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Nexus between Indigenous Knowledge and Environmental Sustainability in South Asia: A Systematic Literature Review

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Abstract— **The study reviews current state of knowledge and empirical research gaps on indigenous knowledge and environmental sustainability. The study followed Systematic Literature Review based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The review considered 173 articles relevant to South Asian region published during the period from 2015-2025 extracted from LENS.ORG, a free database. Bibliometric analysis using VOSViewer software, and thematic analysis were performed. The review identified 03 key themes 1) Conservation, Ecology and Sustainability of Ecosystems, 2) Ethnobotany, Indigenous Knowledge and Sustainable Development and 3) Climate Change and Adaptation through Local Knowledge Systems. The findings revealed that the empirical studies are lacking in the areas of conservation, ecology, adaptation and the studies connecting the biodiversity and indigenous knowledge.**

Keywords: **South Asia, Climate change, Environmental sustainability, Indigenous knowledge**

I. INTRODUCTION

Indigenous groups offer traditional knowledge and perspectives based on their own locally developed environmental practices and resource use[1]. Indigenous knowledge is developed by indigenous and local communities through long-term interaction with the natural environment resulting in a collective body of knowledge, practices, beliefs, and skills[1], [2].

Environmental sustainability implies responsible use and management of natural resources to meet present requirements while maintaining ecological balance and ensuring protection of resources for future generations [3].

The role of indigenous knowledge in promoting and managing environmental sustainability has been in the limelight for many years, resulting vast amount of literature to the scientific knowledge base [1], [3]. However, despite the growing body of literature in this area, a synthesis of empirical studies focusing on South Asian region is scant [3]. Therefore, conducting a review study on indigenous knowledge and environmental sustainability is imperative to identify possible knowledge gaps. The results of the study will benefit future research and evidence-based decision making.

Therefore, the objectives of the study were;

1)To evaluate the current state of knowledge on indigenous knowledge and environmental sustainability

2)To identify the research gaps in the area of study

II. METHODOLOGY

A. *Study selection process and methods*

Systematic Literature Review (SLR) methodology was employed for the present study. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram was used for the article selection (Figure 01) [4], [5], [6].

LENS. ORG was used for retrieving articles which is a free access multidisciplinary database. The search string used for the article retrieval is given below.

("indigenous knowledge" OR ("traditional ecological knowledge" OR ("indigenous ecological knowledge" OR "local knowledge"))) AND ("environmental sustainability" OR ("environmental management" OR "environmental conservation"))

The initial search identified 13,428 publications from LENS.ORG database. The articles identified were screened based on inclusion/exclusion criteria given in Table 01.

TABLE 01. INCLUSION AND EXCLUSION CRITERIA

Criteria	Inclusion	Exclusion
Published year range	2015-2025	Articles published out of this range
Language of articles	English	Non-English
Source type	Journals	Non journals
Study type	Primary studies	Secondary studies
Geographic location	South Asia	Non- South Asian countries

Default options of LENS.ORG and manual screening were performed at the screening stage. The articles that met the inclusion criteria (Table 1) were extracted. This resulted in 213 publications for the eligibility assessment. All authors independently assess

eligibility, and collective decision was made in selecting articles for the study. Both qualitative and quantitative studies were taken for the present study. Total number of articles selected for the study is 173.

The methods of data analysis for the research were bibliometric and thematic analyses. Keyword cooccurrence network and density visualization maps were developed using VOSviewer.

