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Natural Resource Structure and Tourism–Landscape Relationships in Chikhaldara Hill Station, Maharashtra

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ABSTRACT: The Satpura ranges of Maharashtra offer visitation opportunities in Chikhaldara with its high elevations, rough terrain and forests, waterfalls and water features. This paper explores the relationships of these landscape features with the location and nature of tourism sites and the challenges that may occur where visitor facilities and access are in close proximity to sensitive land. The analysis is based on the source study documentary material, location map from Google Earth and the field observations and photographs. It outlines a recurring theme: perspectives are associated with ridges and plateau edges; water attractions are related to drainage and catchment; and forests play a role in the ecological process and in the visual character of the destination. These relationships are qualitative and no quantitative statements about the extent or causes of environmental change can be made from the available data. The findings of the paper are used to define practical priorities for terrain-sensitive development, view-shed protection, drainage continuity, forest-edge management and visitor facilities, and identify the spatial data required for future testing.

1. INTRODUCTION

Tourism in hill stations is close to nature, which determines the location, structure and attractiveness of the tourist destinations. The characteristics of landforms, vegetation, water resources and scenic viewpoints affect the visitor experience as well as the development of roads, accommodation and other tourism related infrastructure. Attractions are built at hill stations, but often a lot of the value of the hill station is simply its natural resources, such as ridges, valleys, plateaus, waterfalls, lakes and forested slopes. These features offer opportunities for sightseeing, recreation and nature-based tourism and play valuable ecological roles. It is therefore important to understand the relationship between natural resources and tourism, in order to plan and manage hill destinations sustainably. Landscape and tourism planning documents also view natural and cultural assets as key planning considerations for the development of destinations (Dalal Mott MacDonald, 2003; Government of Maharashtra, 2025). The Government of Maharashtra, 2025, UN Tourism, 2023).

The Chikhaldara Hill Station in the Satpura ranges, Amravati district, Maharashtra is the suitable area to see these relationships. The topography varies across the area, with ridges, plateaus, scarps, valleys and gorges, as well as lakes, streams, seasonal cascades and forested areas. Devi Point, Hurricane Point, Goraghat Point, Monkey Point, Panchbol Point, Prospect Point, Thakur Point, Mozari Point, Shakkar Lake, Kalapani Lake, Bhimkund and Gawilgarh Fort are important tourist places. The attraction of these sites are closely linked to the surrounding landscape. High ground offers an overview, water features add beauty, and woodlands add elegance to roads, viewpoints and recreational areas. Gawilgarh Fort is another example of how a heritage attraction can have a part of its tourism value due to being on a higher ground with a natural setting. Government of Maharashtra, 2025; Department of Tourism, Government of Maharashtra, n.d.).

Natural resources in these places should not be used only for the purposes of tourism. Their physical and ecological functions impact the long-term visitor experience. Ridges and plateau margins are places to view and can be sensitive to excavation, construction and erosion. Valleys and gorges provide unique landscapes and drainage passages and habitat. Lakes and seasonal watercourses are dependent on the land surrounding them, and vegetation provides a role in protecting the soil, in providing

habitat continuity and in providing the visual character of the landscape. Changes in one element could thus have an effect on other elements within the tourism environment. Studying this relationship can help to explain the significance of landscape sensitive planning in such destinations as Chikhaldara. (Varghese & Yelisetty, 2006; UN Tourism, 2023).

The development of tourism can create increasing demands for the natural landscapes that are attracting tourists. Sensitive areas can be disturbed by road widening, construction, road traffic, unregulated visitor access and vegetation clearance, as well as by informal parking and disposal of waste. Buildings and structure may block key sightlines, and development on slopes can reveal soil and/or change the flow of surface water at viewpoints. Lack of management may lead to litter and localised disturbance around lakes and water margins. Tourism facilities and access may also creep up the edges of the forest. They are interrelated and can impact areas outside of the confines of a single tourist attraction. (Štrba et al., 2022; Government of Maharashtra, 2025).

The potential of tourism and natural-resource value of Chikhaldara are acknowledged in the literature and planning material available, but the association between the physical landscape and distribution of tourist locations needs further investigation. An attraction-centred approach may result in facilities and visitor requirements being identified at specific sites, but fails to take account of the wider land forms, drainage systems, vegetational and visual corridors that continue their attraction. Tourism opportunities and environmental sensitivities need to be considered from a landscape perspective. (Department of Tourism, Government of Maharashtra, n.d.; Pande, 2016; Wagay et al., 2019).

This background led to the present study to investigate the relationship between the natural-resource structure and tourism at Chikhaldara Hill Station. It aims to: Identify the main landform and water and vegetation features of selected tourist sites; Understand how these resources contribute to tourism experiences and ecological functions; Understand potential environmental pressures at the intersections between tourism and sensitive landscape features; Propose planning and management measures that can support the long-term quality of the destination. Documentary information, the location map available on Google Earth, and field observations and photographic records provide a qualitative interpretation of these relationships. It does not claim to establish a statistical cause, but instead addresses the extent of the impacts to the environment that were measured.

The available literature on the Chikhaldara and surrounding Melghat area shows focus on natural-resource management, regional ecology and tourism planning, and on ecotourism. The study on forest management in East Melghat Forest Division is a good example of the relevance of spatial information in forest planning (Varghese & Yelisetty, 2006). The ethnobotanical knowledge and plant use of the Korku community of Melghat forest area are reported by Wagay et al. (2019), indicating the ecological and cultural importance of the area.. Government tourism-planning documents also provide a policy context for sustainable tourism development in Maharashtra (Dalal Mott MacDonald, 2003; Government of Maharashtra, 2025). (Pande, 2016; Varghese & Yelisetty, 2006; Wagay et al., 2019).

Taken together, these sources establish the relevance of natural resources, ecological context and planning considerations to Chikhaldara's tourism development (Dalal Mott MacDonald, 2003; Government of Maharashtra, 2025; Varghese & Yelisetty, 2006; Wagay et al., 2019). However, the references available in the source manuscript do not provide a sufficiently systematic basis for claiming that previous research has comprehensively assessed the spatial relationships between individual tourist locations and their supporting landscape systems. This study addresses that issue through a descriptive comparison of tourist locations, landforms, water features, vegetation and potential pressure pathways. (Government of Maharashtra, 2025; UN Tourism, 2023).

