Floral Richness and Ecotourism Potential of Mundhum Trekking Trail in Eastern Nepal

Achyut Tiwari[*1], Aashish Bidari[1], Sawan Rajbanshi[1], Ramesh Kumar Rai[2]

Received: 23 May 2025 Revised: 28 September 2025 Accepted: 16 November 2025 Published: 31 January 2026

The Mundhum Trekking Trail (MTT) is a newly revived cultural trail in eastern Nepal, enriching traditional biocultural diversity. MTT shares elevation up to 4165 meters (viewpoint of Silchung Peak) from sea level and encompasses various lakes and mountains with high cultural values. Among them Salpa Pokhari and Silichung Peak (4,155 m asl) are key places. In this communication, we have reviewed the history and the initiatives undertaken to revive this trail, enumerated flowering plants and biocultural diversity and analyzed the ecotourism potentiality of this trail. We reported 264 species of angiosperms, belonging to 84 families and 190 genera, with the maximum number of species and genera belonging to Poaceae followed by Asteraceae. Further, we identified the culturally important plant and animal species used by Kirati people along the trail. Our results indicate that the newly revived historical trail has huge potential both as a cultural and an ecotourism trail. Besides, there has already been a surge of visitors in recent years, there is equally an urgent need to conserve the rich biocultural diversity along the trail to develop and promote it as purely a cultural ecotourism trail.

Keywords: Biodiversity; Ecosystems; Kirat; Mundhum; Plant.

The Mundhum Trekking Trail is in Koshi Province in eastern Nepal covering the altitude range of 1600- 4155 masl at Silichung peak, and extending on the borders of Solukhumbu, Khotang, Bhojpur, and Sankhuwasabha districts. Mundhum Trekking Trail (MTT) has been listed among the 100 new destinations explored by the government of Nepal as one of the highly potential ecotourism destinations in Nepal, and the government of Nepal has also recently proposed to develop and promote MTT to attract more trekkers (GON, 2024; Nepal Tourism Board, 2024). MTT provides a view of 6 of the 8,000-meter peaks, including Mt. Everest (8848 m), Lhotse (8516 m), Lhotse Sar (8382 m), Makalu (8463 m), Cho Yu and Kanchanjunga (8586 m). The MTT passes through several indigenous ethnic villages occupied by Kirat (Mundhumi) communities. *Mundhum* is the ancient ritual tradition of the Kirati people, serving as the religious scripture, mythological narrative, and guide to social, cultural, and spiritual life. Traditionally, Mundhum is often recited orally by ritual specialists known as Nakchhong (for the Rai) or Phedangma, Samba, Yeba/Yema (for the Limbu). The MTT begins from the mid-hill mountains of eastern Nepal, representing Chakhewa Vanjyang from the border of the Khotang and Bhojpur districts of eastern Nepal to Mehrung Hill, Maiyung Hill, Lauri Hill, Salpa Pokhari, Shilichung Peak, and back to Bhojpur Bazaar through Maiyung Hill and Suntale Hill.

Nepal's unique geographic position, with altitudes ranging from 59 m to 8,848 m and diverse climates, fosters exceptional ecological and floral diversity, hosting 5,820 species of angiosperms and ranking 10th in Asia and 31st globally in flowering plant diversity (Bhuju et al., 2007; Shrestha et al., 2023). Nepal represents diverse phytogeographical provinces and vegetation types, including tropical rainforests dominated by *Shorea robusta* in the lowlands, temperate oak and conifer forests in the mid-hills, and alpine meadows and dwarf rhododendron scrubs in higher altitudes (Miehe et al., 2015). This richness

[1]Central Department of Botany, Tribhuvan University Kirtipur Kathmandu Nepal
[2]Mundhum Farm Stay, Namobuddha Kavrepalanchok Nepal
*Email: achyut.tiwari@cdb.tu.edu.np

results from the convergence of various floristic elements, including drier Western and Central Asiatic provinces, humid Sino-Japanese provinces, Southeast Asiatic elements in eastern foothills, African-Indian desert elements in the west, and typical Indian flora in the south, this shows Nepal's transitional position of floral diversity between the eastern and western Himalayas (Shrestha & Joshi, 1996; Welk, 2016).

Among 215,644 plant species that have been cataloged globally, Nepal's contribution to global flora exhibits its critical role in the Himalayan biodiversity (Shrestha & Joshi, 1996; Shakya et al., 1997). The flora of Nepal is crucial for understanding the region's unique geography and altitudinal climatic variations, and provides baseline data for studies on environmental change and biodiversity. With more than 35 forest types, 75 vegetation units, and 118 ecosystems (Stainton, 1972), Nepal's botanical wealth is safeguarded through in-situ conservation in Protected Areas (PAs) as well as ex-situ conservation efforts in the botanical gardens and herbaria. These measures ensure the sustainable use and preservation of the country's rich plant diversity.

Biodiversity includes the diversity of life on Earth, including plants, animals, and microorganisms, and is categorized into three dimensions: genetic diversity (variability within species), taxonomic diversity (diversity across taxa), and ecosystem diversity (variety of ecosystems and biomes) (Rawat & Agarwal, 2015; Chaudhary et al., 2016). Biodiversity provides environmental services and goods that are essential for the survival of all living beings. Biodiversity conservation requires comprehensive scientific documentation and a deep understanding of nature, which is facilitated through extensive research and exploration. Nepal's rich plant heritage, deeply intertwined with its cultural identity, is celebrated through traditional medicinal practices, spiritual rituals, and festivals that are of global attraction. Ecotourism thrives well when visitors explore Nepal's biodiversity hotspots, such as Conservation Areas and National Parks, where the ecological and cultural significance of local flora is highlighted through guided treks. Furthermore, ecotourism and community-led conservation initiatives offer opportunities for experiential learning, promoting sustainable tourism and fostering appreciation for Nepal's natural and cultural treasures. The synergy between biodiversity, culture, and ecotourism certainly ensures the preservation of Nepal's unique heritage while supporting economic growth and environmental balance. Hence, MTT also represents the Mundhumi cultural value of living in close harmony with nature, serving for biodiversity conservation. In this context, the MTT region is well recognized for its unique biodiversity, encompassing dense upper temperate forests, pasturelands, watersheds, and wetlands that support unique flora and fauna. It is a home to diverse Rhododendron species, Bamboo, and threatened wildlife such as the Red Panda (*Ailurus fulgens fulgens*), Mountain eagle (*Aquila chrysaetos*), Deer (*Moschus chrysogaster*), Himalayan giant honeybees (*Apis laboriosa*), Leopard (*Panthera pardus*), bear (*Ursus thibetanus*), Danfe (*Lophophorus impejanus*), and Himalayan goral (*Naemorhedus* sp.). MTT includes a sub-tropical to alpine landscape (Bhojpur Bazar to Silichung Peak) that harbors stunning scenery where forests give way to grasslands. The main cultural heritage of MTT is the settlements of the Kirati people, where the livelihood of local people is closely connected to nature. Despite its biocultural richness, the region faces multifarious threats, including deforestation, forest/land degradation, and climate change, which jeopardize its biological resources. Limited knowledge of local biodiversity hinders the development of effective conservation strategies. Hence, this study is aimed at a) exploring the general history of the Mundhum Trekking Trail, b) documenting the diversity of plant species, c) analyzing the biocultural diversity along the MTT, and d) evaluating the ecotourism potential of the MTT. It is expected that the findings of the study will be highly instrumental for developing MTT as a cultural and ecotourism trail.

Materials and Methods

Study area

This study was carried out along the Mundhum Trekking Trail (MTT) in eastern Nepal. It is situated between Bhojpur and Khotang districts and passes through the high mountain regions of Solukhumbu and Shankhuwasabha districts. MTT lies within the upper temperate to sub-alpine landscape of eastern Nepal, beginning at Bhojpur Bazar at 1600 m above sea level and ending at Silichung Peak with 4165 m (Figure 1). The area is exposed to a typical monsoon climate system with four seasons: summer (June-September), autumn (October-November), winter (December-January), and spring (March-May). More than 80% of rainfall occurs in the summer. The climate is warmer in summer and colder in winter with high humidity (99%). The temperature rise up to 25°C and drops below 0°C. The topography of the study area is mountainous terrain. The soil type varies from sandy loam to clay and clay loam.

