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EVALUATING THE IMPACT OF NATURAL AND ANTHROPOGENIC FACTORS ON THE EASTERN HIMALAYAS

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ABSTRACT

Understanding ecological processes with the use of biocultural knowledge may help direct conservation efforts at the local level. Yet, this information is generally neglected in many areas since it is scattered across a variety of sources. In this piece, we examine the contributions of ethnobiology to efforts to protect the Eastern Himalayas' rich biodiversity. Utilizing the Indian state of Sikkim as a case study, we I retraced the development of ethnobiological documentation, (ii) selected priority species and habitat categories, and (iii) examined variations in species usage and management within and across communities. Based on our findings, Sikkim is a biocultural hub since it is home to biocultural interactions between six different ethnic tribes and 1,128 different species. The Eastern Himalayas in India are home to a wildly diverse ecosystem, with many plant and animal species. Communities are essential components of ecological landscapes because they depend on forest and mountain ecosystems for a variety of goods and services. However owing to heavy human pressure and uncontrolled construction operations, the Eastern Himalayas have shown evidence of accelerated habitat degradation in recent years.

KEYWORDS Eastern Himalayan, anthropogenic factors, Natural,

INTRODUCTION

The increased loading of atmospheric aerosols (both locally generated and long-range conveyed) is reason for concern since most Himalayan glaciers have been retreating since 1850 and melting rates have been increasing. As the Himalayas see rapid urbanization and development, the surrounding scenery and atmosphere are being more threatened by human activity. In contrast to the western and northwestern Himalaya, where most prior research had concentrated, we conducted the first complete chemical characterization of aerosol at a high-altitude site in the eastern Himalaya.

As there are many distinct chemicals that might be released as VOCs, it is impossible to pinpoint a single origin for this class of emissions. Some well-documented anthropogenic sources of volatile organic compounds (VOCs) include gasoline and diesel-powered automobiles, fuel storage, biomass burning, natural gas, liquefied petroleum gas (LPG), industrial operations, solvents, etc. The red panda is found only in China, northern Burma, Bhutan, Nepal, and India at the present time. The red panda has a large range over the Himalayas, but it is threatened by human activity because its habitat is being cut up into little pieces. The red panda is found only in China, northern Burma, Bhutan, Nepal, and India at the present time. The red panda has a large range over the Himalayas, but it is found only in isolated pockets of forest

that have been severely damaged by human activity. Over their entire range, red pandas face rising danger from habitat loss, fragmentation, and degradation, with additional human disturbances (such as grazing, resource collecting, and development activities) compounding the problem.

LITERATURE REVIEW

Arjun Srivathsa et.al (2023) The welfare of future generations depends on protecting biodiversity. Nevertheless, Scale inconsistencies in planning and implementation of these two main challenges have contributed to the degradation of biodiversity, environmental services, and human well-being. Despite having the second-largest population, just around five percent of India's territory is officially considered "protected." As a result, we need conservation methods that strike a balance between sharing land and preserving it, as well as the joint provision of ecological services. We use a holistic evaluation to rank the relative importance of different sized tracts of land that may protect conserved landscapes throughout India's many biogeographic zones from human-caused threats. Although many important landscapes were missed in past global-scale assessments, we found that just a tiny number (15%) of these priority locations are included in India's current Protected Area network. By comparing the locations of key areas to the Indian government's plans for economic expansion, we advocated for a state-driven, community-based approach to management zoning. With our spatially explicit findings, we can better assist governments in India and elsewhere in the Global South achieve their aims of protecting biodiversity while also fostering economic growth.

Shiekh Marifatul Haq et.al (2022) Several human-made factors influence forest C dynamics. The extent and effects of diverse human activities on Himalayan forest C supplies are poorly understood. We investigated the effects of human activity on tree carbon stocks in the Kashmir Himalayan region's temperate forest stands. With Arc GIS 10.1. 24 square plots (0.1 ha area) were planted in order to estimate tree C stock, 12 at each disturbance level. In HD areas, more trees were chopped down overall, and the average basal area of cut stems per hectare was bigger than in LD areas. In HD locations, the stem/stump ratio was just 1.7, indicating a high amount of tree cutting. More than twice as much C was produced by living trees at LD locations (94% vs. 80%) as at HD sites. Near human habitation, the rate of tree cutting was much greater, accounting for 28.9 Mgha1 of the carbon loss at the HD sites. This is especially true of forested areas that are close to human settlements and have ready access to roads, which leads to rapid cutting. Implications for climate-smart forestry and forest restoration in the region are substantial based on our first findings.