2. LITERATURE REVIEW

2.1 Natural Resources as Interacting Landscape Systems

The natural resources in the hill-station environment are highly interdependent and the importance of the natural resource contributions to tourism can only be understood when they are viewed in their totality. Distribution of surface drainage and movement of water is influenced by landforms; distribution of vegetation is influenced by soil moisture and water availability. Vegetation, in turn, stabilizes soil, increases infiltration and provides landscape character. These interactions are very significant for Chikhaldara, as the tourism environment is characterized by high altitude, valleys, gorges, water bodies and forests. The four categories of resources defined in the original study—land, water, vegetation, and energy—thus serve as a good framework

for looking into the landscape, but evidence is more detailed for landforms, water, vegetation than it is for energy resources. (Varghese & Yelisetty, 2006; Wagay et al., 2019; Hall & Page, 2014; Dudley, 2008).

The physical attributes of individual landforms also impact upon their role in tourism. Plateaus and ridges offer high places and high view points, while valleys offer depth to the landscape and gorges offer an enclosed feel to the landscape experience. Scarps create conspicuous edges that can suggest views and seasonal waterfalls and can affect access routes, while saddles link up higher ground and can affect access routes. Meanwhile, these characteristics have ecological and physical aspects related to drainage, vegetation distribution and habitat. It is useful to understand their interrelationships, as alterations made to a landform can impact on the experience it provides to visitors as well as the environmental conditions. In this context, the relationship between natural resources and tourism could be best understood at the landscape-system level and not just within the confines of individual attractions. (Varghese & Yelisetty, 2006; Leung et al., 2018).

2.2 Hill-Station Tourism and Topographic Advantage

The spatial nature of hill-station tourism needs to be considered and topography plays an important role in that regard. High ground offers views and vistas from afar, and the edges of plateau margins, ridges and valleys offer contrasts in elevation that can add to the beauty. The presences of these features are seen in the following tourist sites of Chikhaldara: Devi Point, Hurricane Point, Goraghat Point, Monkey Point, Panchbol Point, Prospect Point, Thakur Point and Mozari Point. The map of the area and photographic records suggest a relationship of these viewpoints with the higher landforms. This observation gives further qualitative explanation of the influence of topography on the tourist landscape, but is not a proof of the fact that the elevation directly determines the location of tourist destinations. Their distribution may also be affected by accessibility, historical development and visitor preferences. (Department of Tourism, Government of Maharashtra, n.d.).

The bigger picture seen from an elevated viewpoint will also have an impact on its tourism value. Changes in the foreground, nearby slopes, across the valley walls or far across the ridgelines can impact the viewing experience even in the absence of a physical change to the viewpoint itself. Viewpoints, therefore, should take into account the visual context around them as well as the immediate visitor space. Chikhaldara has a particular aspect to this, in that the development of tourism infrastructure must take into account the prominent boundary of the plateau, the ridges and approach routes. These relationships are interpreted descriptively, however, in the present study, and do not involve the calculation of viewsheds using GIS nor numerical assessment of visual change. (UN Tourism, 2023; Government of Maharashtra, 2025).

The inventory that follows is of the same format as the one provided as a reference in the supplied paper, but is presented in multiple pages. It reorganises the original study's landform and resource evidence in the following way: Physical character, tourism role, ecological function, relationship and pressure. Tables 1-3 present a summary of the resource inventory, landscape dependencies of selected tourist locations, and possible pressure pathways.

The natural-resource inventory provides an overview of the physical attributes, tourism uses, ecological uses and potential stresses for the key landscape features (Table 1).

Table 1. Detailed Natural-Resource Inventory and Tourism Relationship

Category	Resource / feature	Physical character	Tourism role / use	Ecological / landscape role	Relationship	Principal pressure
Land	Plateau / elevated surface	Broad high surface forming the hill-station setting	Supports settlement, roads, tourism facilities and access to viewpoints	Controls runoff direction; supports vegetation and habitat mosaics	Interdependent	Construction, impervious surface, edge disturbance
Land	Ridge	Elongated elevated landform and drainage divide	Viewpoints, scenic drives, orientation and borrowed views	Drainage division, habitat continuity and wind exposure	Interdependent	Road widening, construction, visual intrusion
Land	Steep slope	Inclined terrain connecting plateaus	Scenic backdrop and approach experience	Runoff transfer, erosion	Interdependent	Cut-and-fill, erosion, slope instability

		and valleys		sensitivity, vegetation support		
Land	Valley	Low land between hills, commonly associated with drainage	Scenic depth, borrowed views and landscape contrast	Drainage corridor and habitat	Interdependent	Development, drainage alteration, waste
Land	Gorge	Narrow steep-sided valley	Waterfall/stream setting and dramatic scenery	Water movement, shaded habitat and geomorphic expression	Interdependent	Erosion, unsafe access, visitor disturbance
Land	Knoll	Small hill or mound within larger terrain	Local viewing and activity potential	Slope habitat and micro-topographic diversity	Interdependent	Erosion, construction, path widening
Land	Scarp	Steep escarpment or cliff at plateau edge	Panoramic views and waterfall origin	Slope habitat, rock exposure and drainage break	Interdependent	Edge construction, erosion, visual change
Land	Saddle	Low transition between higher points	Movement route, local views and drainage transition	Vegetation transition and drainage organisation	Interdependent	Road development and widening
Water	Shakkar Lake	Standing water body within hill landscape	Lake-edge recreation, scenery and stopping point	Water storage, local habitat and microclimatic influence	Interdependent	Waste, bank disturbance, runoff and siltation
Water	Kalapani Lake	Water body associated with surrounding vegetation	Scenic water attraction and landscape contrast	Aquatic/edge habitat and local water function	Interdependent	Litter, edge modification, drainage change
Water	Streams	Linear flowing water connected to drainage	Seasonal scenic element and route feature	Drainage conveyance and vegetation support	Interdependent	Channel obstruction, pollution, erosion
Water	Waterfalls	Vertical or steep water movement over relief	Seasonal attraction and photographic destination	Hydrological expression of terrain and rainfall	Interdependent	Visitor concentration, erosion, upstream disturbance
Water	Cascades	Water descending over steep rocky surfaces	Seasonal scenery and microclimatic experience	Water movement, vegetation support and downstream contribution	Interdependent	Seasonal disturbance, litter, unsafe access
Water	Torrents	Temporary or permanent rapid flow on steep slopes	Dynamic seasonal landscape feature	Transfers runoff to downstream channels	Interdependent	Drainage modification and erosion