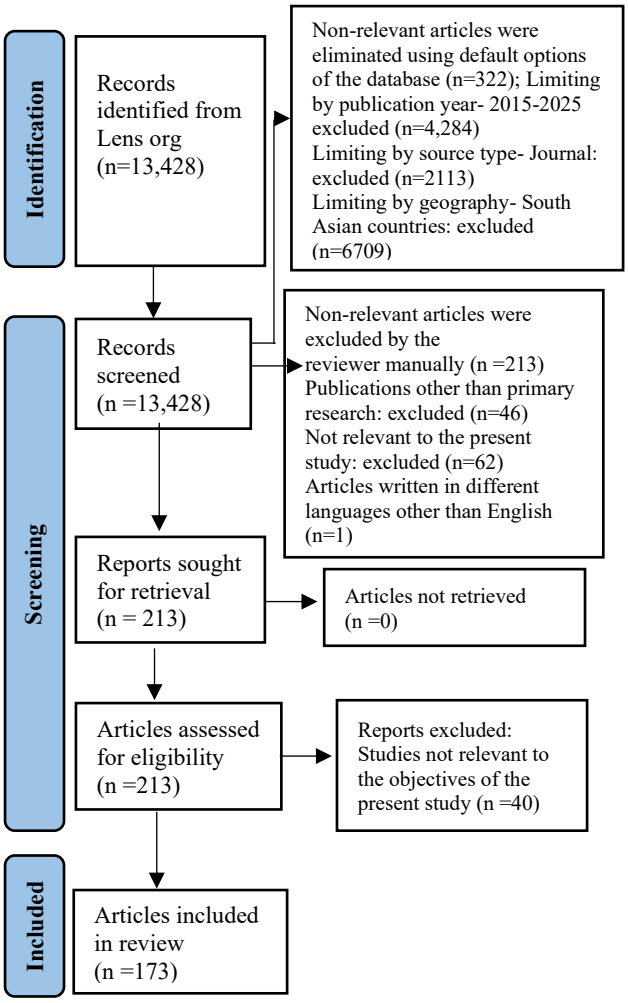


Figure 01. PRISMA flow diagram

III. Results and Discussion

When the minimum occurrence threshold was one, a total of 650 keywords were identified (Table 02). However, as the threshold increased from 2, 3, 4, and 5 times, respectively, the number of keywords decreased substantially from 74, 28, 16, and 09. This indicates that most areas represented by the keywords have not been commonly investigated, while a small number of keywords were repeatedly used, reflecting the main research themes. Five (05) was selected as the threshold for further analysis.

TABLE 02. *OCCURRENCE OF KEYWORDS IN ARTICLES*

Minimum keywords occurrences	Threshold keywords level
1	650
2	74
3	28
4	16
5	09

Table 03 revealed that "climate change" and "indigenous knowledge" were the most frequently occurred keywords, each appearing 17 times. This indicates their key role in the areas of indigenous knowledge and environmental sustainability. Other prominent keywords included "sustainability" (12 occurrences) and "sustainable development" (7 occurrences), strongly emphasized on considerable number of studies carried out in the areas of environmental and sustainable practices. Additionally, keywords such as "ethnobotany" (6 occurrences), "biodiversity", "conservation", "ecology", and "adaptation" (5 occurrences each) indicating their relationship with indigenous knowledge systems and environmental sustainability.

TABLE 03. KEYWORDS WITH A MINIMUM OF 05 OCCURRENCES IN ARTICLES

Keyword	No. of occurrences
Climate change	17
indigenous knowledge	17
sustainability	12
sustainable development	7
ethnobotany	6
biodiversity	5
conservation	5
ecology	5
Adaptation	5

Figure 02 indicates the connection between studies based on the frequency of keyword occurrence. Largest green and blue nodes represent higher frequency of appearing the terms 'indigenous knowledge' and 'climate change'. Colors represent three (03) main themes in the present study. The core link represents connection between adaptability, climate change and indigenous knowledge indicating a strong research focus on using indigenous knowledge to adapt climate change.