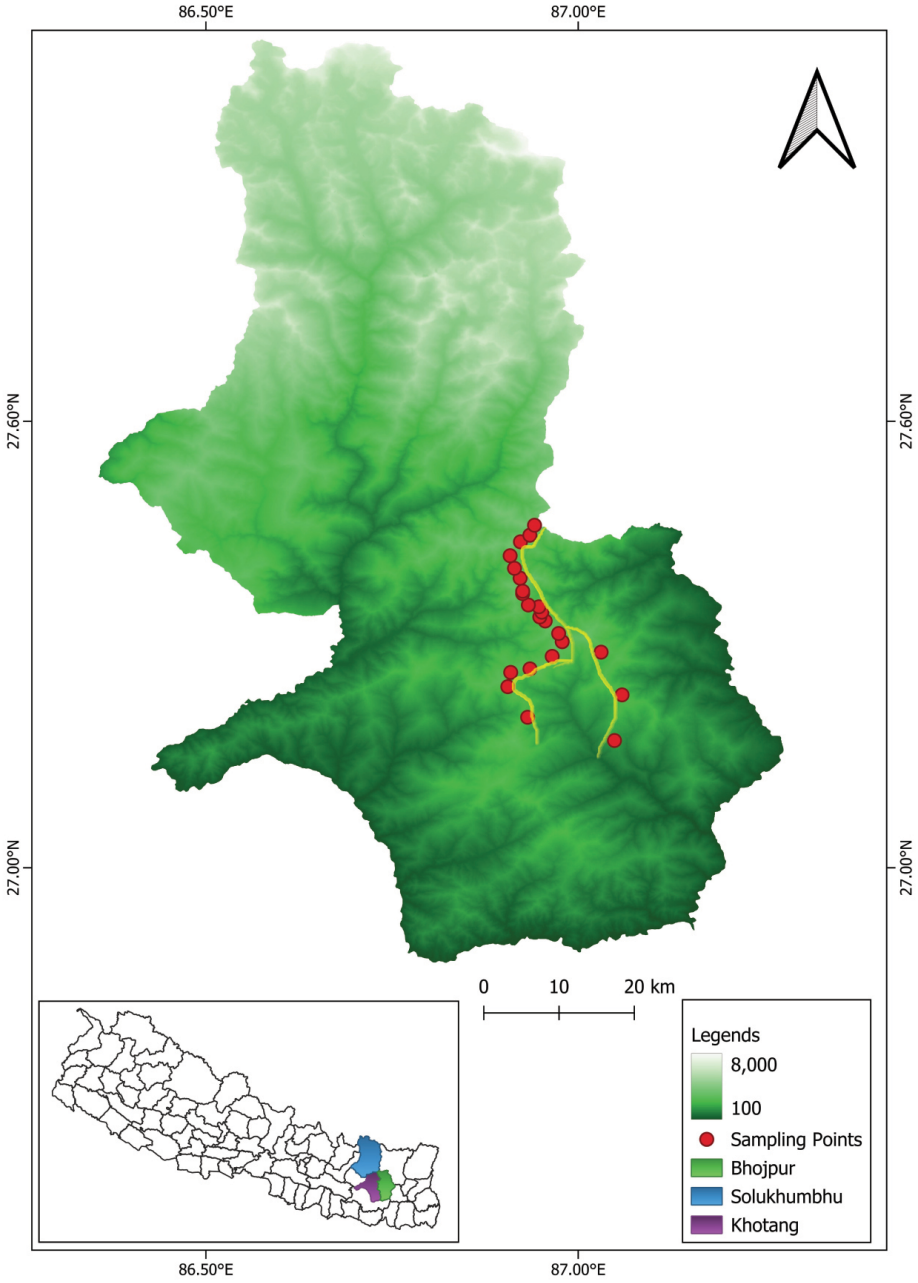

Figure 1: Location of Mundhum Trekking Trail in eastern Nepal, sampling sites for floristic study along the Mundhum Trekking Trail

Plant collection, herbarium preparation and identification

Field data was collected from the MTT during field visits of early September 2023 (Monsoon) and May (Pre-monsoon) 2024, capturing two seasons of flowering time of plants. A random cum purposive sampling method was used to include plant species from all the vegetation types during the transect walk carried out along the forested as well as non-forested areas along MTT and its surroundings. The secondary information was generated from the various field consultations and key informant interviews with local people and stakeholders of MTT. The key informants were herders, tea shop owners, and the representatives of rural municipalities and the MTT management committee.

Plant specimens were compiled within the MTT area, covering all the habitat types and vegetation types, wherever possible. The common plant species were identified on the spot, where field identification was certain. In other cases, field notes, local names, and photographs were taken, and herbarium specimens were collected. The specimens were identified with the help of references including Hara and Williams (1979), Hara et al. (1982), Flora of Bhutan (Grierson and Long (1983-2001), Stainton (1972), Polunin and

Stainton (1984), Stainton (1988), Wu et al. (1994-2008), and by herbarium study. The nomenclature of the species followed standard literature at POWO (2025). We characterized the forest and vegetation types of MTT following Dobremez (1976), TISC (2002) and Shrestha (2008), based on plant species, elevation and habitat structure along MTT.

Biocultural diversity and ecotourism potential

Data on biocultural diversity were collected with the help of key informant interviews along the trekking trail and with the help of published literature. Particularly, we focused on culturally important plants and animals that have been used by the local Kirati (Mundhumi) people since historical times. We used plant specimens, photographs, animal parts (horn, skin, feathers, etc.), and related information for gathering biocultural diversity in the region.

We evaluated the potential of MTT as an ecotourism destination by using the standard checklist that synthesizes principles from established frameworks and guidelines in sustainable tourism (Ceballos-Lascurain, 1996; Honey, 2008). The criteria from organizations like the International Ecotourism Society (TIES) (e.g., Butler, 1999; Fennell, 2020) and the Global Sustainable Tourism Council (GSTC) were used to identify critical factors for ecotourism success. We used semi-quantified scores (maximum=5, high=4, moderate=3, fair=2, low=1) for each factor as a potential driver for ecotourism success.

Results

History of Mundhum Trekking Trail (MTT)

The Mundhum Trekking Trail (MTT) is located in eastern Nepal, and the trail has been used by Mundhumi people in history previously; and the historic trail was recently reopened in 2018 AD. MTT follows a long path and is an ancient one, which traces back its origin to Mundhum culture-oral scripture and spiritual basis of the Kirat people, Rai, Limbu, Sunuwar, and Yakkha communities. MTT is also a well-liked trail because one of the trails was the same one that was used by the first Everest summiteers, Tenzing Norgay Sherpa and Edmund Hillary, when visiting Everest in 1953. The Kirati people had a religious path, which was the historical Mundhum Trail that connected their places of worship, provided cultural interchange, facilitated local trade, and ensured the Kirati people and their connection to nature and spirituality. The reopened MTT is believed to help a lot in saving the oral heritage of the Mundhum as it connects the cultural tourism with the ancestral knowledge. MTT is very much rooted in Mundhumi culture; one of the ancient religious scriptures, oral literature, and guiding philosophy of the Kirat people, who is an indigenous ethnic community mainly located in eastern Nepal, Sikkim, and Darjeeling of India. It is Kiratism (Kirat Dharma), the backbone of Kirat religion, and it is a spiritual and cultural underpinning of Kirat communities, the Rai, Limbu, Sunuwar, and Yakkha (Hodgson, 1847; Bista, 2004). The term is a coined word based on the Limbu terms, Mun, which means power, and Dhum, which means word or wisdom. It may be interpreted as the strength of great knowledge or wisdom.