Water	Drainage network	Connected channels, depressions and runoff paths	Indirectly supports lakes, waterfalls and scenic vegetation	Catchment function and erosion control	Interdependent	Road crossings, blockage, construction runoff
Water	Seasonal pools / Bhimkund setting	Water held within rocky/gorge environment	Nature-based and culturally recognised attraction	Local aquatic habitat and hydrological storage	Interdependent	Crowding, waste, slippery/eroding access
Vegetation	Forest cover	Continuous or semi-continuous wooded landscape	Scenic enclosure, nature experience and destination identity	Habitat, soil protection, infiltration and microclimate	Interdependent	Clearance, fragmentation, fire and visitor disturbance
Vegetation	Forest edge	Transition between wooded land and roads/clearings	Approach scenery and edge viewpoints	Ecotone, habitat transition and slope protection	Interdependent	Road widening, informal parking, trampling
Vegetation	Seasonal vegetation	Vegetation expression varying with rainfall and season	Changes scenic character through the year	Soil cover, habitat and seasonal ecological function	Interdependent	Clearing, trampling and altered runoff
Vegetation	Riparian / drainage vegetation	Plants associated with water channels and moist depressions	Enhances water attractions and shaded experience	Bank stability, filtration and habitat	Interdependent	Channel clearing, litter and bank erosion
Vegetation	Slope vegetation	Plant cover on steep and bouldery terrain	Visual continuity across hillsides	Erosion control and habitat	Interdependent	Cut slopes, construction and path creation
Visual	View-shed	Visible landscape from major viewpoints	Primary resource for viewpoint tourism	Landscape character and perception of ecological continuity	Interdependent	Buildings, signage, utilities and vegetation removal
Climate	Microclimatic variation	Local differences created by elevation, shade and vegetation	Comfort and distinctive hill-station experience	Supports vegetation and habitat variation	Interdependent	Vegetation loss and heat-retaining surfaces
Energy	Solar/wind potential	Supporting resource category identified in source framework	Potential support for lower-impact tourism services	Can reduce dependence on conventional supply if sensitively located	Context dependent	Visual intrusion and poorly sited infrastructure

The relationships between selected tourist locations and their associated natural features are summarised in Table 2.

Table 2. Tourist Locations and Their Landscape Dependencies

Tourist location	Primary natural setting	Tourism function	Landscape dependency	Principal sensitivity
Devi Point	Elevated ridge/plateau edge	Panoramic viewpoint	Long-distance view, steep edge and surrounding vegetation	View-shed obstruction, edge erosion, crowding

Hurricane / Hariken Point	Elevated hill edge	Panoramic viewpoint	Valley, forest and hill views	Construction, road pressure, visual clutter
Goraghat Point	Elevated terrain / valley edge	Scenic viewpoint	Relief contrast and borrowed landscape	Erosion, visitor pressure, edge modification
Monkey Point	Elevated landform	Viewpoint / stop	Topographic exposure and surrounding vegetation	Crowding, litter, vegetation disturbance
Panchbol Point	Gorge / elevated edge	Viewpoint and acoustic/scenic experience	Deep gorge, forest and distant views	Visitor concentration and edge disturbance
Prospect Point	Elevated ridge / plateau margin	Viewpoint	Panoramic exposure and scenic depth	Visual intrusion and road-side pressure
Thakur Point	Elevated terrain	Viewpoint	Ridge/valley relationship	Construction and visitor pressure
Mozari Point	Elevated terrain	Panoramic viewpoint	Wide landscape visibility	Visual clutter and edge development
Shakkar Lake	Lake and catchment	Water-based scenic attraction	Water surface, vegetation and terrain enclosure	Waste, bank pressure, drainage alteration
Kalapani Lake	Lake and vegetation	Water-based scenic attraction	Water-vegetation contrast	Litter, edge disturbance, runoff
Bhimkund	Gorge/water system	Water/landform attraction	Rock, water and seasonal hydrology	Crowding, erosion and waste
Gawilgarh Fort	Elevated heritage landscape	Heritage + panoramic tourism	Historic structure within hill/forest setting	Access pressure, insensitive construction, view change

The principal pathways through which tourism-related activities may affect sensitive landscape features are summarised in Table 3.

Table 3. Pressure Pathways and Potential Landscape Effects

Pressure	**Sensitive resource/interface**	**Mechanism**	**Potential effect**	**Planning response**
Construction	Plateau edges, ridges, slopes, forest interfaces	Cut-and-fill, vegetation removal, new building mass	Erosion, habitat loss, altered drainage and visual intrusion	Slope controls; suitability zoning; design review
Road development	Ridges, saddles, slopes, drainage crossings	Widening, excavation, embankment and paving	Runoff concentration, fragmentation and visual change	Drainage-safe design; limit unnecessary widening
Vehicular movement	Viewpoints, road edges, tourist nodes	Traffic, parking and repeated edge occupation	Noise, compaction, congestion and informal expansion	Managed parking, drop-off and shuttle evaluation
Waste	Viewpoints, lakes, forest edges, water channels	Litter and unmanaged disposal	Scenic degradation, water contamination and wildlife interaction	Collection, segregation, removal and enforcement
Visitor trampling	Forest edges, slopes, water margins	Informal paths and repeated foot pressure	Soil compaction, erosion and vegetation loss	Defined trails, barriers and durable surfaces
Drainage	Roads, construction sites,	Blockage, diversion and	Erosion, siltation and	Protect channels; permeable surfaces;

disturbance	lake catchments	increased runoff	changed seasonal flows	runoff controls
View-shed degradation	Major viewpoints and heritage setting	Buildings, signage, utilities and clutter	Reduced scenic quality and destination identity	View corridor mapping and design controls
Seasonal concentration	Waterfalls, cascades, holiday peaks	Short-period high visitor loads	Localised waste, crowding and path erosion	Seasonal staffing, maintenance and visitor management

