



Plant Biodiversity of District Pithoragarh: Review

Gayatri Thakurathi¹, Kamlesh Kumar Bhakuni² and Sheetal Mahar³

^{1,2,3}Laxman Singh Mahar Campus, Pithoragarh, Soban Singh Jeena University Almora

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Introduction

Uttarakhand is well known for its rich plant biodiversity. The Uttarakhand Himalayas are rich in pristine biodiversity, encompassing a wide variety of flora and fauna. This region's diverse physiographic and climatic conditions, along with its multiple altitudinal zones and soil types, contribute significantly to its rich biodiversity. The state is divided into two regions: Kumaon and Garhwal. The Kumaon region is situated between latitudes 28°44' and 30°49' N and longitudes 78°45' and 81°1' E, encompassing six districts: Almora, Bageshwar, Champawat, Nainital, Pithoragarh, and Udham Singh Nagar. As per the Forest Survey of India, Uttarakhand hosts a diverse range of forests, classified into nine main types: tropical moist deciduous forests, tropical dry deciduous forests, sub-tropical pine forests, Himalayan moist temperate forests, Himalayan dry temperate forests, sub-alpine forests, moist alpine scrub, dry alpine scrub, and trees outside forests. These are further categorized into 43 distinct forest types, following the classification by **Champion and Seth (1968)**.

Pithoragarh district lies between 29°35'N to 29.58'N latitude and 80°13'E to 80.22'E longitude, covering a geographical area of approximately 7,100 square kilometers. It shares its borders with Tibet to the north, Nepal to the east, and parts of the Chamoli, Bageshwar, Almora, and Champawat districts. The district is enriched by rivers such as Dhauliganga, Kali, Goriganga, and Ramganga, which serve as its primary water sources (**Bargali et al., 2022**).



Pithoragarh experiences four distinct seasons: winter, summer, monsoon, and spring. However, winter is the longest season, lasting from October to March. The temperature varies across the region, dropping as low as 0°C in winter and rising to about 30°C during the summer. The district's elevation ranges from 500 meters to 4,000 meters above sea level, featuring diverse landscapes and a variety of forest types. Semi-temperate type forest (1000 to 1500m), sub temperate type (1500 to 2000 m) temperate type forest (2000 to 3000 m) and alpine forest ranges from 3000 to 4000m.

A recent study by **Rana and Rawat (2017)** compiled a comprehensive list of 10,503 plant species from the Himalayas, classified into 2,322 genera and 240 families. Among the Himalayan regions, Bhutan and Sikkim recorded the highest number of plant species, with 6,283 documented. They are followed by Nepal with 5,516 species, Uttarakhand with 4,990 species, Arunachal Pradesh with 4,503 species, Himachal Pradesh with 3,324 species, and Jammu and Kashmir with 2,118 species.

A mutualistic relationship exists between biological system and cultural diversity. This relationship was seen since vedic period and during the time of Buddha and Mahavira. Nature provides everything such as light, air, food, and water which creates life possible. This awareness of life in nature led to the worship of light, air, food, and water. Cultural values and religious beliefs are very much inter-linked that indirectly led to the great management of forest ecosystems (**Anthwal et al., 2010**).

Method

Extensive efforts have been undertaken to review and analyze research conducted in the Himalayas, particularly in the Kumaon region and Pithoragarh, focusing on plant biodiversity, invasive species, and medicinal and aromatic plants. These studies, published in scientific journals up to 2023, provide valuable insights into the region's ecological and botanical diversity.

This review aims to present a critical and well-founded analysis of research papers and articles published in peer-reviewed academic journals, as well as findings documented in books, dissertations, and Ph.D. theses. While conference proceedings, unpublished manuscripts, research abstracts, and dissertations can provide valuable insights and well-supported findings, they were excluded from this analysis to maintain a focus on higher-quality and more rigorously reviewed publications.

The study's data was gathered through an extensive search using keywords like “biodiversity,” “Pithoragarh diversity,” “Medicinal and Aromatic Plants,” “Kumaon region,” “Ethno-botany of Pithoragarh,” and “Uttarakhand.” The search covered multiple databases and platforms, including



ScienceDirect, Google Scholar, Web of Science, Scopus, SpringerLink, JSTOR, and Sodhganga, conducted between March and July 2024. This process yielded numerous articles, from which 50 papers were carefully selected for analysis and review. Selection criteria included the year of publication, research focus, geographical coverage, research design and methodology (quantitative or qualitative), study objectives, and key findings. This detailed analysis provides valuable insights into the academic use of these platforms and evaluates the quality of research conducted in Uttarakhand, particularly in Pithoragarh.

Result and discussion

Sacred groves are areas rich in biodiversity, often found in every village or a cluster of villages, each associated with its own deity. These groves are typically surrounded by forest patches that are regarded as sacred (Bisht and Ghildiyal, 2007). Previous studies on sacred groves like Nakuleshwar, Haat Kali, Malya Nath, and Patal Bhuvaneshwar in Pithoragarh district (Singh et al., 2010a; b; Singh, 2011; Singh et al., 2011; 2012; 2013) primarily focused on biodiversity conservation and the ethnobotanical uses of the species found in these areas. Various other sacred grooves in Pithoragarh such as Dhvaj, Thalkedar, Lateshwar are dominated by *Quercus* spp., *Rhododendron* spp. and *Cedrus deodara*.

