

A Geographical Assessment of Spatial Distribution, Multifunctional Values and Conservation Challenges: Natural Lakes of Uttarakhand

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Abstract

Natural lakes constitute important components of the Himalayan environment and provide ecological, cultural, religious, tourism and economic benefits. This paper presents a geographical assessment of the natural lakes of Uttarakhand, locally identified mainly as Tal and Kund. The study examines their spatial distribution, geographical setting, religious significance, tourism potential, drinking-water and irrigation functions, fisheries, wildlife habitat and livelihood benefits. It also assesses their present condition, with particular attention to accessibility, inadequate management, waste accumulation, sediment deposition and seasonal decline in water levels. Based on an inventory of 46 known perennial water-bearing natural lakes, comprising 33 Tals and 13 Kunds, the study highlights the uneven geographical distribution and multifunctional value of these water bodies. The findings indicate that natural lakes represent an important natural-resource base for Uttarakhand and have considerable potential to contribute to tourism, pilgrimage tourism, state revenue and local employment. At the same time, their long-term sustainability depends on integrated conservation, planned development, regular monitoring and meaningful participation of government agencies, non-governmental organisations and local communities.

Keywords: Natural lakes; Tal; Kund; Uttarakhand; Himalaya; Spatial distribution; Tourism; Natural resources; Lake conservation; Local livelihoods

1. Introduction

Natural lakes are important components of the physical environment and constitute valuable natural resources because of their ecological, hydrological, cultural and socio-economic functions. They provide water, support biodiversity, sustain local livelihoods and contribute to recreation, tourism and cultural activities. Their importance therefore extends beyond their physical presence and is closely associated with the geographical setting and socio-economic conditions of the regions in which they occur.

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The significance of natural lakes becomes particularly pronounced in mountainous environments, where topography, climate, glacial processes and hydrological conditions strongly influence their spatial distribution and characteristics. The Himalayan region contains numerous natural water bodies that are closely associated with ecological processes, human settlements, religious traditions and tourism activities. In the discipline of population geography the study of both sexes separately assumes more importance due to their various complimentary and contrasting roles in the socio-economic development of a particular region (Kumar, A. 2023). Uttarakhand, located in the central Himalayan region of India, represents an important geographical setting in this context. The state is characterised by high mountain ranges, glaciers, rivers, diverse climatic conditions and rich biodiversity, within which numerous natural lakes occur, particularly in the High and Middle Himalayan zones.

Uttarakhand's natural lakes are distributed across steep elevational and climatic gradients, and that variation is central to their resource character (Kumar, A., 2026). Natural lakes in Uttarakhand are locally identified mainly by the terms Tal and Kund. These water bodies differ in their geographical settings and are also associated with diverse cultural and religious traditions. The term Kund is particularly associated with sacred places and religious practices, whereas Tal is commonly used for natural water bodies of greater extent and depth. The distribution of these lakes is uneven across the state. Available information identifies 46 perennial water-bearing natural lakes, comprising 33 Tals and 13 Kunds, with a greater concentration in the High Himalayan region, a lower occurrence in the Middle Himalaya and negligible occurrence in the Lower Himalayan region.

The natural lakes of Uttarakhand perform multiple functions and provide benefits at local, regional and state levels. Their importance includes tourism, pilgrimage tourism, religious and cultural activities, boating and water sports, drinking-water supply, irrigation, fisheries, wildlife habitat and local livelihood opportunities. They also contribute indirectly to state revenue and employment through tourism and pilgrimage-related economic activities. Lakes such as Nainital and Bhimtal illustrate the relationship between natural water bodies, tourism and local economic development, while several high-altitude lakes are associated with pilgrimage, religious traditions and pastoral activities.

Despite their diverse values, many natural lakes of Uttarakhand face geographical and management-related challenges. High-altitude lakes are often located far from settlements and motorable roads, making accessibility difficult. Inadequate tourism infrastructure, waste accumulation, sediment deposition, seasonal reduction in water levels and insufficient management arrangements affect the condition and utilisation of several lakes. Management attention is also uneven, with greater attention generally directed towards lakes that have already become important tourism or pilgrimage destinations. The absence of a uniform and effective conservation framework for all natural lakes creates further challenges for their long-term protection and sustainable utilisation.

Although the natural lakes of Uttarakhand have considerable geographical, ecological, cultural and economic significance, there remains a need for an integrated geographical assessment that brings together their spatial distribution, Tal and Kund classification, multifunctional values, present condition and conservation challenges. A systematic assessment of these dimensions

is important for understanding the spatial pattern of natural lakes and for identifying the opportunities and constraints associated with their sustainable development.