2.3 Water Resources and Tourism

Water-based tourism is heavily dependent on topography in Chikhaldara. A catchment is a lake, a drainage line is a stream and a waterfall/cascade/torrents is a situation where runoff meets a steep slope/scarp. The physical structure of this attraction only considers the part that can be seen by the visitor as one attraction and not a part of a connected hydrological system. The surrounding catchment, drainage crossings, surface cover and slope condition can affect the movement of water in the landscape and the potential for sediment and/or waste to be carried downstream. The original study does not report on catchment boundaries, water quality results or discharge measurement, but instead identifies these relationships descriptively. Implications are therefore considered as a foundation for planning and future investigation; not as the measured hydrological effects. (Department of Tourism, Government of Maharashtra, n.d.; UN Tourism, 2023)

Water-based attractions are enhanced by seasonality. Rainfall can during and after the monsoon season cause the visible flow to increase, and also change the vegetation, runoff and access conditions, while it can match a different appearance or appeal to visitors during drier seasons. Duration and magnitude of these changes cannot be measured for each site without repeated observations over seasons. Water features should be recorded at similar times during the monsoon, post monsoon and dry season in a future assessment, along with the presence of visible drainage obstruction, bank disturbance and litter. (UN Tourism, 2023).

2.4 Forests, Vegetation and Scenic Character

Forest in the broader scale of Melghat area acts as an ecological service, but also creates the visual culture of Chikhaldara. Forest cover offers scenic enclosure around roads, around viewpoints, to help create microclimatic differences, protects soil on slopes, and supports habitat. Forest boundaries are especially significant as edges may also be sites where there is road, visitor traffic, parking, and buildings. This edge can then be a tourism asset and a disturbance interface. (Varghese & Yelisetty, 2006; Wagay et al., 2019; Government of Maharashtra, Forest Department, n.d.).

2.5 Tourism Development and Environmental Pressure

Principal pressures identified in the source study include construction, road development, vehicle traffic, waste, vegetation removal, erosion and disturbance of drainage. Not reported as statistically measured impact magnitudes. Rather than that, they are observed or likely processes by which tourism-related activities might change the landscape systems that support attractions. This is important in the context of research integrity because the study can establish a relationship and management priorities without asserting quantified cause. (Štrba et al., 2022; UN Tourism, 2023; Geneletti & Dawa, 2009; Sundriyal et al., 2018; United Nations Environment Programme (UNEP) & World Tourism Organization (UNWTO), 2005).

2.6 Landscape Planning, Regulation and Sustainability

Planning context as cited in the source manuscript is the Sustainable Tourism Plan for Maharashtra and the Unified Development Control and Promotion Regulations for Maharashtra State. These documents, in combination, define the need to take tourism development into broader development-control and infrastructure/environmental-maintenance processes. For Chikhaldara it means that the planning of tourism is not possible without considering the issue of slope safety, drainage, forest context, and visual character and settlement growth. The Government of Maharashtra (2025), Dalal Mott MacDonald (2003), Global Sustainable Tourism Council (2019), Government of India, Ministry of Environment and Forests (2006), Government of Maharashtra, Directorate of Tourism (2025), Maharashtra Metropolitan Region Development Authority (n.d.), Ministry of Tourism, Government of India (2002), Sood et al. (2024).

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One of the common failings in destination planning is the treatment of attractions as if they are a point compared to the system. A point based approach might include facilities near a viewpoint that do not support it, or facilities near the road that brings run-off in the direction of the viewpoint, or facilities near the view corridor that means to the viewpoint. Rather, a system-based approach focuses on what elements of the landscape are drawing in the attraction and what changes are occurring off-site that may have a negative impact. (UN Tourism, 2023; UN Tourism, n.d.).

There is valuable information about the tourist points of Chikhaldara, its forest resources, ecological setting and development potentials in existing material, but comparatively less attention is paid on the spatial relationship between the natural-resource structure and the location of tourist points. This gap is filled in the source study, descriptively. The extended paper builds on this contribution by formalizing a framework for resource–tourism–pressure, distinguishing evidence from inference, and turning the results into a monitoring agenda (Sood et al., 2024; Varghese & Natori, 2024).

There are three parts to the contribution. One is to consider landform, water and vegetation as the enabling form of tourism, rather than background scenery. Secondly, it demonstrates that tourism pressures are focused at the same interfaces where tourism value is created, such as at edges of the plateau, edges and margins of water, and forest edges and access routes. Third, proposes a planning sequence that maps the resource sensitivity of the area first and then additional infrastructure is located. These contributions are qualitative in nature, and are to be used for guiding future GIS and field validation..

3. METHODOLOGY

The study area is the Chikhaldara Hill Station and its tourism scenario in Amravati district of Maharashtra. The map created using Google Earth in the original study was divided into tourist points and natural features according to the settlement and road infrastructure. The map presented is used here as a qualitative spatial reference and cannot be considered as a georeferenced GIS dataset, no exact distances are derived from it. Department of Tourism, Government of Maharashtra (n.d.). Selected tourist sites and the natural features are displayed in a spatial pattern, as seen in Figure 1.



Figure 1. Location of selected tourist points and natural features in Chikhaldara, reproduced from the original study.

There are three general observations that can be made from the mapped pattern. First, multiple viewpoints are found at higher edges, not in one center point of the tourism precinct. Secondly, water features are located in different positions that correlate with local drainage and depressions. Third, the settlements and the road network offer access to an attractive landscape with fragmented elements, establishing multiple links between mobility and sensitive landscape. (Department of Tourism, Government of Maharashtra n.d.).

The conceptual approach regards the natural resource structure as the foundation for generating ecological functions and tourism opportunities. The movement and infrastructure are then clustered in selected landscape nodes due to tourist use. Pressure is represented by erosion, vegetation changed, drainage changed, waste or visual intrusion when intensity or form of use is greater than the sensitivity of the resource system. Responses should therefore be planned on the Resource System level and not on the boundary level of the attraction. The concept links between natural resources, tourism opportunities, environmental pressures and environmental responses are outlined in Figure 2.



Figure 2. Conceptual resource–tourism–pressure framework developed from the original study.