Mundhum is a time-honored oral tradition, which was transmitted across generations by Phedangma, Nokcho, and Samba, whose spiritual leadership or Shamanism made them the leaders of the Kirat religion (Hodgson, 1847; Sharma, 1992; Subba, 1998). Mundhum has its roots in oral recitation as is the case with the Vedic hymns of Hinduism. This oral literature has been held back through centuries and has mainly been preserved by the shamans and includes mythological accounts, principles of life, codes of conduct, spiritual rituals, and the history of creation and human existence. It is closely connected with nature, spirits, and deities as it is based on the animistic traditions of Kirat culture, according to which forests, mountains, rivers, and other natural items are sacred (Subba, 1998; Subba, 1999). Mundhum also describes ceremonies of major aspects of life, birth, marriage, and death, as well as the agricultural methods and annual celebrations such as Udhauli and Ubhauli, that observe the cycle of Kirat living (Sharma, 1992; Subba, 1998). Mundhum is also known to be in the list of the intangible cultural heritage of Nepal, yet it is still essential to the identity of Kirats. It is practised in rituals, festivals, and the teaching of shamans despite the forces of modernity and globalization, which indicate the strength and flexibility of Kirat spirituality (Subba, 1998; Van Driem, 2001).

The Kirat people have a sacred oral scripture called Mundhum, which is full of creation myths, animistic beliefs, and rituals (Sharma, 1992; Van Driem, 2001; Tandukar, 2020). Its mythology has the creation stories of the universe, earth and humanity, which include the deities such as Tagera Ningwaphuma

who are central in the mythology. Animism and shamanism form the core of Mundhum, emphasizing the presence of spirits such as Yuma and Sumnima in natural entities like rivers, trees, and mountains. Shamans, acting as mediators, connect the human and spiritual realms.

Vegetation type and plant diversity

Based on field observation and plant species distribution, we have identified 12 different forest types along MTT (Table 1). These forest types are mainly shaped by the altitudinal variation of MTT, which represents Bhojpur Bazar (1600 m) to Silichung Peak (4165 m).

Table 1: Forest Types Recorded in Mundhum Trekking Trail as per Dobremez (1976), TISC (2002) and Shrestha (2008)

SN	Forest Type	Distribution	Species Association	Localities
1	Subtropical semievergreen forest	2000-5500 ft, at the base of mountains (Arun and Tamor Valley)	*Schima wallichii, Castanopsis indica, C. tribuloides, Dalbergia sericea, Albizzia mollis, A. lucida, A. chinensis, Erythrina suberosa, Duabanga grandiflora, Macaranga pustulata*	Dovan, Suntale, Bhojpur
2	Subtropical evergreen forest	In 3000-5500 ft, in high rainfall area on the outer foothills between the Koshi and the Mechi rivers	Canopy: *Eugenia tetragona, E. ramosissima, Acer oblungum, Acer thomsonii, Machilus odoratissimus, Castanopsis indica, C. tribuloides, Cinnamomum species, Turpinia nepalensis, Lithocarpus spicata, Alnus nepalensis, Albizzia species* understory*: Ostodes paniculata, Leucosceptrum canum, Eurya acuminata, Talauma hodgsonii, Symplocos spicata, Mahonia napaulensis,Casearia graveolens*	Chakewa Bhanjyang, Pakhuwa Bhanjyang, Dhotre Deurali Phedi
3	*Quercus incana*, *Quercus lanuginosa* forest	4000-8000 ft, A few patches in the Arun, Tamor valleys	Canopy*: Quercus incana (Syn.: Q. leucotrichophora), Q. lanuginosa (Syn.: Q. lanata),* Second storey: *Rhododendron arboretum, Lyonia ovalifolia, Rhus wallichii, Carpinus viminea, Myrica esculenta, Ilex dipyrena, Cornus capitata*	Pakhuwa Bhanjyang, Phedi
4	*Quercus semecarpifolia* forest	8000-1000 ft, on south face, mainly West	Canopy: *Quercus semecarpifolia, Pinus excelsa* Second storey: *Rhododendron arboretum, Lyonia ovalifolia, Acer species*	Chakewa Bhanjyang, Phedi
5	*Castanopsis tribuloides, Castanopsis hystrix* forest	6000-7000 ft, in East	Canopy: *Castanopsis tribuloides, Castanopsis hystrix, Quercus lamellosa* Second storey: *Lindera pulcherrima, Neolitsea umbrosa, Machilus odoratissima, Symplocos species, Rhododendron arboreum*	Chakewa, Dhotre Deurali
6	*Quercus lamellosa* forest	6500-8000 ft, ridges in upper Arun and Tamur	Canopy: *Quercus lamellosa, Q. Lineata, Castanopsis tribuloides* Second storey: *Ilex sikkimensis, Ilex dipyrena, Litsea elongate, Machilus duthiei, Acer species, Lyonia ovalifolia, Rhododendron arboretum, Daphniphyllum himalayense, Prunus nepalensis*	Chakewa, Dhotre Deurali
7	Lower temperate mixed broadleaved forest	5000-7000 ft, mostly evergreen, usually north or west faces (side valleys of Arun and Tamor,	*Machilus duthiei, M. odoratissima, Neolitsea umbrosa, Cinnamomum tamala*	Dhotre Deurali
8	Upper temperate mixed broadleaved forest	8000-10500 ft in central and east midlands, on north and west faces	*Magnolia campbellii, Acer campbellii, Osmanthus suavis, Schefflera impressa, Corylus ferox*	Pakhuwabhanjyang
9	Rhododendron forest further higher range: R. fulgens, R. wightii	8500 ft to alpine zone, mostly in east	Lower range: *Rhododendron grande, R. hodgsonii, R. falconeri Ridge,* south aspect: *R. abroreum Higher range: R. campanulatum, R. wallichii, R. thomsonii, R. campylocarpum*	Dhotre-Maiyung
10	*Betula utilis* forest	Treeline species, 11000-12500 ft	Canopy: *Betula utilis, Abies spectabilis,* Second storey: *Acer pectinatum, A. caudatum, Juniperus recurva, Sorbus foliolosa, Rhododendron campanulatum, R.*	Rawadhap

			fulgens, R. arboretum, R. hodgsonii. Prunus cornuta, P. rufa	
11	*Abies spectabilis* forest	10000 ft to treeline, mostly in central midlands	Canopy*: Abies spectabilis (*Syn.*: A. webbiana), Tsuga Dumosa* Second layer: *Betula utilis, Juniperus recurva, Sorbus cuspidate, S. foliolosa, Acer* sp. *Third layer:* Rhododendrons*, Daphne bholua*	Maiyung, Hanspokhari, Rawadhap
12	Moist alpine scrub	Above tree line, up to 14500 ft, on wet areas	*Rhododendron species, Juniperus recurve, Salix sikkimensis, Lonicera species, Berberis* sp., *Potentilla fruticosa*	Salpapokhari, Silichung

During the field study carried out in early September 2023 and May 2024, we collected more than 280 vascular plants in the region, including dicot and monocot plants, gymnosperms, and ferns. The region is also well represented by the good diversity of Rhododendron species in Nepal (estimated at more than 15 species). Further, we have categorized four different corridors of plants, such as the medicinal plant zone, the rhododendron zone, grasslands for livestock, sand timber, and forest trees. Our results showed that MTT is well represented by its unique plant diversity that supports wildlife and the ecosystem functioning of the region.

We recorded a total of 264 species of angiosperms, belonging to 84 families and 190 genera. The maximum number of species and genera belongs to the Poaceae family, i.e., 34 species and 29 genera, followed by Families such as Asteraceae, Cyperaceae, Rosaceae, Ericaceae and so on (Figure 2). The maximum number of species is found to be in the *Rhododendron*, i.e., 13. Similarly, there are 6 species of *Cyperus*, 5 species of *Carex*, followed by *Arisaema*, *Berberis*, *Rubus*, and so on (Figure 2).

Depending on the floristic composition and use value of the major vegetation zones of the trail, we have categorized the whole MTT into four categories, such as the Timber and Fodder Zone, Rhododendron Zone, the Livestock Pastureland and Medicinal Plant Zone (Figure 3, Table 2). Each zone has high potential in terms of its value for ecotourism services. However, mountain biodiversity is globally threatened, including the biodiversity of MTT. The region is facing problems like rapid environmental changes (Manandhar et al., 2011), habitat degradation (Chaudhary et al., 2015), and deforestation (Pandit et al., 2007).