Five species of oaks occupy the different habitats at successive altitudes viz., *Quercus glauca*, *Q. leucotrichophora*, ; *Q. lanuginose*, *Q. floribunda* and *Q. semecarpifolia*. As the altitude increases, noticeable changes in vegetation can be observed. Between 1,000 to 3,000 meters, dominant species such as *Rhododendron arboreum* (Burans), *Quercus leucotrichophora* (Banj), *Lyonia ovalifolia* (Anyar), and *Myrica esculenta* (Kaphal) are among the first to appear. Alongside these, species like *Viburnum cotinifolium*, *Symplocos paniculata*, *Neolitsea umbrosa*, and *Cornus macrophylla* can also be found interspersed. Among gymnosperms, *Pinus roxburghii* (Chir) is the first to emerge in this elevation range (Bisht et al., 2018). The various plant types are mentioned in **Table1** which were present in Pithoragarh forests.

Table 1: Plant diversity of local forest present in Pithoragarh.

S.no.	Botanical name	Common name	Family	Habit
1.	<i>Acer oblongum</i>	Putali	Aceraceae	Tree
2.	<i>Aegle marmelos</i>	Bel	Rutaceae	Tree



3.	<i>Adiantum cappilus vineris</i>	Hansraj	Adiantaceae	Fern
4.	<i>Adiantum lunulatum</i>	Sunku	Adiantaceae	Fern
5.	<i>Asplenium dalhousiae</i>		Aspediaceae	Fern
6.	<i>Albizia mollis</i>	Sirisha	Mimosaceae	Tree
7.	<i>Arisaema jacquemontii</i>	Sanp ka butta, cobra lily	Araceae	Herb
8.	<i>Asparagus adscendens</i>	Satavari, Keruwa	Liliaceae	Shrub
9.	<i>Bidens Pilosa</i>	Samasa, Araharjhad	Asteraceae	Herb
10.	<i>Berberis asiatica</i>	Kilmora	Berberidiaceae	Shrub
11.	<i>Berberis chitria</i>	Kingore-lal, Chotara, Totar	Berberidiaceae	Shrub
12.	<i>Bacidia convexula</i>		Bacidiaceae	Fungus
13.	<i>Bacidia millegrana</i>		Bacidiaceae	Fungus
14.	<i>Bulbothrix setschwanensis</i>		Parmeliaceae	Lichen
15.	<i>Centella asiatica</i>	Brahmi	Apiaceae	Herb
16.	<i>Chaerophyllum reflexum</i>	Ginjari	Apiaceae	Herb
17.	<i>Coriaria nepalensis</i>	Makola	Coriariaceae	Shrub
18.	<i>Carpinus viminea</i>	Himalayan hornbeam	Betulaceae	Tree
19.	<i>Cassia floribunda</i>	Devil's finger	Fabaceae	Tree
20.	<i>Cinnamomum tamala</i>	Tejpat, Darchini	Lauraceae	Tree
21.	<i>Cynodon dactylon</i>	Doob	Poaceae	Herb
22.	<i>Cedrus deodara</i>	Deodara	Pinaceae	Tree
23.	<i>Conocephalum conicum</i>	Snakeskin liverwort	Conocephalaceae	Bryophytes
24.	<i>Candelaria concolor</i>	Lemon lichen	Candelariaceae	Fungi



25.	<i>Caloplaca himalayana</i>		Teloschistaceae	Lichen
26.	<i>Duchesnea indica</i>	Indian strawberry	Rosaceae	Herb
27.	<i>Dirinaria consimilis</i>		Pertusariaceae	Lichen
28.	<i>Dirinaria applanta</i>		Pertusariaceae	Lichen
29.	<i>Diploschistes actinostomus</i>	Crater lichen	Thelotremataceae	Lichen
30.	<i>Equisetum diffusum</i>	Himalayan horsetail	Equisetaceae	Pteridophytes
31.	<i>Fissidens javanicus</i>		Fissidentaceae	Bryophytes
32.	<i>Fissidens grandifrons</i>		Fissidentaceae	Bryophytes
33.	<i>Ficus palmata</i>	Beru, manjir	Moraceae	Tree
34.	<i>Fagopyrum esculentum</i>	Oggal, kuttu	Polygonaceae	Herb
35.	<i>Geranium ocellatum</i>	Bhanda, bhit jari	Geraniaceae	Herb
36.	<i>Goodyera hemsleyana</i>		Orchidaceae	Herb
37.	<i>Meconopsis aculeata</i>	Kanta, blue poppy	Papaveraceae	Herb
38.	<i>Galium aparine</i>	Khuskhusa, Kuri	Rubiaceae	Herb
39.	<i>Heterodermia diademata</i>		Physciaceae	Lichen
40.	<i>Heterodermia obscurata</i>		Physciaceae	Lichen
41.	<i>Heterodermia speciosa</i>		Physciaceae	Lichen
42.	<i>Hyperphyscia adglutinata</i>		Physciaceae	Lichen
43.	<i>Hyperphyscia syncola</i>		Physciaceae	Lichen
44.	<i>Ipomoea nil</i>	Morning glory	Convolvulaceae	Climber
45.	<i>Juglans regia</i>	Walnut	Juglandaceae	Tree
46.	<i>Lecanora interjecta</i>		Lecanoraceae	Fungi
47.	<i>Lecanora subimmersa</i>		Lecanoraceae	Fungi
48.	<i>Machilus duthiei</i>	Lanceleaf Bay tree	Lauraceae	Tree



