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Afforestation, Ecological Restoration and Tourism Resilience

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Abstract **Original Research Article**

Himachal Pradesh's tourism economy depends on the ecological health of its forests, mountains, rivers, landscapes and biodiversity. Climate change, rising temperatures, erratic rainfall, melting glaciers, landslides, erosion, overcrowding, waste flows and pressure on natural resources threaten the environmental foundations of tourism. This study examines afforestation and ecological restoration as climate-resilience strategies for tourism in Himachal Pradesh. The study analyses how forest cover, tree plantation, soil stability, water regulation, biodiversity protection and community participation can support tourism sustainability. The study uses the afforestation data for 2020-2025, which records 62,096.80 hectares afforested and 48,815,734 plants planted. The analysis argues that afforestation should not be understood only as a climate-mitigation activity, in a mountain tourism economy, it is also a destination-resilience strategy. Forests act as carbon sinks, regulate water cycles, reduce erosion, stabilise slopes, protect biodiversity, sustain communities dependent on forest resources and preserve the landscapes that attract tourists. The study concludes that Himachal Pradesh needs to integrate afforestation, ecological restoration, carrying-capacity regulation, community participation and tourism planning into a single resilience framework.

Keywords: Afforestation; ecological restoration; tourism resilience; Himachal Pradesh; mountain ecosystems; climate adaptation.

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1. INTRODUCTION

Tourism in Himachal Pradesh is inseparable from ecology. Visitors are drawn to the state because of its mountains, forests, valleys, rivers, snow landscapes, biodiversity, rural settlements, pilgrimage sites and cultural environments. These resources are not merely scenic backgrounds, they are the ecological foundation of the tourism economy. If forests degrade, slopes become unstable, water sources decline, biodiversity is lost or landscapes become polluted, tourism also becomes vulnerable. The long-term viability of tourism therefore depends on protecting the environmental systems that make destinations attractive, safe and liveable.

Climate change has intensified this relationship between ecology and tourism. Rising temperatures, erratic rainfall, melting glaciers, flash floods, landslides, droughts and changing snow patterns affect mountain ecosystems and tourism-dependent livelihoods. The mountain ecosystems in Himachal Pradesh are vital to the state economy and heritage, but they face significant pressure from climate change, increasing tourist accessibility, visitor footfall, trail overuse, littering, wildlife disturbance and water stress (Tewari *et al.,* 2017). These pressures threaten sustainable development and local livelihoods.

Afforestation and ecological restoration are important responses to these challenges. Afforestation, understood as planting trees on deforested lands, helps mitigate climate change by absorbing carbon dioxide and reducing greenhouse gases. In Himachal Pradesh, forests containing species such as Deodar, Pine and Oak help curb global warming, enhance soil stability, reduce landslide risk, prevent erosion, regulate the water cycle, support biodiversity and sustain communities dependent on forest resources. These functions are directly relevant to tourism because they protect the landscapes and ecosystems that tourism depends on.

This study examines afforestation and ecological restoration as tourism-resilience strategies in Himachal Pradesh. It analyses the mountain ecosystem and the afforestation progress, both of which support ecological-restoration.

The central argument is that afforestation should be integrated into tourism planning rather than treated as a separate forestry activity. In mountain destinations, forest cover influences slope stability, water availability, biodiversity, landscape quality, disaster risk and community livelihoods. A tourism system that damages forests undermines its own resilience. A tourism system that supports ecological restoration can build a more sustainable foundation for long-term economic and social benefits.

2. Research Problem and Objectives

The research problem addressed in this study is that Himachal Pradesh's tourism sector depends on fragile mountain ecosystems that are increasingly threatened by climate change, environmental degradation, visitor pressure and land-use change. Tourism development often focuses on roads, accommodation, visitor facilities and destination promotion, but the ecological systems that sustain tourism receive less integrated attention. Afforestation and ecological restoration can reduce climate vulnerability, but their role in tourism resilience is not always fully recognised.

The study has four objectives. First, it examines how climate change and tourism pressure affect mountain ecosystems in Himachal Pradesh. Second, it analyses the ecological and tourism-related functions of afforestation, including carbon absorption, soil stability, water regulation, biodiversity protection and landscape preservation. Third, it interprets the afforestation progress data from 2020-2025 and discusses its relevance for tourism resilience. Fourth, it proposes a framework for linking afforestation, ecological restoration, community participation and sustainable tourism planning.