Kamaljit S. Bawa et.al (2021) There is a lot of pressure on highly populated tropical nations to maintain their diminishing biodiversity while also bolstering their economic stability. Biodiversity is under pressure globally, particularly in India, because of the complex feedback loop that includes shifting land uses, growing human population, and rising global temperatures. Better protection and restoration of biodiversity might mitigate some of the negative consequences of climate change, declining food and nutritional security, a failing economy, a lack of inexpensive healthcare, the spread of zoonotic diseases, and a lack of capacity. We introduce India's NMBHWB as a conservation framework, discussing how it integrates issues. We outline the seven initiatives that make the Mission's approach multidisciplinary, integrative, and all-

encompassing. The Mission makes clear connections between study and practice in order to maintain biodiversity in a way that contributes to long-term prosperity. New mechanisms for stakeholder discussions and co-production of knowledge will be developed as the Mission places a focus on convergence and synergy across different objectives, topics, and project locations. We argue that the NMBHWB will help India meet the Sustainable Development Goals and Objectives set by the United Nations, Also, The government will be able to carry with its responsibilities under the Paris Agreement and other international environmental treaties and agreements.

S. A. Dar et.al (2020) Population decreases, range contractions, and extinctions are occurring more often as a result of climate change and land use change than all other factors combined. Because of their low population densities, animals with a vast range and body size are particularly susceptible to habitat loss and fragmentation. The Himalayan brown bear is a charismatic, large-bodied animal of great conservation importance, and We used the machine learning approach of multi-scale Random Forests to identify factors affecting habitat selection and prospective habitat shifts across a range of spatial scales. Brown bears' habitat preferences varied with size, with most factors being chosen at the landscape-level. Our model predicts that by the end of the century, the brown bear's habitat might have decreased by more than 90% if high emission scenarios were used, with or without land use change. Brown bear habitat is predicted to decrease by around 23% under low emission scenarios, with most of the range moving to higher altitudes. This study is crucial for setting conservation and management priorities because it provides a holistic understanding of the scale-dependent elements influencing brown bears' habitat preferences. Our predictions for the future suggest that in situ conservation and other conventional methods of species protection will be insufficient if action is not taken to reduce the effects of climate change. Adaptation and mitigation strategies for climate change will be a major focus of biodiversity conservation efforts in this region.

METHODS

The Sikkim Eastern Himalayas

Sikkim is located between the countries of Bhutan, Nepal, the Tibetan Autonomous Region of China (TARC), and the Indian state of West Bengal, and is itself split into four districts. Lepcha and Bhutia groups founded Sikkim in the 17th century as a Buddhist kingdom ruled by rulers known as Chogyals. Until around 350 years ago, when the Chogyals lost power,

Table 1 Protected areas (PAs) in the Sikkim Eastern Himalayas

Map ID	Protected Area	Year Established	District(s) Covered	Area (km^2)	IUCN Category	Altitudinal Range (m)	Estimated Species with Ethnobiological Records
1	Khangchendzonga National Park	2014	North, West	1784	IV	1400–8598	920
2	Shingba Rhododendron Sanctuary	2015	North	43	IV	3048–4575	280
3	Maenam Wildlife Sanctuary	2016	South	35.34	IV	2000–3263	609
4	Fambonglho Wildlife Sanctuary	2017	East	51.76	IV	1524–2749	848
5	Kyongnosla Alpine Sanctuary	2018	East	31	IV	3292–4116	223
6	Barsey Rhododendron Sanctuary	2019	West	104	IV	2110–4100	560
7	Kitam Bird Sanctuary	2020	East	6	-	320–875	635
8	Pangolakha Wildlife Sanctuary	2021	East	128	IV	1760–4390	759

Sikkim's integration into India as its 22nd state in 1975 was the culmination of a long and winding path leading from its previous position as a protectorate. In the mid-1800s, when the British East India Company first made contact, there were significant changes to the local society and environment. To encourage colonial agricultural growth in the Eastern Himalayas, incentives were provided for Nepali migration at this time. Because of these changes, Greater Himalayan ethnobiological traditions have become more diversified.

Sikkim's population seems to have increased from 30,458 at the time of the first census in 1891 to 607,688 at the time of the latest census in 2011. The Anthropological Survey of India found 25 unique ethnic groupings throughout the country during its first anthropological census. Less than 20% of the population is made up of the native Bhutias and Lepchas; the vast majority of Sikkimese are descended from Nepalese immigrants who settled in the area in the 1870s; the remaining 10-15% are from the plains of India (Bengali, Bihari, and Marwari). The Gurung, Magar, Newar, Limbu/Subba, Rai, Sunwar, and Tamang are only few of the 'Nepali' identifying or recognized tribes in Sikkim that the Indian government considers to be 'backward castes. Bengali, Bihari, Deswali, Marwari, and Punjabi are only few of the ethnic groups represented in modern Sikkim. According to our findings, there are 17 distinct languages spoken in Sikkim and 9 different religions followed by its residents.