3.1 Analytical propositions

Viewpoint tourism: depends on the integrity of wider ridge, plateau-edge and view-shed systems; Water attractions: depend on catchment/drainage continuity in addition to the visible water body; Vegetation: performs tourism and ecological functions simultaneously – loss of vegetation can create multiple impacts; Tourism pressure most consequential where visitor concentration overlaps sensitive slopes, water margins, forest edges and visually prominent landforms; Landscape-sensitive planning should protect the enabling resource system before adding infrastructure.

3.2 Research Design

This qualitative case study examines the relationship between natural-resource structure and selected tourist locations in Chikhaldara. It draws on documentary sources, Google Earth imagery, field observations and photographic records. The analysis is descriptive: it compares the physical setting of tourist locations with the landscape functions and pressures discussed in the source material. It does not estimate statistical effects. (UN Tourism, 2023).

3.3 Documentary Evidence and Source Selection

Documentary evidence in the source study includes government reports, tourism and planning documents, forest-related material and academic studies relevant to Chikhaldara and the wider Melghat region. Sources were used when they contributed

information on natural resources, tourist locations, ecological functions, development pressure or planning context. The evidence was organised around four principal resource groups - land, water, vegetation and energy - and then compared with tourist-site locations and observed pressure pathways. (Dalal Mott MacDonald, 2003; Government of Maharashtra, 2025; Varghese & Yelisetty, 2006; Wagay et al., 2019).

3.4 Field Observation

Field observation was used to record visible site character and pressure rather than to produce instrument-based measurements. Attention was given to landform, vegetation, water, visitor activity, roads, tourism infrastructure, waste, erosion and construction. Because the source paper does not document a repeated seasonal protocol or structured observation sheet, the observations are treated as qualitative and illustrative.

3.5 Photographic Documentation

The original manuscript contains the most forceful direct visual evidence in the form of photographs. Representative images document hills, valleys, gorges, knolls, scarps, saddles and cascades. The photographs have been kept in the results section in this extended paper, and are interpreted as part of the results to the background of the functions of the tourism, its ecological significance, and its pressure.

3.6 Google Earth-Based Interpretation (Google, n.d.).

To determine the relative position of selected tourist points to the hill station and the landscape, Google Earth imagery was used in the source study. The method allows visual comparison of the distribution of attractions, to the wider pattern of terrain and settlement. It does not replace GIS, however: No coordinates, no digital elevation models, no slope classes, no buffer analysis, no network analysis or view-shed calculations are reported. The present paper therefore will only be used descriptively to give spatial interpretation to the map.

3.7 Analytical Procedure

The material was organized by categorizing the main resource groups, recognizing the identified tourist sites, interpreting a general spatial context of the available Google Earth map and comparing the photographs and observations with the documented tourism and environmental context. The resulting synthesis connects the various landscape features with their role in tourism, their ecological function and their potential pressure. This is a conceptual coding task and not a numerical scoring model.

3.8 Evidence Coding

To facilitate interpretation of evidence, there are three dimensions of coding. Resource code: the landscape system (landform, water, vegetation or supporting environmental condition) that enables the resource. Tourism-function code refers to the main role of the tourist (viewpoint, water attraction, heritage setting, route experience or scenic support). Pressure code indicates the main disturbance route (construction, road development, waste, vehicles, trampling, erosion, drainage alteration or visual intrusion). This coding is conceptual and not numerical weighting.

3.9 Validity and Research Integrity

The interpretation is based on multiple types of material such as documentary descriptions, the location map, photos and field observations. The sources offer complementary perspectives of the landscape but they have their restrictions. Interviews, questionnaires, visitor numbers, repeat seasonal observations, ecological sampling and GIS derived measurements are not documented in the available manuscript. The results are therefore to be interpreted as being qualitative, as relationships and planning considerations, rather than as quantified causal effects. (UN Tourism, 2023).

4. RESULTS

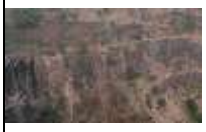
The results are presented in the form of a comparison of features of the landscape, tourist locations and the pressures related to the use of the tourist facilities. Tables 1–3 summarise the resource inventory, turist-location dependencies and potential pressure pathways, and Tables 4 and 5 present the organisation of the photographic interpretations. The location map and conceptual framework are in the figures 1–3, and the source derived analytical chart is shown in figure 4. The photographs and location map aid in illustrating the physical setting, and the tables summarize the relationships described in the source material.

Department of Tourism, Government of Maharashtra (n.d.), Štrba et al. (2022). The location context and conceptual framework are presented in figures 1-3, and the source-derived analytical chart, in figure 4.

4.1 Photographic Interpretation of Landforms

The photographic matrix has been created to highlight that the physical fabric of Chikhaldara does not only provide a scenic backdrop. There is a mix of tourism and ecological uses in each landform, and each faces a unique set of pressures. The tourist functions, their ecological functions and possible pressures are also indicated on the photographical interpretation of the hills and valleys, gorges and knolls, that is, in Table 4.

Table 4. Photographic interpretation of hills, valleys, gorges and knolls using the original source images.

Feature	Photograph	Tourism role	Ecological role	Pressure
Hills		Scenic views, tourist points, borrowed views and microclimatic variation.	Habitat and microclimatic variation.	Construction and visitor pressure.
Valleys		Scenic depth, tourist points, borrowed views and vegetation variation.	Drainage corridor and habitat.	Development and drainage alteration.
Gorges		Waterfall/stream setting and dramatic scenic views.	Water movement and habitat.	Erosion and visitor disturbance.
Knolls		Local viewing/activity potential and landscape variety.	Slope and habitat function.	Erosion and construction.

The first four landform types show how the landform types become more complex, changing in form from broad elevated terrain to more restricted valley and gorge forms. This morphology is acted upon by tourism use: hills and knolls provide exposure and views; valleys and gorges provide depth, enclosure and water-related scenery. Ecologically, these same features form drainage, habitat and microclimatic variation.

4.2 Scarps, Saddles and Cascades

Table 5 takes the photographic interpretation one step further and focuses on scarp, saddle and cascade types highlighting their touristic and ecological roles and pressures..

Table 5. Photographic interpretation of scarps, saddles and cascades using the original source images.

Feature	Photograph	Tourism role	Ecological role	Pressure
Scarps		Waterfall origin, panoramic views and dramatic plateau edges.	Slope/habitat function.	Erosion and construction.