3. METHODOLOGY

The study follows a qualitative research design. It draws on the government reports, policy documents, statistical material and research studies issued by agencies such as the Himachal Pradesh Tourism Department, the Ministry of Statistics and Programme Implementation (MoSPI) and the Ministry of Environment, Forest, and Climate Change (MoEFCC). The analysis is also supported by material from non-governmental institutions, research organisations and international development agencies. The data is interpreted through thematic analysis, with attention to the relationships among tourism, construction, human development, ecological vulnerability and climate change impacts. This approach allows the study to examine afforestation and ecological restoration within the wider climate-resilience framework.

4. Mountain Ecosystems and Tourism Vulnerability

Mountain ecosystems in Himachal Pradesh are central to tourism, but they are also highly sensitive to disturbance. Rising temperatures have made higher areas more accessible to tourists, increasing footfall in fragile zones. This creates pressure through trail overuse, littering, wildlife disturbance, water consumption and pressure on local infrastructure (Tewari *et al.,* 2017). When visitor movement expands faster than ecological management, mountain environments may lose the quality that makes them attractive.

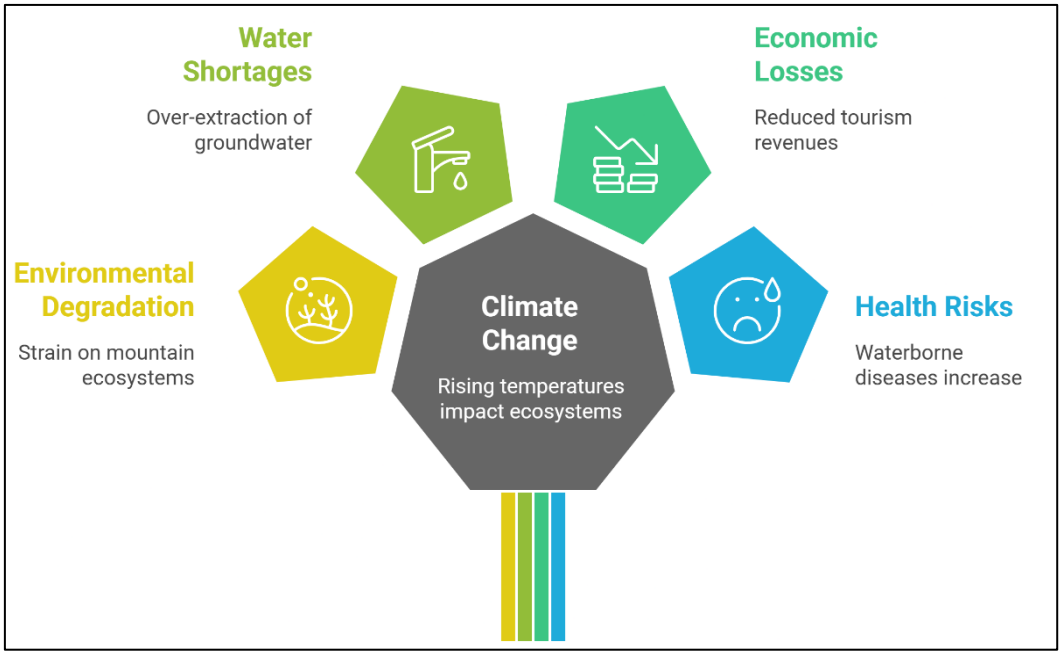

Figure 1: Climate Change Impact on Mountain Ecosystems

Figure 1 ecosystems highlights the multiple pathways through which climate stress affects ecological and tourism systems. Extreme weather events, flash floods, water contamination, ecosystem degradation and strain on natural resources are all relevant to tourism. Floodwaters can carry waste from urban centres, construction sites and tourist facilities into rivers and lakes, contaminating water sources and reducing environmental quality (Hartta, 2025; Lohan *et al.,* 2025). Such degradation affects residents and visitors while undermining the long-term viability of tourism.