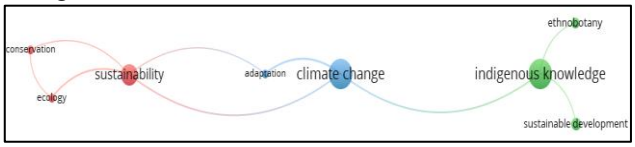


Figure 02. Keyword co-occurrence network visualization

TABLE 04. KEYWORDS CATEGORIZED INTO CLUSTERS, THEMES & KEY FINDINGS

Cluster	Keywords	Source	Key findings	Common theme
Cluster 01- Red	Conservation	[7], [8]	Studies emphasized that contribution of indigenous and tribal communities towards biodiversity conservation through traditional ecological knowledge, sacred grove protection, customary laws, community stewardship, agroforestry, rotational grazing, and local governance systems.	Conservation, Ecology and Sustainability of Ecosystems
		[9], [10], [11]	Research carried out in forest, marine, fisheries, and protected-area settings proved that conservation outcomes improve when local and indigenous communities participate in governance and decision-making processes.	
		[12], [13], [14]	The given studies indicate that there is a connection between biodiversity conservation with the maintenance of traditional resource-use systems, protection of crop wild varieties, field margin vegetation, and community forest management practices.	
	Ecology	[15], [16]	Research revealed that livestock management, pasture use, pest management, forest resource use, and ecosystem management practices are influenced by the indigenous ecological knowledge.	
		[17], [18], [19]	Studies focused on ecology reported that regenerative and traditional farming systems enhanced soil bacterial diversity, soil organic carbon levels, nutrient composition, and overall soil health compared with conventional systems.	
		[20], [21], [12]	Several studies documented relationships between communities and ecosystem services, highlighting the importance of forests, wetlands, field-margin vegetation, and traditional agroecosystems in supporting biodiversity and ecosystem functioning.	
	Sustainability	[7],	A study found that traditional knowledge on ecology contributes to sustainable resource management, biodiversity conservation, climate resilience, and long-term environmental sustainability.	
		[22], [23], [24], [25]	Research in the areas of agroforestry, organic agriculture, regenerative agriculture, integrated farming, and conservation agriculture stated that improved livelihoods, soil fertility, biodiversity, and resource-use efficiency provide positive outcomes for sustainability.	
		[26]	According to a study, when local knowledge, community participation, and ecosystem stewardship are incorporated into governance and development initiatives, it strengthens the sustainability.	
Cluster 02- Green	Ethnobotany	[27], [28], [29]	Extensive use of medicinal plants, wild edible species, indigenous fruits, ethnomedicinal resources, and parasitic plants for healthcare, nutrition, food security, and livelihoods were documented during several ethnobotanical surveys.	Ethnobotany, Indigenous Knowledge and Sustainable Development
		[30], [31], [32]	The role of medicinal plant species used by Indigenous and forest-dependent communities in treating human and livestock ailments and supporting local healthcare systems was highlighted in several studies.	
		[33], [34], [35]	A significant contribution of indigenous foods, underutilized species, and wild vegetables to nutritional diversity and food security in local communities was revealed in several studies.	
	Indigenous Knowledge	[36], [15], [37]	The studies consistently reported that forest management, farming, fishing, water conservation, grazing systems, biodiversity management, and environmental stewardship were guided by the Indigenous Knowledge Systems (IKS), Traditional Ecological Knowledge (TEK), and Indigenous and Local Knowledge (ILK).	

