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# A Review of Nepal's Main Tree Species' Dendrochronological Potential

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## Abstract

In Nepal, numerous studies in the field of dendrochronology are conducted. Before beginning dendrochronological research, it is crucial to comprehend the nature of the species through its distribution, related species, and climatic response. This study aims to evaluate the dendrochronological potentiality of the major tree species that have been studied in Nepal up to this point. In order to do this, we searched published articles through March 2020 using the Google engine, listing the species names that have been used thus far in dendrochronological research conducted in Nepal. From the published research articles and reviews, we were able to identify the following species: Pinus roxburghii, Pinus wallichiana, Rhodendendron campanulatum, Tsuga dumusa, Ulmus wallichiana, Larix potaninii, Picea smithiana, Abies spectabilis, Betula utilis, Cedrus deodara, Cupressus torulosa, and Picea smithiana.

**Keywords:** Plant life; Tree species; Biodiversity.

## Introduction

It is well known that studying a tree species' distribution range can help manage and conserve against the negative effects of climate change by providing a better understanding of the growth-climate relationship. The environment and its components have been greatly impacted in recent years by patterns of changing climate. Over the past century, the average global temperature has risen by more than 1.3°F, and by 2100, it is predicted to have increased globally by 2°F to 11.5°F. The entire ecosystem and landscape are impacted by this changing climate, but the Himalayas are particularly hard hit since their temperatures are rising faster than those of other regions. Thus, the Himalayan ecosystem is thought to serve as a gauge for the effects of and changes in climate [1].

## Methodology

There aren't many approaches to comprehending climate dynamics and referencing pertinent research for them. One of the most widely used and respected scientific techniques is dendroclimatology. While many kinds of plants and trees can be used for this kind of research, conifers are the best species to identify the climatic response in high altitude regions [2,3].

The most effective and straightforward method for determining historical growth and climatic conditions for this kind of research is tree ring analysis. Any species of tree or shrub that can meet the requirements for producing rings that are distinct for the majority of the year, having ring features that can be cross-dated using dendrochronology, and growing old enough to give the time control needed for a specific investigation. Thus, the goal of this study is to list and briefly describe the main dendrochronology-possible species that have been investigated in Nepal to date [4,5].

For dendro-related research, a total of 60 articles covering 20 species from 25 districts have been examined in Nepal thus far. After analyzing 85 publications up to March 2020 for this study, we discovered that Nepal's dendrochronologists had studied 114 sites, primarily related to species such as A. spectabilis, P. wallichiana, T. dumusa, P. smithiana, B. utilis, P. roxburghii, and J. recurva (Figure 1). Likewise, research is conducted on species such as A. pindrow, U. wallichiana, C. torulosa, R. Campanulatum, L. potanini, and C. deodara [6-8].

P. wallichiana is the second-highest (18%) studied species in the field of dendrochronology. It is a member of the Pinaceae family. It's a big evergreen tree that grows naturally in South Asia, ranging from Afghanistan to Bhutan. It extends from 1,800 meters to 3,600 meters in Nepal, and on rare occasions, up to 4,400 meters as well. In the midland region between the main Himalaya and the foothills, it is widely distributed. It typically grows best in deep, moist soils, either alone or in combination with Quercus semecarpifolia, C. deodara, A. pindrow, and P. smithiana. B. utilis and J. macropoda are its associates at higher elevations. Previous research has demonstrated this species' potential for various dendrochronological study applications due to its distinct annual rings and extensive geographic range. The longest developed to date was 694 years, from 1303 to 1996. Similar to this, a 405-year tree ring chronology was created from the Dolpa area in Nepal's trans-Himalayan region, where moisture stress is the primary factor limiting radial growth during the spring and summer [9,10].

## Results

There are sizable tracts of native Himalayan Birch (B. utilis, D. Don) forests in the Himalayan region. It has a long lifespan (more than 400 years) and holds the potential to create extensive tree-ring chronologies. Regretfully, not much is understood about its dendrochronological potential to date. According to reports, the growth of Himalayan birch is positively impacted by the mean temperature of July and September in west Nepal the previous year and the precipitation that falls in the western Himalayas in March, April, and June. Given its extensive distribution throughout High Asia, more research is required to determine whether it has the ability to create a lengthy, high-elevation tree-ring chronology, especially in the central Himalayas.

## Discussion

P. ciliata is a large, handsome, deciduous, and dioecious and fast-growing tree of temperate and sub temperate regions of the Himalayas. An intolerant tree that grows best on deep moist soils, but can grow on a

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variety of sites and soils including rocky exposed, land slide areas. It also grows best on alluvium, stream beds and/or sandy loams. It is adapted to a precipitation zone of 750 to 1250 mm/ yr or more, in a temperature range of -20 to 35 degree Celsius. It prefers a humid, semi-arid cool, cold temperate, climate. It does not coppice except when young. It is relatively fast growing. Yields of 6 to 13 m3/ha/yr. have been recorded. P. ciliata is a handsome large tree, notable for its attractive light grey bark when young, and large cordate leaves with pale undersides. It seems to have been introduced to the Forestry Commission's Research Station at Alice Holt, Surrey in 1959 when material was sent from the Forest Research Institute in Dehradun, India.

## Conclusion

The primary species studied to construct a lengthy tree ring chronology and determine the relationship between trees and climate are Himalayan confers. The majority of dendrochronologists concentrated their study on a small number of species. Up until 2013, twenty species from twenty-five districts were the subject of 60 published articles. There were twenty-seven more articles published between 2013 and March 2020. A. spectabilis is the species among these that has been studied the most, followed by P. wallichiana. Likewise, extensive research has been done on T. dumosa, P. smithiana, B. utilis, and P. roxburghii. However, the least studied species are those such as J. recurva, P. ciliate, A. pindrow, U. wallichiana, C. torulosa, R. campanulatum, L. potanini, and C. deodar. Numerous other species are currently being researched in China rather than Nepal.

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