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Plateau-edge scarps		Scenic views, borrowed views, vegetation and microclimatic variation.	Slope/habitat function.	Road development and edge disturbance.
Saddles		Movement, stream origin/transition and vegetation variation.	Drainage and vegetation transition.	Road development.
Cascades		Seasonal water scenery, streams, microclimate and vegetation variation.	Water movement and vegetation support.	Seasonal disturbance and visitor pressure.

This is the reason why scarps are particularly significant as they are visually conspicuous, and slope sensitive and hydrologically expressive. Water can run out or down steep sides, viewpoints can be out at the same steep sides, the panoramic view. Saddles serve as a link between higher ground and so have lower geometry and can draw routes. The direct interaction of relief, water and vegetation is shown in cascades (Varghese & Yelisetty, 2006).

4.3 Viewpoints and Elevated Landforms

The most consistent common feature is the linkage of perspectives to higher elevation ridges. Devi Point, Hurricane Point, Goraghat Point, Monkey Point, Panchbol Point, Prospect Point, Thakur Point and Mozari Point are connected to ridges, edges of plateaus or other higher land. They are not viewed from a viewing platform per se, but are built on elevation and edge condition/visibility. (Department of Tourism, Government of Maharashtra, n.d.).

The relationship may be described in terms of a dependency chain: the topographic exposure is created by elevated landform, the view-shed is created by topographic exposure, the scenic tourism value is created by view-shed, the view-shed brings visitors to concentrate at the edge, and the concentration of visitors brings pressure to the elevation landform. The tourism asset and the sensitive resource are thus found to be in the same spatial location.

4.4 View-shed as a Natural-Tourism Resource

The view-shed is a functional resource of the landscape for tourism, but unlike soil or water is not a tangible resource. The quality is dependent on how continuous the foreground, middle ground and distant scenery is. Impacts to the landscape such as billboards, road edge structures, building encroachments and over-clearing can change the landscape impression even if they are not physically at the View Point. (UN Tourism, 2023).

The distribution of viewpoint tourism therefore justifies the focus of the source study on protecting view-sheds. The areas that can be seen from major viewpoints should be identified on future GIS, as should be the visually sensitive ridges, valley walls and approach corridors. Until it can be done there is a need for planning decisions to exercise caution in relation to visible margins of the plateau.

4.5 Terrain Sensitivity

The more the terrain is steep, the more important the form of development becomes. The exposure of soil and runoff concentration from cut and fill, retaining walls, widening of the road, and informal foot paths. If the interventions are on scenic edges, there may be some physical disturbance at the same time as visual impact. This bi-sensitiveness is a hallmark of Chikhaldara's tourism ambiance. (Štrba et al., 2022; UN Tourism, 2023).

4.6 Water-Based Attractions and Drainage Relationships

There is a relation between tourism and hydrology, as shown in Shakkar Lake, Kalapani lake, Bhimkund, cascades, torrents and

seasonal waterfall settings. The lakes offer more or less level surfaces of water, and the cascades and torrents demonstrate the runoff of water over the steep terrain each season. Bhimkund is a combination of rock, gorge and water features. Form of these attractions is variable and they all rely on drainage continuity and dependence on catchment condition.

Source evidence is not provided with discharge measurements, catchment boundaries or water-quality data. However, this is enough to allow for identification of management pathways. The increase of impervious surface can lead to a corresponding increase in runoff, disturbed slopes can lead to increased sediment pollution, blockage of channels can lead to alteration of flow patterns, and waste dumped near water can impact the scenic and ecological value of the water. These pathways provide justification to plan for the watershed before quantitative hydrological modelling (UN Tourism, 2023).

4.7 Seasonal Dependence

A significant unquantifiable variable is seasonality. Waterfall and cascade visibility can be enhanced during the monsoon season and also during the dry season; vegetation density and surface runoff may increase during the rainy season; and different patterns in the use of the cascades may be observed during the dry season. The original study admits that the seasonality is not completely captured. Future studies should thus conduct observations during both monsoon and post-monsoon and dry seasons and not assume the observations are from the same time period.

4.8 Water Margins as Visitor Interfaces

Water margins will be expected to have high levels of stopping, photography and informal seating and food-related activity. This leaves them exposed to trampling, edging and litter, which modify them. There should be a distinction between those areas accessible to visitors that have only a marginal impact on the environment and those areas where disturbance is more significant, with focus placed on developing facilities where disturbance can be controlled.

4.9 Forest and Vegetation Relationships

At various levels, forests enhance the tourism experience at Chikhaldara. At the regional scale they set the wooded hill character of the destination; at the route scale they frame roads and approaches; and at the site scale they offer a sense of shade, enclosure and foreground scenery. Vegetation provides habitats, soil protection, infiltration and local microclimate (Varghese & Yelisetty, 2006; Wagay et al., 2019).

The interface of tourism and forest areas is significant. Roads and viewpoints usually tend to appear at border areas of open and wooded surfaces. These edges can develop into expansion areas for parking, stalls, widening and informal paths. Small, repeated changes can eventually turn a vegetated edge to a broken up service strip. This is an ongoing process and cannot be reflected in attraction-by-attraction planning.

4.10 Gawilgarh Fort as a Heritage-Landscape Relationship

Gawilgarh Fort is different from natural view points as it is a built heritage site which has tourism value but is still enhanced by natural setting. It is sited at a high elevation, with a challenging climb and an all-encompassing forested vista, thus offering a heritage-landscape experience. The finding illustrates that when landscape setting is an integral component of the visitor experience, natural-resource planning is applicable to cultural attractions as well.

4.11 Combined Resource Functions

The results indicate that more than half of the features serve multiple purposes. A scarp can be a viewpoint edge, waterfall origin, habitat surface and visual landmark. A valley can be a drainage path, foreground and vegetational area. A lake can serve as a tourist attraction, as a water body and as a microclimatic element. The multifunctionality is the main argument for integrating tourism planning into landscape planning.