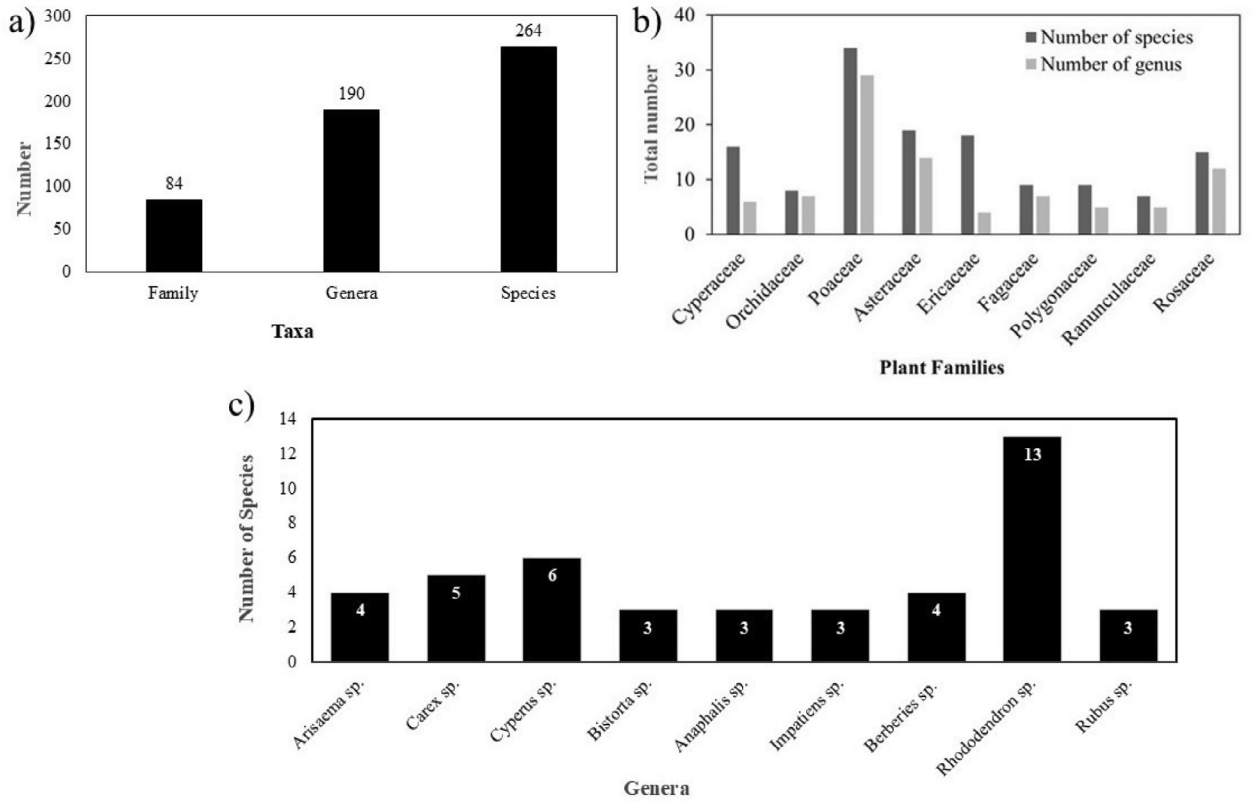

Figure 2: Floral richness a) total number of families, genera, and species, b) plant families with high numbers of genera and species, c) number of plant species in the larger genera

Table 2: Major Vegetation Zones of Mundhum Trekking Trail

SN	Biodiversity zone	Altitude	Locality	Key plant species
1	Timber and Fodder	1600-2500 m	Bhojpur bazar, Pakhuwabhanjyang, Tyamke, Chakhewa, Dhotre Deurali, Fedi	*Pinus, Alnus, Albizia, Berberis, Castanopsis, Rhododendron, Michelia*
2	Rhododendron Zone	2200-4100m	Chakhewa, Maiyung, Rawadhap, Kulupankha, Salpapokhari, Silichung	Different species of *Rhododendron* (more than 13 species of *Rhododendron including Rhododendron arboreum, R. anthopogon, R. barbatum, R. campanulatum, R. lepidotum*
3	Livestock Pastureland	2500-3500 m	Maiyung, Rawadhap, Nikas, Salpapokhari, Gurase,	*Iris, Kobresia, Imperata, Bistorta, Aconitum, Lophophorus,* Deer, etc.
4	Medicinal Plant zone	1600-4100 m	Sub-tropical, temperate and sub-alpine, alpine herbs	*Asparagus, Astible, Rubia, Swertia, Valerina, Nardostachys,* etc.

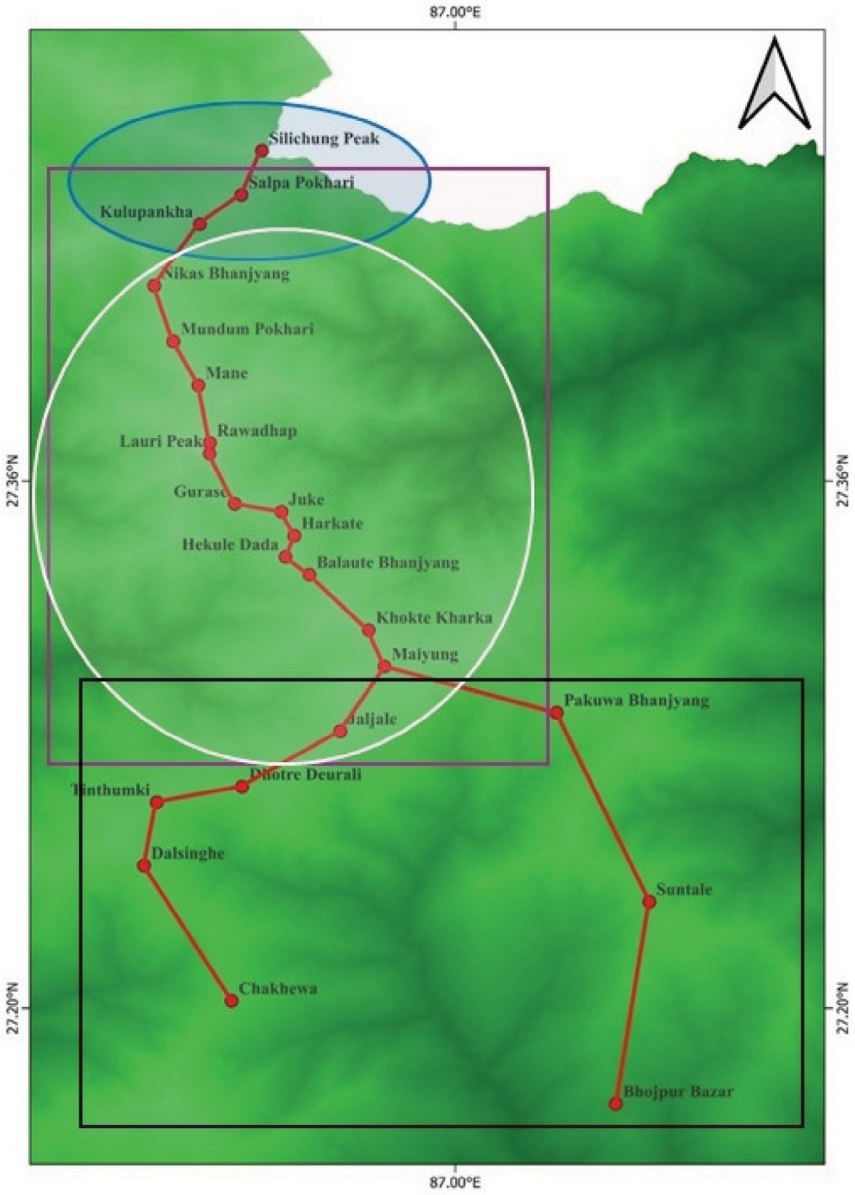

Figure 3: Important biodiversity zones in MTT; blue circle: medicinal plant zone, purple box: Rhododendron zone, white circle: livestock zone and black box: forest timber and fodder zone

Biocultural diversity

Our results indicated the rich diversity of flora and fauna used in rituals of the Rai community, showing the rich biocultural diversity along MTT. We have reported that 24 species of animals and 32 species of plants are commonly used in traditional rituals of the Rai community (Table 3, 4). The locals have very good knowledge about these plants and animals, and they are also conscious about the conservation of the biocultural diversity.