Overcrowding at tourist hotspots also creates water pressure. Hotels, restaurants and tourist facilities consume water at high levels during peak seasons. This can lead to groundwater over-extraction and local water shortages, aggravating tensions and reducing community resilience to climate variability (The World Bank, 2014; Masoodi & Sundriyal, 2020). In this way, tourism pressure interacts with climate stress. A destination may be vulnerable not only because of natural climate events but because tourism demand increases pressure on limited ecological resources.

The socio-economic consequences of ecosystem degradation are significant. Environmental decline can increase maintenance costs, reduce the attractiveness of tourist destinations, lower tourism revenue and harm local businesses during extreme events (Hartta, 2025; Lohan *et al.,* 2025). Waterborne diseases and pollution can affect both residents and tourists, potentially deterring future visitors. Biodiversity loss and degradation of mountain ecosystems also threaten communities that depend on natural resources for income and well-being (Tewari *et al.,* 2017; Hartta, 2025).

Tourism resilience must therefore be understood ecologically. A destination is not resilient only because it has roads, hotels or marketing. It is resilient when the ecosystems that support those facilities remain healthy. Forests, water sources, slopes, trails, rivers, biodiversity and community resource systems are part of the tourism infrastructure, even if they are not always labelled as such.

5. Afforestation as Climate Mitigation and Tourism Adaptation

Afforestation has emerged as a key strategy for responding to climate change in Himachal Pradesh. The afforestation helps mitigate climate change by acting as a carbon sink, absorbing carbon dioxide and reducing greenhouse gases. Forests in Himachal Pradesh, including Deodar, Pine and Oak, help curb global warming, stabilise soil, reduce landslide risk, prevent erosion, regulate the water cycle and maintain groundwater levels and river flow. These functions are especially important because Himachal Pradesh is a vital water source for northern India.

The value of afforestation for tourism is both direct and indirect. Directly, forests provide landscape beauty, biodiversity, shade, recreation and ecological appeal for visitors. Many tourism activities depend on forested landscapes, including nature walks, eco-tourism, trekking, birdwatching, cultural tourism, pilgrimage routes, rural tourism and wellness tourism. Indirectly, forests reduce risks that can disrupt tourism, such as erosion, landslides, water scarcity and heat stress. A forested landscape can help stabilise slopes, regulate runoff and preserve the environmental quality that supports tourism.

Afforestation is therefore both a mitigation and adaptation strategy. As mitigation, trees absorb carbon and reduce greenhouse gas concentration. As adaptation, forests help landscapes withstand climate stress. In a mountain state, adaptation functions are especially important. Trees reduce erosion, regulate water cycles, protect biodiversity and support ecological balance. These functions strengthen destination resilience under conditions of erratic rainfall, warming and landslide risk.

Afforestation also has a community dimension. Forests support communities dependent on forest resources, including non-timber forest products, local livelihoods, water access and cultural practices. Himalayan communities use and manage forest resources in ways that can support livelihood diversity and ecological continuity (Masoodi & Sundriyal, 2020). When tourism planning ignores forest-dependent communities, ecological restoration may become top-down and disconnected from local needs. When communities participate in restoration, afforestation can support both conservation and livelihoods.

The connection between afforestation and tourism should be framed carefully. Afforestation should not become a justification for expanding tourism into every restored area. Some restored landscapes may need protection from intensive visitor use. Others may support low-impact eco-tourism or environmental education. The appropriate tourism model depends on ecological sensitivity, community consent, carrying capacity and management capacity.

6. Progress in Afforestation Activities, 2020-2025

Table 1 shows afforestation activities undertaken by the Himachal Pradesh Forest Department between 2020 and 2025. Over five years, a total of 62,096.80 hectares were afforested and 48,815,734 plants were planted. The year-wise progress is presented below.

