., Brancalion, P.H.S., Lamb, D., Laestadius, L., Calmon, M., Kumar, C., 2015. A policy-driven knowledge agenda for global forest and landscape restoration. Conserv. Lett. 10, 125–132.

Chazdon, R., Brancalion, P., 2019. Restoring forests as a means to many ends. Science 365, 24–25.

Chazdon, R.L., Gutierrez, V., Brancalion, P.H.S., Laestadius, L., Guariguata, M.R., 2020. Co-creating conceptual and working frameworks for implementing forest and landscape restoration based on core principles. Forests 11, 706.

Chazdon, R.L., Wilson, S.J., Brondizio, E., Guariguata, M.R., Herbohn, J., 2021. Key challenges for governing forest and landscape restoration across different contexts. Land Use Policy 104, 104854.

Choksi, P., Agrawal, A., Bialy, I., Chaturvedi, R., Davis, K.F., Dhyani, S., Fleischman, F., Lechner, J., Nagendra, H., Srininvasan, V., DeFries, R., 2023. Combining socioeconomic and biophysical data to identify people-centric restoration opportunities. npj Biodivers. 2, 7.

Curtis, P.G., Slay, C.M., Harris, N.L., Tyukavina, A., Hansen, M.C., 2018. Classifying drivers of global forest loss. Science 361, 1108–1111.

Fagan, M.E., Reid, L., Holland, M.B., Drew, J.G., Zahawi, R.A., 2020. How feasible are global forest restoration commitments? Conserv. Lett. 13, e1270.

Fischer, H.W., Chhatre, A., Duddu, A., et al., 2023. Community forest governance and synergies among carbon, biodiversity and livelihoods. Nat. Clim. Change 13, 1340–1347.

Fischer, H.W., Schultz, B., Coleman, E.A., Filippi, A.M., Guleria, V., Güneralp, B., Kurli, V., Lawrence, B., Ma, A., Ramprasa, V., 2025. Forest restoration for environment and well-being is associated with empowered local governance over long time horizons. Environ. Res. Lett. 20, 094022.

Garrett, L., Lévite, H., Besacier, C., Alekseeva, N., Duchelle, M., 2022. The Key Role of Forest and Landscape Restoration in Climate Action. FAO, Rome, Italy.

Gopalakrishna, T., Visconti, P., Lomax, G., Boere, E., Malhi, Y., Roy, P.S., Joshi, P.K., Fedele, G., Yowargana, P., 2024. Optimizing restoration: A holistic spatial approach to deliver Nature's Contributions to People with minimal tradeoffs and maximal equity. Proc. Natl. Acad. Sci. USA 121, e2402970121.

Goswami, M., Prakash, S., Nautiyal, S., Mukul, S.A., 2024. Potential environmental implications of sandbar afforestation: Insights from ecosystem restoration initiatives in a sandbar of Brahmaputra River Assam, India. Land Use Policy 147, 107354.

Kumar, D., Scheiter, S., 2019. Biome diversity in South Asia - how can we improve vegetation models to understand global change impact at regional level? Sci. Total Environ. 671, 1001–1016.

Lal, R., 2023. Restoring South Asia's degraded soils and ecosystems for peace and prosperity. J. Soil Water Conserv. 78, 97A–102A.

Laudari, H.K., Aryal, K., Maraseni, T., Pariyar, S., Pant, B., Bhattarai, S., Kaini, T.R., Karki, G., Marahattha, A., 2022. Sixty-five years of forest restoration in Nepal: lessons learned and way forward. Land Use Policy 115, 106033.

Laumonier, Y., Azzu, N., Adzan, G., Narulita, S., Khikmah, F., Meybeck, A., Pingault, N., Gitz, V., 2022. Asia-Pacific roadmap for primary forest conservation. Food and Agriculture Organization of the United Nations (FAO). Rome Cent. Int. For. Res. (CIFOR) (Bogor, Indonesia).

Mansourian, A., 2020. Enabling Factors to Scale Up Forest Landscape Restoration: The Roles of Governance and Economics. WWF, Germany and IUFRO, Austria.

Karki, M., Sellamuttu, S.S., Okayasu, S., Suzuki, W. (Eds.), 2018. The IPBES Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES, Bonn, Germany.

Mukul, S.A., Herbohn, J., Firn, J., 2016. Co-benefits of biodiversity and carbon sequestration from regenerating secondary forests in the Philippine uplands: implications for forest landscape restoration. Biotropica 48, 882–889.

Mukul, S.A., Quazi, S.A., 2009. Communities in conservation: changing protected area management and enhanced conservation in Bangladesh. In: Leslie, R.N. (Ed.), The Future of Forests in Asia and the Pacific: Outlook for 2020. Food and Agriculture Organization of the United Nations (FAO). Regional Office for Asia and the Pacific, Bangkok, Thailand, pp. 143–159.