		[38], [37]	Several studies mentioned that indigenous knowledge is characterized by transition across generations, close link to local culture, customs, rituals, beliefs and resource management practices	
		[15], [27], [39]	Multiple studies recognized the concerns regarding erosion of indigenous knowledge due to modernization, changing livelihoods, migration, education, and declining intergenerational transmission.	
	Sustainable Development	[36], [40], [22]	Indigenous practices support livelihoods while maintaining ecological sustainability as revealed by the studies on shifting cultivation, traditional agroforestry, pastoral systems, organic agriculture, and local food systems.	
		[26], [41], [42]	Importance of community participation, indigenous rights, equitable governance, and knowledge co-production in achieving sustainable development objectives is further emphasized by several studies.	
Cluster 03- Blue	Climate Change	[43], [18], [40]	Traditional agriculture practices were recognized as climate-smart approach that improves food security, resilience to drought, water scarcity and environmental stress, and sustainability under changing climatic conditions.	Climate Change and Adaptation through Local Knowledge Systems
		[44], [45]	Studies reported observations of local communities on climate change, including increased temperatures, erratic rainfall patterns, droughts, floods, shifts in seasons, declining water availability, and reduced agricultural productivity.	
		[46], [47], [48]	Impacts of climate change on agriculture, fisheries, forests, food systems, public health, and livelihoods, specifically among Indigenous and rural communities through research studies.	
		[47], [15]	Several studies reported that there is a threat of climatic changes on traditional food systems, agro-pastoral livelihoods, biodiversity resources, and ecosystem services.	
	Adaptation	[49], [45]	Practices of local communities for climate change adaptation include crop diversification, changing cropping calendars, drought-tolerant crops, water management, agroforestry, livestock diversification, migration, and community-based forest management.	
		[44], [45], [50]	Studies identified that environmental observations, traditional skills, and knowledge accumulated over generations were used by indigenous communities to respond to climatic changes.	
		[44], [45]	Research from several developing counties revealed that local adaptation practices help communities reduce vulnerability and cope with climate-related risks.	
		[51], [52], [53]	Studies reported that integrating indigenous knowledge with scientific approaches enhances adaptation planning and climate resilience.	

The results relevant to the 01st objective of the study: to evaluate the current state of knowledge on indigenous knowledge and environmental sustainability were presented in Table 04.

The results relevant to the 2nd objective of the study were identified from the color-coded density visualization map of keywords related to indigenous knowledge and environmental sustainability (Figure 03), created by VOSviewer. In the map, color ranges from red, green, yellow indicating the higher to lower density of studies. Therefore, conservation, ecology, adaptation could be recognized as areas where empirical studies are lacking.

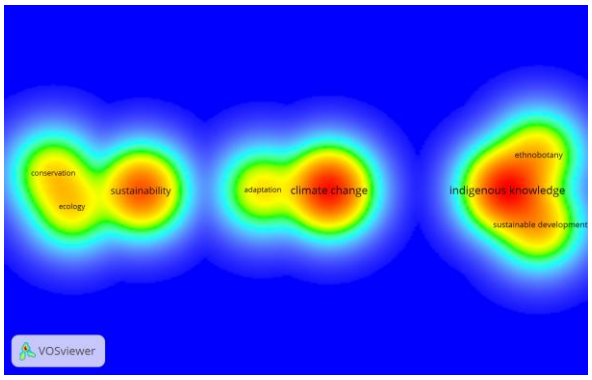


Figure 03. Density visualization map of keywords

Additionally, the relationship between biodiversity and indigenous knowledge, sustainability has not been studied.

IV. CONCLUSION

The present study employed Systematic Literature Review based on PRISMA. The study's first objective was to thematically analyze the current knowledge on indigenous knowledge and environmental sustainability.

Accordingly, 03 key themes 1) Conservation, Ecology and Sustainability of Ecosystems, 2) Ethnobotany, Indigenous Knowledge and Sustainable Development and 3) Climate Change and Adaptation through Local Knowledge Systems were identified.

The study indicates that indigenous knowledge plays a vital role in environmental sustainability by supporting biodiversity conservation, sustainable resource management, ecosystem resilience, and climate adaptation through traditional ecological practices and community-based governance. Further, indigenous knowledge significantly contributes to the sustainable development of healthcare, food security, and livelihoods.

The study also recognized the crucial role of indigenous knowledge in climate change adaptation through climate-smart agricultural practices, crop diversification, water conservation, agroforestry, and other locally developed adaptation strategies.

Studies stressed the importance of preserving indigenous knowledge and strengthening community participation and equitable governance to address modernization challenges. Additionally, the studies highlight that integrating traditional knowledge with scientific approaches strengthens the environmental sustainability.

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