Table 1: Progress in Afforestation Activities (2020-2025)

Year	Area Afforested (in Hectares)	Number of Plants Planted
2020–2021	15,439.00	12,281,237
2021–2022	13,613.24	11,053,415
2022–2023	15,131.86	11,790,266
2023–2024	9,992.00	7,374,670
2024–2025 (up to 30.01.2025)	7,920.70	6,316,146
Total	**62,096.80**	**48,815,734**

Source: Department of Tourism & Civil Aviation, Government of Himachal Pradesh, 2025

The data show substantial afforestation activity across the five-year period. The highest area afforested was recorded in 2020-2021, with 15,439 hectares and 12,281,237 plants. The year 2022-2023 also recorded a high afforested area of 15,131.86 hectares and 11,790,266 plants. The data show a decline in 2023-2024 and 2024-2025, though the 2024-2025 figure is listed only up to 30 January 2025. Even with this decline, the cumulative scale remains significant.

For tourism resilience, these figures matter because afforestation is not merely a forestry output. The area restored and the number of plants planted represent potential improvements in carbon absorption, soil stability, biodiversity habitat, water regulation, landscape quality and community resource support. In tourism-dependent regions, such ecological functions can reduce long-term vulnerability.

However, the interpretation of afforestation data should go beyond plantation numbers. The success of afforestation depends on survival rates, species suitability, ecological location, community participation, protection from grazing or damage, water availability and long-term monitoring. Planting millions of trees is important, but ecological restoration requires that plantations survive, mature and function as resilient ecosystems. Tourism planning should therefore be linked not only to afforestation targets but also to ecological outcomes.

The species composition also matters. The forests of Deodar, Pine and Oak contribute to ecological stability. Different species provide different benefits in relation to soil stability, water retention, biodiversity, carbon storage and cultural value. Ecological restoration should therefore prioritise native and site-appropriate species rather than plantation numbers alone. In tourism landscapes, the visual, ecological and cultural value of forest species should be considered alongside climate benefits.

7. Afforestation, Water Security and Slope Stability

Water security is a critical issue for Himachal Pradesh because the state is a vital water source for northern India. Forests regulate the water cycle and help maintain groundwater levels and river flow. This function is directly relevant to tourism because destinations require water for residents, visitors, hotels, restaurants, sanitation and ecological health. Where tourism increases water demand, forest conservation and afforestation can help maintain catchment stability.

Afforestation can contribute to water security by improving infiltration, reducing runoff, maintaining soil moisture and supporting groundwater recharge. In mountain environments, these processes are essential because rainfall can quickly become runoff if slopes are degraded. Forest cover slows water movement, reduces erosion and helps maintain the hydrological balance. In tourism regions, this can reduce water scarcity and support more stable destination functioning.

Slope stability is another important function. The trees enhance soil stability, reduce landslide risk and prevent erosion. In hilly terrain, roots help bind soil, vegetation reduces surface runoff and forest cover protects slopes from direct rainfall impact. While forests cannot eliminate landslides, they can reduce erosion and improve slope resilience in vulnerable landscapes. This is important for tourism because landslides can disrupt access, damage infrastructure and reduce destination safety.

Afforestation should therefore be integrated with landslide-risk reduction and watershed management. Plantations near vulnerable slopes, degraded catchments and erosion-prone areas can support long-term risk reduction if designed carefully. However, afforestation alone cannot substitute for safe road engineering, drainage management and land-use regulation. It should be part of a broader ecological-risk management strategy.

The relationship between forests and tourism is especially visible in eco-tourism. The Himachal Pradesh Tourism Policy emphasises eco-tourism and sustainable tourism practices (Government of Himachal Pradesh, 2019). Eco-tourism depends on healthy ecosystems. If afforestation improves forest cover, biodiversity and landscape quality, it can support low-impact tourism. However, visitor numbers must be managed so that restored landscapes are not degraded by overuse.

8. Biodiversity, Community Livelihoods and Ecological Restoration

Afforestation supports biodiversity by providing habitat for flora and fauna and maintaining

ecological balance. Biodiversity is important for tourism because it enhances nature-based experiences, supports eco-tourism, contributes to landscape diversity and strengthens ecosystem resilience. In Himachal Pradesh, forests and mountain ecosystems are part of the state's cultural and ecological identity. Their degradation would reduce both ecological value and tourism appeal.

Biodiversity protection also supports local livelihoods. Communities in Himalayan regions depend on forest resources, including non-timber forest products, fodder, fuelwood, medicinal plants and ecosystem services (Masoodi & Sundriyal, 2020). Ecological restoration can therefore support livelihood security if community access and conservation needs are balanced carefully. Tourism can add another livelihood layer through eco-guiding, nature interpretation, homestays, forest-based cultural experiences and local products.