1.1 Research Gap

Existing discussions on the natural lakes of Uttarakhand have addressed different aspects of their ecological, cultural, tourism and management significance. However, a broader geographical assessment integrating the distribution and classification of perennial natural lakes with their multifunctional importance and present conservation challenges remains important. In particular, the spatially uneven occurrence of Tal and Kund, their diverse geographical and socio-economic functions, and the accessibility and management problems affecting different lake environments require consideration within a common geographical framework.

1.2 Novelty of the Present Study

The present study addresses this gap by examining the natural lakes of Uttarakhand as a spatially distributed natural-resource system. It considers an inventory of 46 perennial water-bearing lakes, comprising 33 Tals and 13 Kunds, and integrates their geographical distribution with their religious, cultural, tourism, economic and livelihood values. In addition, the study examines major issues affecting their present condition, including accessibility, waste accumulation, sedimentation, seasonal decline in water levels and management deficiencies. On this basis, the study proposes conservation and sustainable-development measures involving government institutions, non-governmental organisations and local communities.

1.3 Objectives of the Study

- a) To examine the spatial distribution and geographical characteristics of natural lakes (Tal and Kund) in Uttarakhand.
- b) To assess the multifunctional significance of natural lakes in terms of religious, cultural, tourism, ecological and socio-economic values.
- c) To examine the present condition and major conservation challenges affecting the natural lakes of Uttarakhand.
- d) To suggest appropriate measures for their conservation and sustainable development.

2. Study Area and Geographical Setting

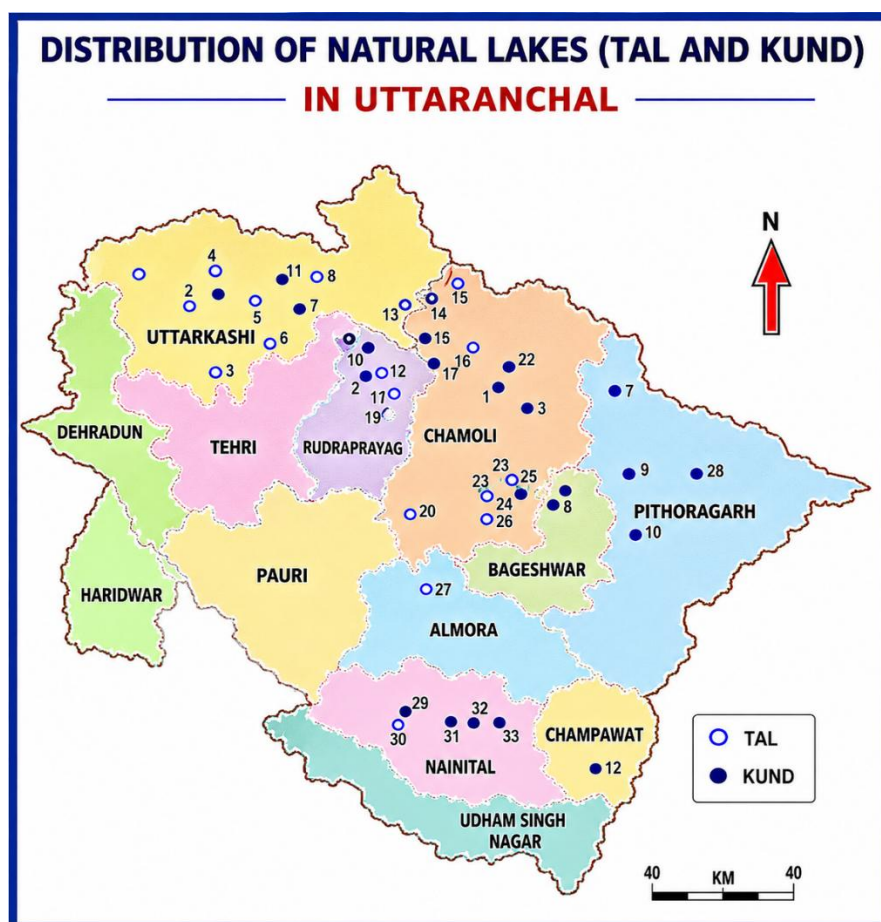
Uttarakhand is situated in the central Himalayan region of northern India and is characterised by diverse physiographic, climatic and ecological conditions. The state comprises high mountain ranges, glaciers, valleys, rivers and rich biodiversity, creating favourable geographical conditions for the occurrence of natural lakes. The distribution of these lakes is closely associated with altitude, topography, glacial processes and local environmental conditions.