4.12 Source Analytical Chart

The original paper contains a comparative analytical table of the tourist-point associations with natural features and severity and ecological/tourism-use scores. The chart is reproduced since it is source evidence. The original methodology, however, does not provide a repeatable scoring procedure, manual size, weighting or statistical procedure for all values. It should therefore be treated as a hypothesis-suggesting and description-based synthesis and not a verified quantitative measurement. Figure 3 shows the comparative assessment between the tourist-point associations and the environmental pressures and the

ecological/tourism-use scores that the source study provided for the various sites.

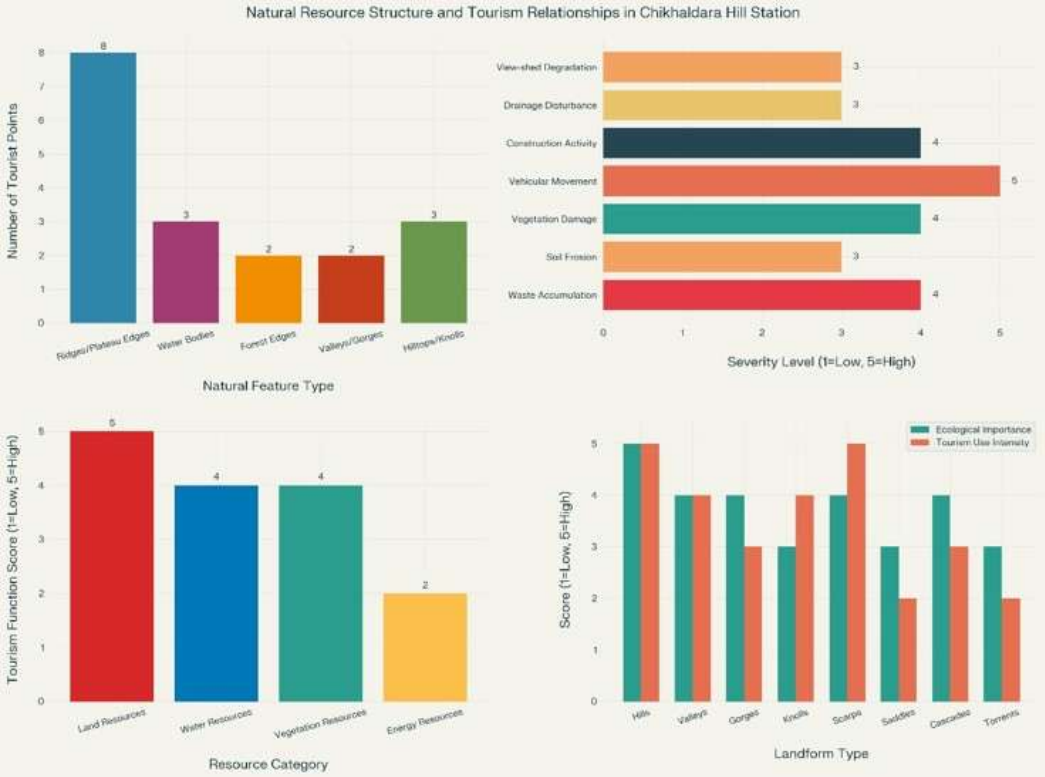


Figure 3. Analytical chart from original study. Numbers are kept as source-based description, and are not considered as statistically verified results.

The limitation is not a serious one, however, because the chart illustrates the intended analytical logic of the study, that is, the presence of natural features, the presence of tourism functions, the perceived level of pressures, and the integration of ecological and tourism uses. This logic could be expressed in a transparent index and could be applied to a future study by establishing variables, the units of measurement, scoring rules and repeated observations.

5. DISCUSSION

The major discovery is that the sensitive areas and the tourism value areas of Chikhaldara are generally in the same areas. High perimeters offer a sweeping view, but can be vulnerable to erosion and sight line, whereas water's edge entices people to visit and can be impacted by litter, foot traffic and disturbance of the banks. Likewise, the boundary of the forest landscape may be arranged to enclose tourist corridors and vistas but also may provide for easy parking and additional development. The overlaps indicate the importance of planning at the level of landscape systems that are connected to one another rather than single locations. (Štrba et al., 2022; UN Tourism, 2023).

The results support a shift from attraction-based planning towards landscape-system planning. The ridges and scarps, the valleys, the drainage systems and forests, which are not built structures, but are the integral parts of Chikhaldara, are also its forms of tourism infrastructure. These natural attributes provide panoramic vistas, access points, local microclimates, water-based activities and the scenic appeal of the site. As such, degradation of these systems can reduce the quality of destinations in a similar way as the degradation of built infrastructure can impact service quality. This view alters the order of planning decisions. First, the planners should identify the various resource systems involved, their environmental sensitivity, and the function of these systems for tourism, before finding a tourism project and trying to mitigate its environmental impact. The infrastructure can then be identified and planned to meet the needs of visitors and access while preserving the natural resource values that attract them. The State government of Maharashtra (2025) and UN Tourism (2023).

The value of tourism and the vulnerability of the environment are often clustered in the same areas. Steep edges and high visibility are assets for views across the plateau but disadvantages due to steepness. Water margins may be vulnerable to littering, trampling and bank disturbance, while still providing opportunities for contact and are an attractive place for scenic appreciation. Forest edges can increase the interest of the landscape, and can be influenced by the removal of minor vegetation. This spatial synergy helps to shed light on the issue of whether a generic standard of development is adequate for the tourist landscape as sensitive to the environment. Planning measures must consider the particular characteristics and vulnerabilities of the individual landscape features as well as their interactions with other landscape areas.

The landscape-system approach has an important implication because environmental and visual impacts could happen outside of the scope of a single attraction. A building outside a viewpoint may block significant viewpoints and a road work on a higher slope could change runoff patterns and impact water bodies downslope. Likewise, the removal of vegetation from outside a tourist platform may affect the scenic quality of the adjacent area and parking development on approach roads may contribute to forest edge fragmentation. These associations suggest that planning boundaries are not limited to the immediate zone identified as a tourist attraction, but should, as far as possible, shape the links between the functional landscape.

The pressure pathways mapped in this study can take the form of a series of related activities. When developments are undertaken to support tourism, access roads must be built, adding to the number of vehicles travelling through the area and the need for parking. Expanding parking areas could result in larger disturbed areas leading to more runoff and erosion, and land uses and services supporting these parking areas could lead to further waste generation. While interventions might seem quite small on their own, there is a possibility that these interventions can impact sensitive landscape features (ridges, forest edges, water margins) over time in combination with other developments. Thus, environmental management should not only account for the impact of the individual project but also the cumulative impacts from the series of infrastructure projects and activities related to visitors. (Štrba et al., 2022).