However, there is a risk that tourism may commodify restored landscapes without benefiting local communities. If eco-tourism is developed around forests but local residents do not participate in decision-making or revenue-sharing, restoration may serve external tourism markets more than community resilience. Community participation is therefore essential. Local communities should be involved in planning, plantation protection, biodiversity monitoring, visitor management and benefit-sharing.

The importance of community engagement in tourism planning and management, noting that local participation ensures that needs and perspectives are considered and enhances community resilience (The World Bank, 2014; Masoodi & Sundriyal, 2020). This principle applies strongly to ecological restoration. Forests are lived landscapes, not empty tourism assets. Restoration should respect local knowledge, customary use and community priorities.

Afforestation can also create green livelihood opportunities. Nursery work, plantation maintenance, eco-guiding, trail restoration, biodiversity monitoring, interpretation services, waste management and environmental education can provide employment if linked with community-based tourism. Such work should be recognised as skilled ecological labour rather than informal voluntary activity. This is important for making restoration socially inclusive.

9. Integrating Afforestation into Tourism Planning

Afforestation should be integrated into tourism planning at three levels: destination planning, landscape planning and policy planning. At the destination level, tourism sites should identify degraded areas, erosion-prone slopes, water-stressed zones and biodiversity-sensitive locations. Afforestation can then be targeted to improve ecological stability and visitor management. For example, tree planting around trails, roads, springs and degraded slopes can reduce erosion and improve landscape quality.

At the landscape level, afforestation should be linked with catchment management, slope protection, biodiversity corridors and climate adaptation. Tourism destinations are not isolated points; they are part of wider ecological systems. A hotel or tourist market may depend on water from forested catchments, roads through slope systems and biodiversity-rich surroundings. Therefore, tourism planning should consider ecological systems beyond immediate destination boundaries.

At the policy level, afforestation should be connected with sustainable tourism, climate adaptation, disaster-risk reduction and rural livelihood programmes. The study recommends regulated homestay development, eco-tourism initiatives, carrying-capacity enforcement, green infrastructure, climate risk assessments and community-driven models that integrate livelihoods with environmental conservation. These recommendations indicate that ecological restoration can be part of a broader tourism resilience strategy.

Carrying capacity is central. Afforestation can restore ecological conditions, but tourism pressure must be controlled. Newly restored areas should not automatically become high-use tourist sites. Visitor numbers, trail use, waste management, noise, water demand and local community consent must be considered. Eco-tourism should be low-impact and conservation-oriented, not mass tourism under a green label.

Environmental education is another important link. Restored forests and afforested areas can become spaces for nature interpretation, school tourism, responsible travel awareness and community-led ecological learning. Tourists who understand the role of forests in water security, slope stability, biodiversity and climate resilience may be more likely to behave responsibly. Environmental education can therefore support both conservation and tourism quality.

10. DISCUSSION: AFFORESTATION AS TOURISM INFRASTRUCTURE

The central contribution of this study is to argue that afforestation should be understood as tourism infrastructure. Conventional tourism infrastructure includes roads, hotels, transport, signage, parking, restaurants and visitor facilities. However, in a mountain tourism economy, forests, slopes, water systems and biodiversity are equally infrastructural. They support the conditions that make tourism possible.

A forested catchment that maintains water flow supports hotels and households. A stabilised slope protects roads and settlements. Biodiversity enhances

eco-tourism and nature-based experiences. Tree cover improves landscape beauty and moderates microclimates. Forest resources support local communities that host tourism. In this sense, afforestation creates ecological infrastructure.

This perspective changes how tourism investment should be understood. Investment in tourism should not be limited to built facilities. It should include investment in ecological restoration, forest protection, catchment health, erosion control, biodiversity conservation and community stewardship. Such investments may not produce immediate visitor numbers, but they protect the long-term viability of destinations.

Afforestation also helps address the contradiction between tourism growth and ecological fragility. If tourism expands without ecological restoration, it can intensify degradation. If restoration occurs without tourism regulation, restored landscapes may be damaged by visitor pressure. The solution is not to separate tourism and ecology but to govern them together. Tourism planning should include ecological limits, while afforestation programmes should consider tourism pressures and community livelihoods.