Negi, V.S., Pathak, R., Dhyani, V., Durgapal, M., Joshi, R.K., Bhatt, I.D., 2022. Land restoration in the Himalayan region: steps towards biosphere integrity. Land Use Policy 121, 106317.

Florentine, S., Gibson-Roy, P., Dixon, K.W., Broadhurst, L. (Eds.), 2023. Ecological Restoration: Moving Forward Using Lessons Learned. Springer, Cham, Switzerland.

Katila, P., Colfer, C.J.P., de Jong, W., Galloway, G., Pacheco, P., Winkel, G. (Eds.), 2024. Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward. Oxford University Press, UK.

Ota, L., Chazdon, R.L., Herbohn, J., Gregorio, N., Mukul, S.A., Wilson, S.J., 2020. Achieving quality forest and landscape restoration in the tropics. Forests 11, 820.

Ota, L., Firn, J., Chazdon, R., Gregorio, N., Mukul, S.A., Viani, R., Romero, C., Herbohn, J., 2021. Using leading and lagging indicators for forest restoration. J. Appl. Ecol. 58, 1806–1812.

Pandey, H.P., Gnyawali, K., Dahal, K., Pokhrel, N.P., Maraseni, T.N., 2022. Vegetation loss and recovery analysis from the 2015 Gorkha earthquake (7.8 Mw) triggered landslides. Land Use Policy 119, 106185.

Poffenberger, M., 2000. Communities and forest management in South Asia. Bohol (Philippines): IUCN, DFID, and Asia Forest Network.

Reddy, C.S., Saranya, K.R.L., Pasha, S.V., Satish, K.V., Jha, C.S., Diwakar, P.G., Dadhwal, V.K., Rao, P.V.N., Murthy, Y.V.N.K., 2018. Assessment and monitoring of deforestation and forest fragmentation in South Asia since the 1930s. Glob. Planet. Change 161, 132–148.

Roy, A., Fleischman, F., 2022. The evolution of forest restoration in India: the journey from precolonial to India's 75th year of Independence. Land Degrad. Dev. 33, 1527–1540.

Sarkar, O.T., Mukul, S.A., 2024. Challenges and institutional barriers to forest and landscape restoration in the Chittagong Hill Tracts of Bangladesh. Land 13, 558.

Shaw, R., Luo, Y., Cheong, T.S., Halim, S.A., Chaturvedi, S., Hashizume, M., Insarov, G. E., Ishikawa, Y., Jafari, M., Kitoh, A., Pulhin, J., Singh, C., Vasant, K., Zhang, Z., 2022. Asia. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, pp. 1457–1579.

Sims, M.J., Stanimirova, R., Raichuk, A., Neumann, M., Richter, J., Follett, F., MacCarthy, J., Lister, K., Randle, C., Sloat, L., 2025. Global drivers of forest loss at 1 km resolution. Environ. Res. Lett. 20, 074027.

Stanturf, J.A., Kant, P., Lillesø, J.P.B., Mansourian, S., Kleine, M., Graudal, L., Madsen, P., 2015. Forest Landscape Restoration as a Key Component of Climate Change Mitigation and Adaptation. IUFRO, Vienna, Austria.

Ullah, A., Zeb, A., Saqib, S.E., Kächele, H., 2022. Landscape co-management and livelihood sustainability: lessons learned from the billion trees afforestation project in Pakistan. Land Use Policy 115, 106034.

UNCCD. 2022. The global land outlook, 2nd edition. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany.

Vincent, J.R., Curran, S.R., Ashton, M.S., 2021. Forest restoration in low- and middle-income countries. Annu. Rev. Environ. Resour. 46, 289–317.

Sharif A. Mukul[a,b,c,*]
[a] Department of Environment and Development Studies, United International University, Dhaka 1212, Bangladesh
[b] Tropical Forests and People Research Centre, University of the Sunshine Coast, Maroochydore DC, QLD 4556, Australia
[c] Department of Earth and Environment, Florida International University, Miami, FL 33199, USA

Tek Maraseni[a]
[a] Centre for Sustainable Agricultural Systems, University of Southern Queensland, Toowoomba, QLD 4350, Australia

Sunil Nautiyal[a,b]
[a] Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Bengaluru, Karnataka 560072, India
[b] G.B. Pant National Institute of Himalayan Environment, Almora, Uttarakhand 263643, India

[*] Corresponding author at: Department of Environment and Development Studies, United International University, Dhaka 1212, Bangladesh
E-mail address: mukul@eds.uiu.ac.bd (S.A. Mukul).