Natural lakes occur predominantly in the High and Middle Himalayan zones, while their occurrence is negligible in the Lower Himalayan region. The geographical distribution is also uneven between the Garhwal and Kumaon regions. The High Himalayan region of Garhwal

contains a relatively larger concentration of natural lakes, whereas in Kumaon, Tals are more commonly associated with the Middle Himalayan region and Kunds with higher Himalayan areas.

For the present study, 46 known perennial water-bearing natural lakes have been considered, comprising 33 Tals and 13 Kunds. Their locations are represented spatially in Figure 1 and their names are presented in Table 1.

[Figure 1. Spatial Distribution of Natural Lakes (Tal and Kund) in Uttarakhand



Source: Compiled from the geographical and tourism sources used in the study.

3. Data Sources and Methodology

The present study is based primarily on secondary data obtained from books, research papers, government publications, tourism documents, maps and relevant geographical literature. Survey of India maps and the Uttarakhand tourism map were used as important sources for identifying the location and distribution of natural lakes. Information relating to 46 perennial natural lakes, comprising 33 Tals and 13 Kunds, was compiled and examined.

A descriptive-analytical geographical approach was adopted for the study. The lakes were examined under five broad dimensions: (i) spatial distribution and geographical setting, (ii) Tal and Kund classification, (iii) religious and cultural significance, (iv) tourism and socio-economic functions, and (v) present condition and conservation challenges. The spatial

distribution of the lakes was interpreted with the help of the available distribution map, while their multifunctional significance and major management issues were assessed through documentary evidence and geographical interpretation.

The study does not employ primary water-quality measurements, statistical modelling or remote-sensing-based change detection. Therefore, its findings are interpreted within the scope of a descriptive geographical assessment based on available secondary information.

4. Spatial Distribution and Inventory of Natural Lakes

The spatial distribution of natural lakes in Uttarakhand is closely associated with the state's Himalayan physiography. On the basis of the available inventory, 46 perennial natural lakes are identified, comprising 33 Tals and 13 Kunds. The greater occurrence in the High Himalayan region and lower occurrence towards the Middle and Lower Himalayan zones reflects the influence of elevation, terrain and geomorphological conditions.

Table 1. Inventory of Perennial Natural Lakes (Tal and Kund) in Uttarakhand

Sl. No.	Tal	Sl. No.	Kund
1	Runsara Tal	1	Tapta Kund
2	Dodi Tal	2	Nandi Kund I
3	Nachiketa Tal	3	Hem Kund
4	Seven Tal	4	Benni Kund
5	Khara Tal	5	Roop Kund
6	Masep Tal	6	Devi Kund
7	Shasta Tal	7	Suraj Kund
8	Kedar Tal	8	Nag Kund
9	Masab Tal	9	Nandi Kund II
10	Painya Tal	10	Thamri Kund
11	Vasuki Tal I	11	Massar Kund
12	Chorobari Tal	12	Shyam Lal Kund
13	Vasuki Tal II	13	Bedai Kund
14	Arva Tal		
15	Rishi Tal		
16	Satopanth Tal		
17	Kashini Tal		

18	Maindogila Tal		
19	Deoria Tal		
20	Ben Tal		
21	Oobna Tal		
22	Kagbhusandi Tal		
23	Sup Tal		
24	Jhal Tal		
25	Brahma Tal		
26	Bekhar Tal		
27	Tarag Tal		
28	Parvati Tal		
29	Nainital		
30	Khurpa Tal		
31	Sat Tal		
32	Bhim Tal		
33	Naukuchiya Tal		

Source: Nainital Taal and Kund Patrika (2026)

5. Geographical Characteristics and Distribution

The Himalayan region extends across a vast mountainous environment with marked variations in altitude, relief, climate and hydrological conditions. Uttarakhand, located in the central Himalayan region, contains numerous natural lakes that are closely related to these geographical characteristics.

In Uttarakhand, natural lakes are commonly referred to as Tal and Kund. The term Kund is generally associated with water bodies viewed from a spiritual perspective or situated near religious places, whereas Tal commonly indicates natural water bodies distinguished by greater depth and extent. Their distribution is uneven, with more lakes occurring in the High Himalayan region, fewer in the Middle Himalaya and negligible occurrence in the Lower Himalayan region.

Natural lakes in the Himalayan region may have developed through geomorphological processes including glacial and tectonic activity. The High Himalayan setting of many lakes reflects the importance of snow, glaciers, relief and local drainage conditions in their formation and persistence.