The afforestation data from 2020-2025 show that Himachal Pradesh has undertaken significant plantation activity. The next challenge is to connect this activity to tourism resilience outcomes. Are afforested areas protecting water sources used by tourism destinations? Are they stabilising slopes near tourist routes? Are they supporting biodiversity in eco-tourism zones? Are communities involved in maintaining plantations? Are restored landscapes being protected from unregulated tourism pressure? These questions can help move afforestation policy from output measurement to resilience measurement.

The discussion also points to the importance of long-term monitoring. Ecological restoration takes time. Planting trees is only the first step. Survival, growth, species diversity, ecosystem function, community benefit and climate resilience must be monitored over years. Tourism planning often operates on shorter development cycles, but ecological resilience requires longer timelines. Aligning tourism with restoration therefore requires patience and institutional continuity.

11. **Recommendations**

First, Himachal Pradesh should integrate afforestation into tourism planning. Destination plans should identify degraded slopes, water-stressed catchments, erosion-prone areas and biodiversity-sensitive zones where restoration can improve tourism resilience. Second, afforestation programmes should prioritise native and site-appropriate species. Deodar, Pine, Oak and other suitable species should be selected according to ecological function, slope stability, water regulation, biodiversity value and local conditions. Third, afforestation should be linked with watershed management. Forest restoration around springs, streams, catchments and river systems can support water security for both communities and tourism facilities. Fourth, restored landscapes should be protected through carrying-capacity norms. Eco-tourism in forested areas should be low-impact, community-managed and regulated to prevent trail overuse, littering, wildlife disturbance and water stress. Fifth, local communities should be central to ecological restoration. Panchayats, women's groups, youth groups, forest-dependent communities and local tourism stakeholders should participate in plantation protection, monitoring, visitor management and benefit-sharing. Sixth, tourism revenue should support ecological restoration. A portion of destination-level tourism income can be directed toward afforestation, trail maintenance, waste management, biodiversity monitoring and community conservation initiatives. Seventh, afforestation outcomes should be monitored beyond plantation numbers. Survival rates, canopy development, biodiversity recovery, soil stability, water recharge, community benefits and tourism pressure should be assessed regularly. Eighth, environmental education should be integrated into tourism. Visitors should be informed about the role of forests in slope stability, water regulation, climate mitigation, biodiversity and local livelihoods. Ninth, restoration should be connected with green livelihoods. Nursery work, eco-guiding, interpretation, trail restoration, biodiversity monitoring and conservation education can create employment for local communities. Tenth, tourism infrastructure approvals should consider ecological restoration needs. New projects should be assessed for forest impact, water demand, slope stability and whether compensatory restoration or catchment protection is required.

12. CONCLUSION

Afforestation and ecological restoration are central to tourism resilience in Himachal Pradesh. The state's tourism economy depends on forests, mountains, rivers, biodiversity and scenic landscapes, but these ecological systems are under pressure from climate change, visitor growth, resource demand and environmental degradation. The mountain ecosystems face trail overuse, littering, wildlife disturbance, water stress, pollution and climate-related hazards. The afforestation data from 2020-2025 show significant restoration activity, with 62,096.80 hectares afforested and 48,815,734 plants planted. This represents an important ecological intervention. However, the tourism relevance of afforestation depends on how effectively plantations support carbon absorption, soil stability, water regulation, biodiversity protection, landscape quality and community livelihoods. The study has argued that afforestation should be treated as ecological tourism infrastructure. Forests help stabilise slopes, regulate

water, reduce erosion, support biodiversity, sustain communities and preserve the landscapes that attract visitors. Tourism planning should therefore include forest restoration, catchment protection, community participation and carrying-capacity regulation. Himachal Pradesh's tourism future cannot be secured through built infrastructure alone. Roads, hotels and visitor facilities must be supported by healthy ecosystems. A resilient tourism economy requires ecological restoration as much as destination promotion. By integrating afforestation with sustainable tourism planning, Himachal Pradesh can protect its environmental foundations while supporting livelihoods, community resilience and long-term climate adaptation.

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