Table 3: Culturally important plant species in MTT

SN	Scientific Name	English Name	Nepali Name
1	*Musa paradisiaca* L.	Banana	Kera
2	*Artemisia indica* Willd.	Artemisia indica Willd.	Titepati
3	*Dendrocalamus hamiltonii* Nees & Arn. ex Munro	Sweet Bamboo	Bans
4	*Oryza sativa* L.	Paddy	Chami/Dhan
5	*Lagenaria siceraria* (Molina) Standl.	Bottle Gourd	Khachandado
6	*Eleusine indica* (L.) Gaertn.	Millet	Kodo
7	*Zingiber chrysanthum* Roscoe	Zinger	Aduwa
8	Yeast	Yeast	Machag
9	*Tagetes erecta* L.	Marigold	Sayapatri
10	*Cynodon dactylon* (L.) Pers.	Bermudagrass	Dubo
11	*Vigna mungo* (L.) Hepper	Black gram	Mas
12	*Thamnocalamus spathiflorus* (Trin.) Munro. P. Pan	Himalayan Bamboo	Makh
13	*Asparagus racemosus* Willd.	Asparagus	Kurilo
14	*Smilax aspera* L.	Common smilax	Kukurdaino
15	*Rhododendron setosum* D. Don, Mem. Wern.	Rhododendron	Bhairampati
16	*Juniperus communis* L.	Juniperus	Dhupi
17	*Buddleja asiatica* Lour.	Butterfly Bush	Bhimsen Pati
18	*Castanopsis hystrix* Miq.	Thorny Chestnut	Musure Katus
19	*Machilus odoratissimus* Nees	Green Laurel	Kaulo
20	*Drepanostachyum falcatum* (Nees) Keng	Himalayan Weeping Bamboo	Khika Bans
21	*Chrysanthemum morifolium* (Ramat.) Hemsl.	Chrysanthemum	Godavari Phool
22	*Gomphrena globosa* L.	Globe Amaranth	Mirmi Phool
23	*Phanera vahlii* (Wight & Arn.) Benth.	Vahl's Kudzu	Bhig Pat
24	*Shorea robusta* Gaertn.	Sal tree	Sal
25	*Thysanolaena latifolia* (Roxb. ex Hornem.)	Broom Grass	Amriso
26	*Imperata cylindrica* (L.) Raeusch.	Cogon grass	Siru
27	*Pittosporum napaulense* (DC.) Rehder & E.H.Wilson	Nepal Pittosporum	Phuke
28	*Typha angustifolia* L.	Cat tail	Pater
29	*Mallotus philippensis* (Lam.) Müll.Arg.	Kamala Tree	Sindure
30	*Rhododendron lepidotum* Wall. ex G. Don	Rhododendron	Bhairungpati
31	*Rhododendron anthopogan* D.Don	Rhododendron	Sunpati
32	*Curcuma zeodaria* Rosc.	Zedoary	Kacharu

Table 4: Culturally important animal species in MTT

SN	Scientific name	English Name	Nepali Name
1	*Capra hircus* L.	Goat/does/nanny goats	Bakhra
2	*Bubalus arnee* Kerr	Water buffalo	Arna
3	*Lophura leucomelanos* L.	Kalij Pheasant	Kalij
4	*Gallus gallus domesticus* L.	Hen/Rooster	Kukhura
5	*Gallus gallus* L.	Red junglefowl	Kukhura
6	*Bos taurus* L.	Cow/oxen	Gai/Goru
7	*Lophophorus impejanus* L.	Himalayan Monal	Danphe
8	*Pycnonotus cafer* L.	Red vented bulbull	Jure Chara
9	*Tragopan satyra* L.	Satyr Tragopan	Munal
10	*Bubalus bubalis* L.	Murrha	Ranga
11	*Sus scrofa domesticus* L.	Pig	Sungur
12	*Zosterops palpebrosus* L.	Indian White-eye	Fista
13	*Picus chlorolophus* Scop.	Lesser Yellownape	Lanche
14	*Myophonus caeruleus* L.	Blue Whistling-thrush	Kalchaudo
15	*Sus scrofa* L.	Wild boar	Bandel
16	*Vespa velutina* Lepeletier	Asian Hornets/wasp	Aringal
17	*Scorpiops harmsi* Birula	Scorpiops	Bachhiu
18	*Labeo rohita* Hamilton	Rohu	Macha
19	*Euphlyctis cyanophlyctis* Schneider	stream dwelling frog	Paha
20	*Bos gaurus* H. Smith	Gaur	Gauri Gai
21	*Ptyas mucosa* L.	Rat Snake	Sarpa
22	*Moschus chrysogaster* Hodgson	Musk deer	Mriga
23	*Naemorhedus goral* Pallas	Himalayan Goral	Ghoral
24	*Hemitragus jemlahicus* Hodgson	Himalayan Tahr	Thar

The precise number of faunal species along the MTT region is inadequately known because of limited scientific expeditions. Much of the research is limited to mammals and birds (Inskipp et al., 2016), despite the region harborings rich floral and faunal diversity as the trail is extended from subtropical to alpine regions.

Figure 5: Some keystone fauna of Mundhum Trekking Trail; a) Chauri (Maiyung Lekh), b) *Ailurus fulgens* (Red Panda), c) Asala Machha /Snowtrout *(Schizothorax richardsonii*)

Red panda (*Ailurus fulgens*), Snowtrout (*Schizothorax richardsonii*), Pig (*Sus scrofa domesticus*), and Chauri (a hybrid of Yak *Bos grunniens* and domestic cattle *Bos taurus*) are considered keystone species in found along MTT (Figure 5) in eastern Nepal due to their critical ecological, cultural, and economic roles. The Red Panda, an indicator of healthy Himalayan forests, plays a vital role in seed dispersal and maintaining forest regeneration, which supports biodiversity in the region (Bista et al., 2004). Snow trout is a cold-water fish species, that plays a vital role in the aquatic ecosystem by acting as a predator and prey, and an important source of livelihood to the local people (Shrestha, 2008). Along with domestication, pigs favor agricultural systems as they are useful in terms of nutrient cycling and soil fertility due to their foraging behaviors (FAO, 2011). Chauri, which have adapted to high altitude areas, are a part of the transhumance lifestyle of eastern Nepal, and provide milk, meat, and wool, and their grazing patterns keep alpine meadows intact and prevent infiltration by shrubs (Dong et al., 2009). These species play a crucial role in maintaining the ecological equilibrium and socio-economic landscape of MTT in eastern Nepal.

The Mundhumi (Kirati) people are a people with a rich cultural background, with the major portion of their culture closely attached to the language, spirituality, and traditions. Their languages are different Tibeto-Burman languages, including Rai and Limbu, and they are Shamanistic and Animistic, with festivals like Sakela being commemorations of their association with nature and their ancestry. Their culture is very lively, as seen in their music, dance, and traditional costumes like Pirka and Phake used by Limbu (Ghale, 2001). Their livelihood is mainly agricultural (terraced farming) and livestock rearing. Kirati people are experts in handicraft; they are weavers, potters, and carvers of wood. They eat rice, millet, and meat, which are supplemented with traditional herbal medicine. The people have a close connection with nature, which involves sacred groves, rivers and trees that hold a great role in their spiritual life (Sharma, 2016). The Kirati people do not abandon their customs, rituals, and tight-knit community life even after modernization.

The broad distribution of rangelands has been an attribute of MTT regions. These rangelands provide good livestock in the high mountain areas. The traditional culture of Goth has been changed into the Goth Stay Model along the MTT, and this gives the first-hand experience of the people living in close contact with nature, like plants and animals. The visitors love Goth Stay, and this has played a significant role in ecotourism. Nevertheless, in recent years, people have been shifting away from livestock, and we should encourage people in the region start keeping livestock.