Chikhaldara is also a place of tourism, but along with the presence of these names, the continuity of the landscape on the way between them also plays a significant role in the identity of this place. The roads, forested slopes, openings in the valleys, scarps and far-off ridges provide a series of experiences of sight and space that add to the uniqueness of the destination. If development disrupts this continuity with a visually dominant structure, through large areas of clear vegetation or inappropriate development infrastructure, then the destination may lose some of its characteristics of a more rural hill settlement. Maintaining landscape continuity is thus a key issue in tourism planning, especially when scenic aspects of the surrounding landscape are an integral part of the visitors' experience.

While the study has identified plausible and observed relationships between the natural resources, tourism activities and environmental pressures, it does not provide a quantification of the causal contribution. For instance, erosion occurring in the vicinity of a tourist site does not, in itself, indicate the relative contribution of visitors, road construction, rainfall or construction. Likewise, the spatial relationship of a viewpoint and a ridge is not statistically indicative of any cause and effect relationship between the characteristics of the ridge and the location or selection of the viewpoint. The results should therefore be taken as qualitative results and should only be looked at as an indicator of planning relevant dependencies and possible risk paths to be further investigated in due course through systematic field measurements, quantitative spatial analysis and longitudinal monitoring.

Where multiple forms of evidence align they provide a boost to the credibility of the analysis. The tourist description is used to show viewpoints and water-based attractions, the location map is derived from Google Earth to show spatial distribution, photographs show representative landforms and field observations show the categories of environmental pressure. None of these sources can give a full picture of Chikhaldara alone; but together they enable a coherent interpretation of Chikhaldara as an integrated landscape system. This triangulation will be useful for highlighting planning issues but acknowledges that further more detailed spatial and environmental information would be needed to determine the magnitude, frequency and drivers of the pressures identified. (Department of Tourism, Government of Maharashtra, n.d.; UN Tourism, 2023).

6. CONCLUSION

The interrelationship between natural resources, landscape characteristics, tourism opportunities and environmental pressures in Chikhaldara Hill Station, Maharashtra were studied. The findings emphasize the need to treat Chikhaldara as a composite landscape system where landforms, water resources, vegetation and climatic conditions collectively add to the tourism value of

the destination. Features like ridges, edges of plateaus, scarps, valleys, lakes, drainage channels and forested slopes apart from providing scenic experiences also decide the spatial character of tourist activities. Thus these natural resources are an integral part of the tourism infrastructure, contributing to the destination's attraction and distinctiveness.

The analysis also reveals that tourism value and environmental sensitivity are often found together. Sites that attract visitors because of their panoramic views, water features, and scenic surroundings may also be vulnerable to erosion, disturbance of vegetation, littering, alteration of drainage, and visually intrusive development. Such pressures may not be confined to individual tourist attractions but may be cumulative, resulting from inter-related activities such as road building, increased parking, vegetation clearance and the development of visitor facilities. Thus, planning decisions based solely on individual attractions may neglect the broader landscape relationships through which environmental changes impact tourism quality.

The study emphasizes the need to move from an attraction-based planning to a landscape-aware approach that recognizes the functional links between natural resources, tourism infrastructure and environmental strains. Sensitive landforms can be identified and vegetation and water margins protected; the movement of visitors can be controlled and infrastructure sited in accordance with the characteristics of the landscape to support tourism development while maintaining the environmental and scenic qualities of the destination. Incorporating landscape considerations into tourism planning may also form a basis for coordination of infrastructure development and environmental management across linked areas.

To summarize, the study offers a qualitative framework for interpreting the relationship between natural resource structure and tourism-landscape interactions in Chikhaldara. It provides a conceptual basis for more systematic landscape assessment and sustainable destination planning, emphasizing the coexistence of tourism opportunities and environmental vulnerabilities. These results can inform further research on spatial mapping, environmental monitoring, visitor-use assessment and evaluation of tourism-related pressures. This would greatly help in strengthening the empirical basis for planning decisions and in supporting the long term conservation of the distinctive hill-station landscape of Chikhaldara.

7. LIMITATIONS

This study adopts a qualitative, landscape-system approach to examine the relationships between natural resources, tourism opportunities, and environmental pressures in Chikhaldara Hill Station. Its findings are based on documentary sources, Google Earth-based spatial interpretation, photographs, and field observations. Although these sources support a contextual understanding of the landscape and its tourism functions, the study does not include a formal GIS-based terrain analysis, systematic spatial measurements, or quantitative modelling of relationships between landscape characteristics and tourism activity.

The study also does not incorporate comprehensive visitor counts, structured surveys of tourists or local communities, or systematic seasonal observations. Consequently, it cannot quantify visitor pressure, establish seasonal variations in tourism-related impacts, or determine the relative importance of different environmental pressures. Similarly, observations concerning erosion, drainage alteration, vegetation disturbance, littering, and visual intrusion are interpreted as potential or visible pressure pathways rather than as quantitatively verified impacts attributable exclusively to tourism.

Also, the study does not establish causal links between specific tourism activities and environmental changes. There could be a variety of factors affecting erosion around a tourist site such as rainfall, slope, road construction and movement of tourists. The contribution of each factor cannot be reliably determined without longitudinal observations and appropriate environmental measurements. The conceptual relationships in the study are thus to be understood as planning-oriented interpretations and not as statistically validated causal models.

Finally, the findings are specific to the landscape and tourism context of Chikhaldara Hill Station and should not be generalised directly to other hill stations without considering their geographical, ecological, infrastructural, and tourism characteristics. Future research could address these limitations through GIS-based landscape mapping, seasonal field surveys, visitor-flow analysis, water and soil assessments, and consultations with relevant stakeholders. Such approaches would enable more precise evaluation of environmental sensitivity, tourism-related pressures, and the effectiveness of landscape-sensitive planning interventions. (UN Tourism, 2023).

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10. Author Declaration

The authors declare that this manuscript is original and has not been published elsewhere. The authors declare no conflicts of interest.