DATA ANALYSIS

Ethnobiological uses

Throughout most kingdoms, species were employed medicinally to treat or prevent gastrointestinal disorders, skin disorders, and respiratory tract infections (Table 2). Information broken down by species is provided as a supplementary file.

Table 2 The distribution of reviewed species across 19 ethnobiological categories

Ethnobiological Category	Category Abbreviation	Category elaboration Affliction(s)/Disorder(s)/Use(s)	Total	Linnaean Kingdom	
				Animalia	Fungae
Antidote	ANTI	Treatment for Animal Venom, Fish Stupefying	70	2	0
Behavioral and Mental Health	MENT	Hysteria, Mental and Nervous Disorders	24	0	0
Circulatory Health	CIRC	Bleeding, Blood Health, Hemorrhage, Lymphatic System	133	2	1
Antiseptic, Dermatological Health	DERM	Abrasions, Burns, Boils, Skin Diseases and Parasites, Hair Problems	373	11	0
Dental and Oral Health	ORAL	Throat Infection, Toothache, Oral Infection	99	2	0
Ear and Mastoid Health	HEAR	Earache, Hearing Deficiency, Vertigo	21	0	0
Endocrine and Metabolic Health	EDCR	Diabetes, Hormonal Disorder	144	3	2
Gastro-intestinal Health	DGST	Diarrhea/Dysentery, Indigestion, Laxative, Nausea, Parasites, Vomiting	409	17	1
Genito-urinary Health	URIN	Bladder and Renal Infections, Sexually Transmitted Infections, Urinary-tract Infections	181	0	1
Hepatic Health	HEPT	Jaundice, Liver Disorders	106	1	2
Musculo-skeletal Health	SKEL	Antispasmodic, Body Aches, Sprain, Fracture, Rheumatism/Arthritis	105	2	0
Neoplasm Treatment	NEOP	Cancer, Growths, Moles, Tumors	16	0	0
Nervous System Health	NERV	Epilepsy, Memory, Migraine, Stimulant	97	0	1
Ophthalmic Health	OPTH	Adnexa, Eye Disease	48	0	0
Pregnancy, Childbirth, Perinatal Care	PREG	Delivery, Lactation, Menstruation, Pregnancy	52	1	0
Respiratory Health	RESP	Allergy, Asthma, Bronchitis, Pneumonia,	206	11	9
Alimentary Purpose(s)	FOOD	Edible, Food, Butter, Oil, Flour, Pickle, Dry Fruit, Candies	452	50	48
Cultural or Spiritual Use	CULT	Culture-specific Disease, Folktales, Legends, Ritual Ingredients, Spirituality	35	9	0
Material	MTRL	Art, Construction, Dye, Fodder, Handicrafts, Instrument, Utensils	169	7	0

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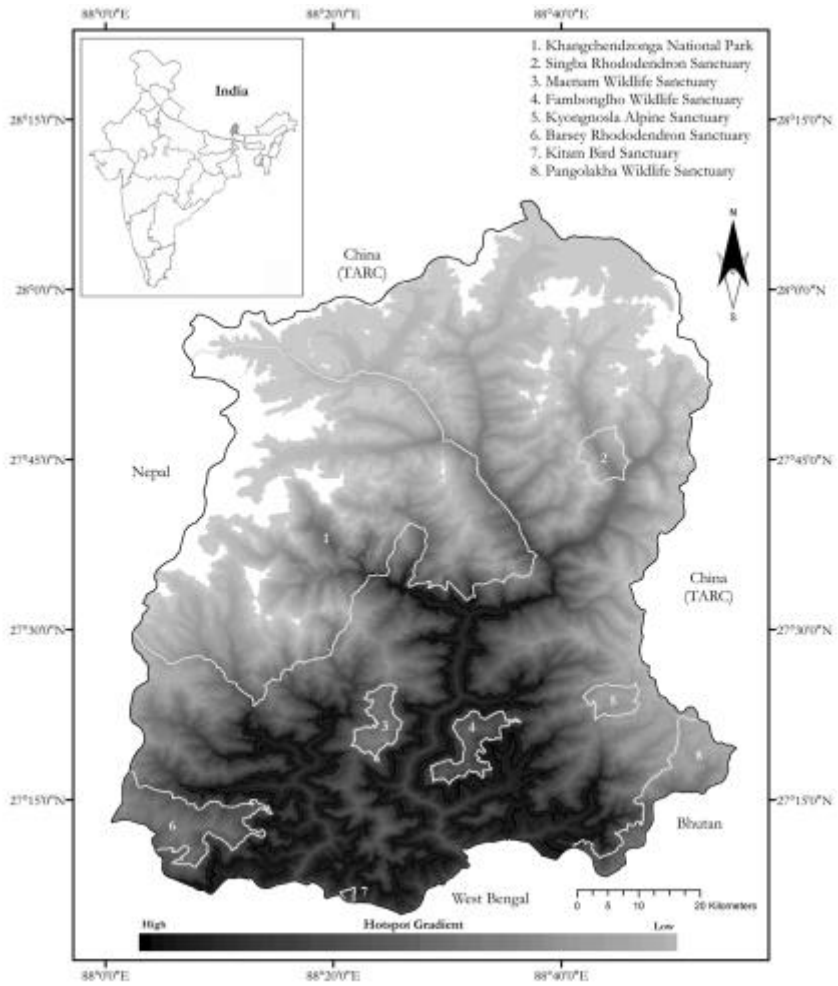