Potential of ecotourism

The Mundhum Trekking Trail in Nepal showcases significant ecotourism potential, blending rich cultural heritage, ecological diversity, and breathtaking scenery. Closely tied to the Kirati people, especially the Rai community, the trail offers unique biocultural diversity (Figure 6, Table 3). We have tabulated the general features of MTT (Table 4) and quantified the critical factors influencing the ecotourism success of MTT, following the standard international trend, following Honey (2008), and criteria from organizations like the International Ecotourism Society (TIES) and the Global Sustainable Tourism Council (GSTC). The total score for evaluating the critical factors was above 75% (Table 4), justifying MTT as one of the highly potential ecotourism/ cultural trekking trails in eastern Nepal. Hence, it appears that the proposal made by the Government of Nepal (GON, 2024; Nepal Tourism Board, 2024) will be translated into reality. However, there are still many areas to improve MTT as an important ecotourism hub of Nepal.

Discussion

History of MTT

The Mundhum Trekking Trail has been officially open only since January 2018 for trekkers. It offers a majestic view of the Himalayan Mountains, which pass through green valleys and lush forest along the trail. MTT harbors many pilgrimage sites for Kirati people, including holy lakes like Salpa Pokhari and Hans Pokhari. Salpa Pokhari is considered the dwelling place of the progenitors of the Kirat people, Sumniwa and Paruhang, also known as Salpa Rani and Salpa Raja, who are believed to have created the Kirat race. To this day, Kirat Mundumi, Dhami, Bijuwa, and Nakchhong perform rituals and prayers in the Salpa Pokhari and Silichung areas, regarding them as spiritual power centers and places where their gurus reside. In the Kirati language, “Sili” means dance, and “Chung” means hill or peak. It is believed that the ancient Kirati ancestors once danced upon these peaks, and the landscapes visible from them were regarded as the homeland of the Kirat people. For the Kirat Rai community, Salpa Silichung holds

Figure 6: Important features of Mundhum Trekking Trail (MTT) a) beautiful landscape with full bloom of Rhododendron, b) magnificent view of the Himalaya from (Mt. Everest region and nearby) MTT, c) Kirat (Mundhumi) people in cultural display, d) a typical cattle herder's shelter for night stay at MTT

Table 3: General information on Mundhum Trekking Trail

Parameters	Value	Observation
Total Length	120 km	Two way
Trekking duration	10-12 Days	Depends on speed, stamina, age group
Highest elevation	4153 m	Silichung Peak
Lowest elevation	1600 m	Bhojpur Bazar
Rural Municipalities included	3	Tyamke Maiyung, Salpasilichho, Kebilasgadhi
Number of Herder's shelter stay (Gothstay)	20	Most of them are all seasons
Number of Permanent tea shops	10	Increasing
Number of temporary tea shops	15	Seasonal
Number of tourist guides trained	120	Increasing
Number of Herder's shelter (Goths)	25	Permanent
Number of Yak, Chauri	400	Decreasing in number
Number of goats	250	Almost stable
Number of buffalos	200	Almost stable
When the trail was reintroduced	2015	Initial survey undertaken
Trend of visitors	Increasing	Maximum in 2024
Targeted visitors for 2025	100K (NRs.)	Visit Mundhum Year
Construction of trail	Almost completed	Only a few sections eft
Expected beneficiaries	200	Households
Average cost for Trekking	20K (NRs.)	Per person

the same spiritual and religious significance as Jerusalem does for Christians, Mecca and Medina for Muslims, and Lumbini for Buddhists, making it an equally revered pilgrimage site.

Floristic structures and plant diversity

MTT represents the sub-tropical to alpine physiographic zone in eastern Nepal, representing 12 different forest types and associated ecosystems. The occurrence of 264 species of angiosperms, belonging to 84 families and 190 genera along MTT, is substantial floral richness in the region. We emphasize that the present enumeration is from along MTT, and the list goes higher if we can elaborate sampling sites beyond MTT, and it requires detailed vegetation surveys in the surroundings of MTT. The existing checklists for Nepal document approximately 6,076 species of flowering plants

Table 4: Ecotourism Potential of Mundhum Trekking Trail

Category	Criteria	Details	Score
Natural Attractions	Biodiversity	Presence of unique flora, fauna, and ecosystems.	5
	Scenic Beauty	Availability of stunning landscapes (mountains, forests, rivers, waterfalls, etc.).	4
	Protected Areas	Proximity to national parks, wildlife sanctuaries, or conservation areas.	3
	Geographical Features	Unique geological or geographical landmarks.	3
	Pristine Environment	Minimal human interference and pollution.	5
Cultural and Historical Value	Local Culture	Rich traditions, customs, and indigenous communities.	5
	Historical Sites	Presence of heritage sites, monuments, or ancient ruins.	3
	Cultural Events	Availability of traditional festivals or events.	4
	Handicrafts and Arts	Unique local handicrafts and artistic expressions.	3
Accessibility	Transport facility? Infrastructure	Availability of roads, airports, or other transport means.	4
	Proximity to Urban Areas	Ease of access for tourists.	4
	Signage and Information	Availability of adequate clear and helpful signposts and information along the trail.	4
Community Involvement	Local Participation	Engagement of local communities in tourism activities.	3
	Employment Opportunities	Potential to create jobs for the local population.	4
	Revenue Sharing	Equitable distribution of tourism revenue.	4
	Cultural Sensitivity	Efforts to preserve and respect local culture and traditions.	4
Conservation Efforts	Environmental Policies	Presence of conservation regulations and enforcement.	3
	Sustainable Practices	Evidence of eco-friendly tourism practices.	5
	Rehabilitation Programs	Ongoing efforts to restore degraded areas.	4
	Education and Awareness	Programs promoting conservation among visitors and locals.	4
Tourism Infrastructure	Accommodation	Availability of eco-lodges or sustainable accommodations.	4
	Guides and Tours	Presence of trained and knowledgeable guides.	4
	Visitor Centers	Availability of facilities providing information and support to tourists.	4
	Safety Measures	Adequate provisions for tourist safety and security.	4
Market Potential	Tourist Interest	High demand for nature-based tourism in the region.	4
	Niche Opportunities	Unique selling points, such as endemic species or rare cultural practices.	3
	Marketing Efforts	Presence of promotional activities for the destination.	5
Environmental Carrying Capacity	Visitor Limits	Established limits to prevent over-tourism.	3
	Impact Monitoring	Mechanisms to assess and mitigate tourism impacts.	4
	Waste Management	Effective systems for managing waste generated by tourists.	4
Education and Research Opportunities	Interpretation Programs	Activities educating visitors about local ecology and culture.	3
	Research Facilities	Potential for academic and scientific research.	3
	Citizen Science	Opportunities for tourists to engage in data collection and conservation.	3
Regulatory and Legal Framework	Government Support	Presence of policies encouraging ecotourism.	3
	Regulatory Compliance	Compliance with environmental and tourism regulations.	4
	Zoning and Land Use	Clearly defined areas for tourism activities.	3

Note: maximum=5, high=4, moderate=3, fair=2, low=1

(Press et al., 2000) and around 534 species of ferns (DPR, 2013). However, expert evaluations suggest that the number of flowering plant species could increase to around 7,000 with further exploration of poorly studied remote regions.

A study of physiographic and ecological landscape in Nepal has been widely carried out, and Dobremez (1976) found that the country has four belts of biogeographic (Western, Northwestern, Central, and Eastern) and 11 bioclimatic zones with 35 forest types, 75 vegetation types, and 118 ecosystems in various physiographic regions in the country. Among them, the largest number of ecosystems is found in the Middle Mountains (Luo et al., 2017), and the total High Himal and High Mountains have 38 ecosystems. The vegetation types across MTT are fairly low, which might be attributed to the low gradient of the altitude and the fairly similar topographic setup of the trail. The Tarai and Siwalik areas with typical tropical flora are not included in MTT. There are 14 and 12 ecosystems in the Tarai and Siwalik regions, respectively (BPP, 1995; BPP, 1996). In total, there are one hundred and twenty-four forest ecosystems, four cultivation ecosystems, one water body ecosystem, and one glacier/snow/rock ecosystem (BPP, 1995). These were later grouped into 36 ecosystem types by TISC (2002) with the exclusion of the Nival zone and water bodies (Shrestha, 2008). Since natural ecosystems are a dynamic environment, their classification and characteristics need to be updated periodically to reflect the current environmental changes (Smith et al., 2009; Luo et al., 2011).