49.	<i>Marchantia paleacea</i>		Marchantiaceae	Bryophytes
50.	<i>Mahonia nepaulensis</i>	Van Kilmora	Berberidaceae	Shrub
51.	<i>Pyracantha crenulata</i>	Ghingaru	Rosaceae	Shrub
52.	<i>Prinsepia utilis</i>	Bhenkal, jhitalu	Rosaceae	Shrub
53.	<i>Polygala persicariaefolia</i>		Polygalaceae	Shrub
54.	<i>Polystechium discretum</i>		Aspediaceae	Fern
55.	<i>Pteris stenophylla</i>		Pteridaceae	Fern
56.	<i>Parmelinella wallichiana</i>		Parmeliaceae	Lichen
57.	<i>Parmotrema austrosinense</i>	Pretty ruffle	Parmeliaceae	Lichen
58.	<i>Persea Odoratissima</i>		Lauraceae	Tree
59.	<i>Parmotrema tinctoria</i>		Parmeliaceae	Lichen
60.	<i>Parmotrema hababianum</i>		Parmeliaceae	Lichen
61.	<i>Punctelia rudecta</i>		Parmeliaceae	Lichen
62.	<i>Pertusaria melastomella</i>		Pertusariaceae	Fungi
63.	<i>Rumex nepalensis</i>	Jungli Palak, Shyam, Amrule, Khoras	Polygonaceae	Herb
64.	<i>Ranunculus arvensis</i>	Chambul	Ranunculaceae	Herb
65.	<i>Rhamnus virgatus</i>	Chadyulla	Rhamnaceae	Tree
66.	<i>Rubus ellipticus</i>	Pila hinsalu	Rosaceae	Shrub
67.	<i>Rubia manjith</i>	Manjith	Rubiaceae	Climber
68.	<i>Ramalina conduplicans</i>		Ramaliaceae	Lichen
69.	<i>Stephania elegans</i>	Taro lehara	Menispermaceae	Climber
70.	<i>Solanum xanthocarpum</i>	Kantakari	Solanaceae	Herb



71.	<i>Symplocos paniculata</i>		Symplocaceae	Tree
72.	<i>Selaginella bryopteris</i>	Sanjeevani butti	Selaginellaceae	Fern
73.	<i>Polystechium discretum</i>		Aspediaceae	Fern
74.	<i>Pteris stenophylla</i>		Pteridaceae	Fern
75.	<i>Quercus semecarpifolia</i>	Kharsu	Fagaceae	Tree
76.	<i>Quercus floribunda</i>	Moru Oak	Fagaceae	Tree

Richard Strachey was the very first person who undertook survey of Pithoragarh in 1846 and then by J.E. Winterbottom in 1848, both have collected 2000 species from 1846 to 1849. Later K.L. Arya from 1991 to 2001 worked on Plan of “Pithoragarh Forest Division” listed total 509 species of plants from Pithoragarh district.

Uttarakhand, about 65% of the geographical area of the state has been recorded under forests (Kapoti et al., 2016) and 29.33 % that of Pithoragarh by Indian forest report 2019, being the second lowest of all the districts. Most of the forests in the state are under the control of forest department, 15% of the forests are managed by Van Panchayat (VP) or Forest Councils.

Localities of Pithoragarh are very much dependent on local forest for their day to day need. People use forest resources for fodder, fire, medicinal purposes and various other uses. Almost forests are covered with Oak and Rhododendron which marks the good soil health in district Pithoragarh. Forest are more conserved because of their religious values in Pithoragarh, people use forests but in sustainable way.

Conclusion

Forest in Pithoragarh are rich source of plant diversity from lower to higher plants. In past few decades due to carelessness of human community and certain road constructions led to the deforestation of forest which marks the loss of various plant species, on the other hand, extreme change in climate resulted in the loss of species as well as the migration of the species. Pithoragarh local forests are not much explored by the researchers, more studies on this site may led to the findings of more and more plant species which have a beneficial effects on human life. No forest can fulfil the greed of human but it can provide almost all the basic sustainable needs for mankind. In Pithoragarh most of the forest are scared due to religious and ethical beliefs of human population the forest still have their recreational value, many important medicinal plants still lie in the centre of the forest, periphery of the forest is directly



used by local community for fodder, fire and grazing. Mainly *Quercus* and *Rhododendron* species are dominant over the Pithoragarh district.

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