6. Multifunctional Values of Natural Lakes

The natural lakes of Uttarakhand perform multiple ecological, cultural and socio-economic functions. Their significance varies according to geographical location, accessibility, size, surrounding environment and cultural associations. Tourism and pilgrimage constitute major sources of economic benefits, while several lakes also support drinking-water supply, irrigation, fisheries, wildlife habitats and local livelihood activities.

From a tourism perspective, lakes such as Nainital and Bhimtal have developed as important destinations and support a range of tourism-related activities, including boating and recreation. Similarly, lakes and Kunds associated with pilgrimage centres possess considerable religious and cultural significance. Tapta Kund and Hem Kund, for example, are associated with important pilgrimage traditions. Natural lakes also contribute to local livelihoods through tourism-related employment, fisheries and other economic activities. In high-altitude areas, lakes may additionally provide water resources for pastoral communities and wildlife. Thus, the significance of natural lakes extends beyond tourism and religion to include broader ecological and socio-economic functions.

7. Present Condition and Conservation Challenges

The present condition of natural lakes in Uttarakhand varies considerably according to geographical location, elevation, accessibility and level of human utilisation. Lakes situated in the High Himalayan region are often located at considerable distances from settlements and motorable roads. Their high-altitude locations and difficult terrain limit accessibility and have also constrained tourism infrastructure and organised development.

At the same time, increasing tourist and pilgrimage activities have created additional environmental pressures around some accessible lakes. Waste accumulation in lake surroundings, sediment deposition associated with surface runoff, seasonal reduction in water levels and inadequate management arrangements have emerged as important concerns. Some lakes may experience substantial seasonal decline in water availability, while others remain comparatively underutilised because of their remote locations. The management of natural lakes is also uneven. Greater attention tends to be directed towards lakes that already contribute significantly to tourism and pilgrimage activities, whereas less accessible lakes may receive limited institutional attention. The absence of a uniform conservation and management framework for the state's natural lakes represents an important challenge for their long-term sustainability.

8. Conservation and Sustainable Management Measures

- a. Integrated lake management: A coordinated management framework should be developed for the natural lakes of Uttarakhand, taking into account their ecological, cultural, tourism and livelihood functions.
- b. Waste and pollution management: Effective systems for solid-waste collection, disposal and prevention should be established around frequently visited lakes.

- c. Catchment and sediment management: Vegetation conservation, soil-erosion control and appropriate catchment-area management should be promoted to reduce sediment deposition and protect lake environments.
- d. Sustainable tourism: Tourism and pilgrimage activities should be regulated according to the environmental carrying capacity and geographical sensitivity of individual lake environments.
- e. Community participation: Local communities should be actively involved in lake conservation, monitoring, awareness programmes and sustainable livelihood initiatives.
- f. Institutional coordination: Tourism, Forest, Environment and other concerned departments, local bodies and community organisations should coordinate conservation and management activities.
- g. Regular monitoring: Periodic assessment of water levels, waste accumulation, sedimentation and other indicators of lake condition should be undertaken to identify emerging environmental problems.

9. Conclusion

The geographical assessment indicates that natural lakes constitute an important natural-resource component of Uttarakhand's Himalayan environment. The state has 46 identified perennial natural lakes, comprising 33 Tals and 13 Kunds, with a predominantly uneven distribution across the High and Middle Himalayan regions. Their geographical settings are closely associated with their ecological, cultural, religious, tourism and socio-economic significance.

The assessment further demonstrates that these lakes provide multiple benefits, including tourism and pilgrimage opportunities, water resources, fisheries, wildlife habitat and livelihood support. However, their potential is accompanied by significant conservation challenges. Difficult accessibility in high-altitude areas, inadequate infrastructure, waste accumulation, sediment deposition, seasonal decline in water levels and uneven management practices may affect the long-term sustainability of these natural resources.

The sustainable future of Uttarakhand's natural lakes therefore requires a shift from lake-specific and tourism-oriented utilisation towards integrated geographical and conservation-based management. Sustainable tourism, catchment protection, waste management, regular environmental monitoring and meaningful participation of local communities should form important components of future lake-management strategies. Coordinated action by government agencies, local institutions, non-governmental organisations and communities can help balance resource utilisation with ecological and cultural conservation.

Overall, the study highlights that the natural lakes of Uttarakhand should be viewed not merely as tourism destinations or religious sites but as multifunctional geographical resources requiring systematic conservation and sustainable management.

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