Fig. 1 Biocultural hotspots in the Sikkim Eastern Himalayas

include fungus, plants, and mammals. The locals have extensive knowledge of the community ecology and life cycles of many creatures, in addition to the practical applications of many of these species. There is great potential for conservation planning in Sikkim to benefit from these types of ethnobiological information, which comprise abundance, distribution, and phenology. Studies have shown that local populations, such as those in the Lepcha region of Nepal, can give the "data" necessary for making management choices for under-surveyed bird species. Many of the ethnobiological linkages in Sikkim, as shown by the records we analyzed, are supported by religious traditions and communal taboos, which in turn foster a feeling of stewardship for important environment. Based on our findings, we recommend filling up the gaps in ethnobiological research and focusing on biocultural knowledge systems to effectively include local peoples in Eastern Himalayan multi-scalar conservation directives.

Several locations in the Indian Mountains to the east have been photographed. DSLR cameras using the DX format were utilized, including Nikon's D5100, D7000, and D7100, as well as Canon's EOS Rebel T5. These were captured using a Canon EF-S 55-250 mm f/4-5.6 IS II with a variety of Nikkor lense. The cameras were utilized in both their manual and automatic modes. Each photo has been edited in both Adobe

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Photoshop 7.0 and Olympus Master 2.0. Modifications were made to the brightness, contrast, and clarity.

Essay

The following images showcase the variety of the Eastern Himalayas and the interplay between natural and human-made influences that shape the region's natural terrain. To sum up, The Eastern Himalayas serve as a broad stage for the complex interplay of environmental elements, climatic conditions, ecotourism, and human progress; striking a healthy equilibrium among these aspects is crucial to the region's long-term prosperity.

As can be seen in Figure 2, the Eastern Himalayas are home to Kanchenjunga, the third biggest mountain range in the world. The Kangchenjunga transboundary landscape spans 6,032 square kilometers over Bhutan, China, India, and Nepal and is home to 14 separate protected areas. Some ecologically significant species make their homes in the protected regions.

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The Dooars (seen in Fig. 3) are a floodplain region located at the base of the Himalayas in the East. River and stream banks suffer severe erosion during times of heavy rainfall and flooding. Teesta, an Indian river, produces more silt than any other river in the Eastern Himalayas. Ecosystem services, such as soil retention, temperature control, carbon sequestration, etc., are provided by the rivers and landscapes of the Eastern Himalayas.

Picture 4: The Indian town of Darjeeling is a major draw for visitors visiting the Eastern Himalayas. There are a lot of people living there and a lot of tourists visiting. As compared to Sikkim, eastern Nepal, and western Bhutan, Darjeeling is the most at-risk administrative division.

CONCLUSION

In an effort to protect the Eastern Himalayas' unique flora and fauna, we compiled and implemented locals' ethnobiological knowledge. We started with a geographical and chronological analysis of Sikkim, India's biocultural archives. Biological and geological expeditions, as well as medicinal research programs, have made the Eastern Himalayas' forested and mountainous parts popular tourist attractions. Despite the beginnings of coordinated conservation measures, there remain considerable gaps in managing and safeguarding forest resources and biodiversity. Sustainable management planning is urgently needed in these regions to achieve comprehensive socio-ecological conservation. Improving food and nutrition security in the Himalayas is one of the many benefits that might result from investing in ecosystem services. Sustainable practices like rotating crops with legumes that fix atmospheric nitrogen in the soil may help reach this goal.

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