Potential of Ecotourism

Nepal possesses a huge potential for ecotourism due to its numerous natural and cultural heritage sites, ecosystems, and distinct geographical characteristics (Nepal Tourism Board, 2020). The nation has more than 13 national parks, 2 wildlife reserves, 6 conservation areas, and 12 buffer zones, offering opportunities to engage in nature-based tourism. The Great Himalayan Trail, Mundhum Trail, and Guerrilla Trail are some of the trails that outline the overlap of biodiversity and cultural diversity, with eco-conscious tourists interested in these (Nepal Tourism Board, 2024). Moreover, with its lowest and highest altitudes in the world, Nepal is an exceptional destination, offering unmatched biodiversity that supports activities such as birdwatching, botanical explorations, and sustainable trekking (Weaver, 2001; Shrestha et al., 2023), and similar aspects could be seen in the case of MTT. We can encourage sustainable tourism by combining ecotourism with the local livelihoods and conservation, which in turn protects the ecotourism environmental and cultural heritage at MTT. Nevertheless, deforestation, climate change, and insufficient infrastructure are some of the challenges that must be addressed to achieve full realization of these prospects (Bhuju et al., 2007; MoF, 2024).

The rangelands and pastures are well-presented features that represent MTT as natural resources which are essential in the mountain communities whose main trade is livestock farming. Nevertheless, the resources are exhausted every year (fire, landslide, cutting down trees, and road widening (Personal observation during field work: A. Tiwari), and the question of the sustainability of the rangelands arises (Dong et al., 2011). This is made worse by constant grazing, heavy stocking of the area, and climatic uncertainties, among other factors. In the meantime, the number of livestock is reducing at a very high alarming rate annually. The ecological issues, as well as the major risks to the sustainability of life in the 1990s mountain livelihoods, are not only caused by this imbalance between resource consumption and the requirements of livestock but also manifested in it (Bajracharya et al., 2010). Conversely, huge potential is found in animal products (ghee, cheese, churpi, meat) of the livestock of MTT; thus, encouragement of livestock and conservation of rangelands is essential in the area, as livestock is encouraged and ecotourism promoted.

MTT faces substantial biodiversity threats, including forest fires, deforestation, climate extremes such as heavy rainfall and seasonal droughts, and the impacts of overgrazing by livestock (Personal ovservation: A. Tiwari). Seasonal droughts severely affect wetlands, jeopardizing aquatic life and wildlife habitats, while increasing visitor numbers contribute to waste management issues due to improper disposal practices. Poaching and road construction also pose a threat to the ecological balance of the region. These are actually more general issues in Nepal regarding ecotourism, including environmental degradation, poor infrastructure, overtourism, and the effects of climate change, especially the melting glaciers and natural disasters (Baral et al., 2020; Shrestha et al., 2019). These concerns require stricter regulations, community education, and sustainable practices to ensure equitable and sustainable tourism (Nepal, 2002; Baral & Stern, 2011; Stone, 2018).

Conclusions

The study has explored the historical and cultural background of the Mundhum Trekking Trail in eastern Nepal and the significance of this trail in Mundhum culture. The number of plant species could increase as the region is quite rich in flora and fauna and the diversity of the ecosystem and needs further exploration. Besides, MTT is also very rich bio cultural diversity and traditional knowledge. We identified MTT as one of the highly potential ecotourism trails in eastern Nepal while evaluating the existing scientific knowledge with practical considerations for assessing and guiding ecotourism development, while prioritizing environmental sustainability and community well-being. Despite the rich floral diversity, biocultural wealth, and high potentiality of MTT, it is experiencing forest fire, grazing, increasing solid waste, and the problems related to environmental changes. Moreover, it is recommended that the MTT must be developed and preserved as a purely ecotourism and cultural trail without the intervention of road networks. The conservation of biocultural diversity and promoting MTT as an ecotourism trail could help us achieve long term goal of biodiversity conservation and sustained ecotourism.

Acknowledgements

We would like to thank Salpasilichho Rural Municipality Bhojpur for providing financial support for this study. We are highly grateful to Mr. Daulath Kulung, the chairman of Salpasilichho Rural Municipality for his great enthusiasm and support regarding the conservation of biocultural diversity of Salpasilichho region. We also convey our thanks to National Herbarium and Plant Laboratories (KATH), Lalitpur, Nepal, for providing us with important suggestions for making plant database. We would also like to thank Durgadhan Rai, Shivahang Rai, Pradeep Rai and Prabeen Rai for their great help during field work. We also thank all the people who welcomed and provided us with good hospitality during our Homestay and Gothstay while working on Mundhum Trekking Trail Plant Survey.

Author's contribution statement

A. Tiwari: Research ideas, sample collection, data analysis, review and final editing of manuscript. **A. Bidari**: Field data collection, herbarium preparation, plant identification. **S. Rajbanshi**: Field data collection, plant identification, taxonomic enumeration. **R. K. Rai**: Research ideas, Fund Acquisition, Manuscript reviewing

Data availability

The data collected for this study is available from the Figshare repository.

References

Bajracharya, R. M., Sherchan, D. P., & Sharma, S. (2010). Rangeland Management and Livestock Production in the Mountain Regions of Nepal. *Journal of Forest and Livelihood, 9*(1), 47-56.

Baral, N., Stern, M. J., & Bhattarai, R. (2020). Contingent valuation of ecotourism in Annapurna Conservation Area, Nepal: Implications for sustainable management. *Ecological Economics, 69*(12), 2415-2422. https://doi.org/10.1016/j.ecolecon.2010.07.007

Baral, N., & Stern, M. J. (2011). A comparative study of two community-based conservation models in Nepal. *Biodiversity and Conservation, 19*(7), 2117-2131. https://doi.org/10.1007/s10531-010-9839-3

Bhuju, U. R., Shakya, P. R., Basnet, T. B., & Shrestha, S. (2007). *Nepal Biodiversity Resource Book: Protected Areas, Ramsar Sites, and World Heritage Sites.* International Centre for Integrated Mountain Development (ICIMOD).

BPP. (1995). *Biodiversity Profile of Terai and Siwalik Physiographic Zones* (Biodiversity Profiles Project Publication No. 12). Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation, His Majesty's Government of Nepal.

BPP. (1996). *An Assessment of the Representation of the Terrestrial Ecosystems within the Protected Areas System of Nepal* (Biodiversity Profiles Project Publication No. 15). Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation, His Majesty's Government of Nepal.

Bista, D. B. (2004). *People of Nepal*. Kathmandu: Ratna Pustak Bhandar, 2004 (reprint edition, ISBN: 9993304182)

Bista, D., Paudel, P. K., Jnawali, S. R., Sherpa, A. P., & Shrestha, S. (2017). Red Panda ecology and conservation in the Himalayas. *Journal of Mammalogy, 98*(6), 1483–1491.

Butler, R. W. (1999). Sustainable tourism: A global perspective. *Tourism Geographies, 1*(1), 7-20.

Ceballos-Lascurain, H. (1996). *Tourism, ecotourism, and protected areas: The state of nature-based tourism around the world and guidelines for its development.* IUCN - The World Conservation Union.

Chaudhary, R. P., Uprety, Y., & Joshi, S. P. (2016). Plant biodiversity in Nepal: conservation and legal status. *Frontiers of Botany*, *66*, 224-68.

Chaudhary, R. P., Uprety, Y., & Rimal, S. K. (2015). Deforestation in Nepal: Causes, consequences and responses. In R. Sivanpillai, & J. F. Shroder (Eds.), *Biological and Environmental Hazards and Disasters* (pp. 335-372). Elsevier Inc.

DPR. (2013). *Plants of Nepal: Fact sheet.* Ministry of Forests and Soil Conservation, Department of Plant Resources, Government of Nepal.

Dobremez, J. F. (1976). *Le Népal: Ecologie et biogeography.* Editions du Centre National de la Recherche Scientifique.

Dong, S., Wen, L., Liu, S., Zhang, X., Lassoie, J. P., Yi, S., Li, X., Li, J., & Li, Y. (2011). Vulnerability of worldwide pastoralism to global changes and interdisciplinary strategies for sustainable pastoralism. *Ecology and Society, 16*(2), 10. https://doi.org/10.5751/ES-04093-160210

Dong, S., Wen, L., Zhu, L., & Li, X. (2009). Implications of transhumance for sustainable development in the Himalayas. *Mountain Research and Development, 29*(2), 144-151.

FAO. (2011). *The role of pigs in smallholder farming systems*. Food and Agriculture Organization of the United Nations.

Fennell, D. A. (Ed.). (2020). *Ecotourism* (5th ed.). Routledge.

Ghale, S. R. (2001). The Ethnography of Kirati People: A Study on their Language, Culture, and Traditions. Kathmandu: Central Department of Anthropology, Tribhuvan University.

GON. (2024). *Fiscal budget for FY 2024/25.* Ministry of Finance. Government of Nepal. (demo.mof.gov.np/uploads/document/file/1724825318_Budget%20Speech%202024_25%20English%20FV.pdf)

Grierson, A. J. C., & Long, D. G. (1983-2001). *Flora of Bhutan* (Vol. 1, Parts 1-3; Vol. 2, Parts 1-3). Royal Botanic Garden Edinburgh & Royal Government of Bhutan.

Hodgson, B. H. (1847). On the Kiranti tribe of the Central Himalayas. *Journal of the Asiatic Society of Bengal, 16*(2), 123-142.

Honey, M. (Ed.). (2008). *Ecotourism and sustainable development: Who owns paradise?* (2nd ed.). Island Press.

Inskipp, C., Baral, H. S., Phuyal, S., Bhatt, T. R., Khatiwada, M., Inskipp, T., Khatiwada, A., Gurung, S., Singh, P. B., Murray, L., Poudyal, L., & Amin, R. (2016). *The status of Nepal's birds: The National Red List Series*. Zoological Society of London.

Luo, Y., Melillo, J., Niu, S., Beier, C., Clark, J. S., Classen, A. E. T., Davidson, E., Dukes, J. S., Evans, R. D., Field, C. B., Czimczik, C. I., Keller, M., Kimball, B. A., Kueppers, L. M., Norby, R. J., Pelini, S. L., Pendall, E., Rastetter, E., Six, J., Smith, M., Tjoelker, M. G., & Torn, M. S. (2011). Coordinated approaches to quantify long-term ecosystem dynamics in response to global change. *Global Change Biology, 17*(2), 843-854. https://doi.org/10.1111/j.1365-2486.2010.02265.x

Manandhar, S., Vogt, D. S., Perret, S. R., & Kazama, F. (2011). Adapting Cropping Systems to Climate Change in Nepal: A Cross-Regional Study of Farmers' Perception and Practices. *Regional Environmental Change, 11*(2), 335-348.

Miehe, G., Pendry, C. A., & Chaudhary, R. P. (2015). *Nepal: An introduction to the natural history, ecology, and human environment of the Himalayas.* Royal Botanic Garden, Edinburgh.

MoF. (2024). *Fiscal policy statement for FY 2024/25.* Ministry of Finance, Government of Nepal. Retrieved from https://mof.gov.np

Nepal, S. K. (2002). Sustainable tourism in protected areas: The case of Annapurna Conservation Area Project, Nepal. *Journal of Sustainable Tourism, 10*(5), 528-545. https://doi.org/10.1080/09669580208667184

Nepal Tourism Board. (2024). *Tourism development initiatives in Nepal.* Retrieved from https://ntb.gov.np

Nepal Tourism Board. (2020). *Nepal Tourism Strategy 2020-2030*. https://ntb.gov.np/

Pandit, M. K., Sodhi, N. S., Koh, L. P., Bhaskar, A., & Brook, B. W. (2007). *Unreported Yet Massive Deforestation Driving Loss of Endemic Biodiversity in Indian Himalaya.* Biodiversity and Conservation, 16(1), 153-163.

Polunin, O., & Stainton, A. (1984). *Flowers of the Himalaya*. Oxford University Press.

POWO. (2025). *Facilitated by the Royal Botanic Gardens, Kew.* https://powo.science.kew.org/

Press, J. R., Shrestha, K. K., & Sutton, D. A. (2000). *Annotated checklist of the flowering plants of Nepal.* The Natural History Museum.

Rawat, U. S., & Agarwal, N. K. (2015). Biodiversity: Concept, threats, and conservation. *16*(3), 19-28.

Shakya, P. R., Adhikari, M. K., Rajbhandari, K. R., Chaudhary, R. P., & Shrestha, K. K. (1997). Country paper: Flora of Nepal. *International Seminar-Cum-Workshop on Flora of Nepal,* Kathmandu.

Sharma, P. (2016). *Cultural Practices and Traditions of the Kirati People of Eastern Nepal*. Journal of Nepalese Studies, 13(2), 45-61.

Sharma, P. R. (1992). *The Tribes of Nepal*. Kathmandu: Mandala Publications.

Shrestha, T. K. (2008). Ecology and status of Snowtrout in Nepal. *Himalayan Journal of Sciences, 5*(7), 23-29.

Shrestha, A. B., Wake, C. P., Mayewski, P. A., & Dibb, J. E. (2019). Precipitation fluctuations in the Himalaya and its vicinity: An analysis based on temperature and elevation dependency. *Climatic Change, 47*(1), 45-72. https://doi.org/10.1023/A:1005620303106

Shrestha, K. K., Bhandari, P., & Bhattarai, S. (2022). *Plants of Nepal (Gymnosperms and Angiosperms).* Heritage Publishers & Distributors Pvt. Ltd.

Shrestha, T., & Joshi, R.M. (1996). *Rare, endemic and endangered plants of Nepal*. WWF Nepal Program, Katmandu, Nepal.

Shrestha, N., Shrestha, A., & Bhusal, K. P. (2023). Bird diversity in Bhaludhunga: Exploring avian diversity in Eastern Mid-hills of Nepal. *Forestry: Journal of Institute of Forestry, Nepal, 20*(1), 112–125. https://doi.org/10.3126/forestry.v20i1.64341

Shrestha, T.B. (2008). Classification of Nepalese forests and their distribution in protected areas. *Initiation 2*, 1–9.

Smith, M. D., Knapp, A. K., & Collins, S. L. (2009). A framework for assessing ecosystem dynamics in response to chronic resource alterations induced by global change. *Ecology, 12*, 3279-3289.

Stainton, J. D. A. (1972). *Forest of Nepal.* John Murray Publishers Ltd.

Stainton, J. D. A. (1988). *Flowers of the Himalaya: A supplement*. Oxford University Press.

Stone, M. T. (2018). Waste management challenges in the Everest region: Examining the role of stakeholders in the world's highest landfill. *Sustainability, 10*(4), 1215. https://doi.org/10.3390/su10041215

Subba, J. R. (1998). *The philosophy and anthropology of Mundhum.* Nirala Publications.

Subba, T. B. (1999). *Politics of culture: A study of three Kirata communities in the Eastern Himalayas.* Orient Blackswan.

Tandukar, J. (2020). Kirat Mundhum: Oral narratives and the spiritual life of the Kirat people. *Journal of Himalayan Studies, 12*(3), 45-60.

TISC. (2002). *Forest and Vegetation Types of Nepal*. TISC Document Series No. 105; Department of Forest, HMG/NARMSAP: Kathmandu, Nepal.

Van Driem, G. (2001). *Languages of the Himalayas: An ethnolinguistic handbook of the Greater Himalayan Region.* Brill.

Weaver, D. B. (2001). *The encyclopedia of ecotourism.* CABI Publishing.

Welk, E. (2016). Phytogeography of the Nepalese flora and its floristic links to neighboring regions. In *Flora of Nepal: Companion volume*. Royal Botanic Garden Edinburgh.

Wu, Z. Y., Raven, P. H., & Hong, D. Y. (Eds.). (1994-2008). *Flora of China* (Vols. 4, 8, 11, 13, 14, 16, 18, 19, 20, 22, 24, 25). Science Press & Missouri Botanical Garden Press.