

Original Research

Local Perceptions of Ecosystem Services and Anthropogenic Disturbances on Endangered *Taxus wallichiana*: Implications for Conservation and Sustainable Management

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Abstract

The current study provides insightful information on the ecosystem services and anthropogenic disturbances that affect the endangered *Taxus wallichiana* forest. *T. wallichiana* has enormous ecological and societal significance, as evidenced by a diverse range of ecosystem services and products in the Kashmir western Himalayan region. The demographic features of participants and ecological services of the *T. wallichiana* were documented during group discussions and personal interviews. The interviews included 106 informants, of whom 19 were women and 87 were men. The majority of informants (82.07%) were male due to restrictions on women's interactions with strangers in the study area. Based on visual assessment at each sampling site, anthropogenic disturbance levels were assessed on a four-point scale (1 = low, 2 = moderate, and 3 = high). The bark is used as a substitute for tea during the winter to feel warm. Tea from *Taxus* bark is also believed to increase vitality and cure other health-related problems. The bark is also considered an anti-cancerous agent among the locals. The highest value of daily fuel wood consumption per capita was 5.25 kg at Kala Ban, whereas the lowest value of daily fuel wood consumption per capita was 1.36 kg at Japsar. Rural communities mostly rely on *T. wallichiana* wood as a source of fuelwood for cooking and heating their homes because upper temperate zones are dominated by mostly coniferous trees like *T. wallichiana* forests and other tree species

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like *Pinus wallichiana*, *Picea smithiana*, and *Abies pindrow*. The species faces severe risks, such as exploitation for fuel, construction, fencing, agricultural expansion, climate change, and other dangers, putting pressure on its native ecosystem. Endangered *T. wallichiana* populations require immediate attention from forest management and policymakers to ensure the survival of this highly medicinal anticancerous plant species.

Keywords: Climate change, Endangered, Ethnobotany, Fuel wood, Population pressure.

Introduction

Himalayan forests are among the most depleted in the world [1–6], and overgrazing, tree harvesting, and nomadic lifestyles constitute the root cause of this degradation [7–10]. The Himalayan yew (*Taxus wallichiana*), a valuable medicinal plant found in these forests, is becoming threatened [11]. *Taxus wallichiana* is known as Barmi in Urdu, Hindko, and Hindi, and common yew or Himalayan yew in English [12]. Although *Taxus* species are distributed in a broad range of altitudes [13], they are most frequently found in the 1800–3300 m range [11, 14]. However, *Taxus* has only recently gained significant conservation attention. Though the plant has long been used by the locals of the Himalayan region, its therapeutic value was only discovered a few decades ago [15, 16].

Taxus wallichiana has enormous ecological and societal significance, as evidenced by a diverse range of ecosystem services and products [11, 12, 17, 18]. Yew's bark and leaves produce taxol, a molecule that has been shown to be effective against breast and ovarian cancer. *Taxus wallichiana* populations provide long-term habitats for the Kashmir region's indigenous flora and fauna, as this species matures in 70 years and has a life expectancy of more than 1000 years [19]. This species provides a wide range of ecological services. It yields strong, decay-resistant hardwood, which is highly valued for lumber and furniture. *Taxus wallichiana* is used for a variety of home applications, including medicine, fuel, and timber [20, 21]. The phytochemical study has shown that this plant has high anti-cancer action due to the presence of paclitaxel (taxol), which is widely used for cancer chemotherapy treatment around the world [22]. *Taxus wallichiana* populations are overexploited by locals throughout the Himalayan range [23]. IUCN classified it as a rare species in 2006 [24], and it is also included in Appendix II of CITES [22]. The International Union for Conservation of Nature has designated this species as endangered (EN). It has considerable conservation value as well as significant economic values, such as timber and medicine [25, 26].

Ecosystems can influence the quality of life and well-being in positive or negative ways, based on the cultural and socioeconomic setting [27, 28]. The idea of ecosystem services (ESs) has recently emerged to represent the numerous values as well as benefits that ecosystems deliver to people [29, 30]. One of the many issues that ES research encounters is the variety of interpretations of their

present classification methods, as well as inconsistencies among ideas and terminologies [31]. However, relatively few studies have focused only on comparing different interpretations of the term [32], and classified ESs depending on their benefits. However, Mea [33] classified ESs into four distinct categories: provisioning (those services that are obtained directly from ecosystems, e.g., food, materials, water, etc.), controlling (those advantages that originate from regulating the functioning of ecosystem processes, e.g., flood control, water regulation, climate regulation, purification, etc.), and sustaining (those methods that must take place for the generation of all other ES, e.g., nutrient cycling, primary production, soil formation, etc.). These various types of ESs operate to benefit mankind by providing livelihoods, managing ecological systems, and promoting overall life and well-being [34, 35]. The interconnections and interdependence of human livelihoods and ecosystems determine the ESs required for human survival [36, 37]. It is thus impossible to separate the human advantages from ESs [38].

Anthropogenic disturbances are leading to increased extinction rates and the loss of biological diversity at all levels, including species, ecosystems, and genetics. Human demands are rapidly increasing, resulting in an unparalleled loss of genes, species, and the environment. Conservation biologists are increasingly concerned with the conservation of wild species. Biologically, conserving and managing endemic, endangered, rare, and threatened species is a top priority [24]. In recent decades, ecologists and environmentalists have made significant studies focused on evaluating the co-dominance of plant species and their relationship with both abiotic and biotic variables under growing natural and anthropogenic pressures [39, 40]. Population growth has led to the exploitation of natural habitats, resulting in continued loss of biodiversity [41–43]. The global vegetation composition has been adversely impacted by a variety of anthropogenic activities, including livestock grazing, tourism, agricultural expansion, and so forth. These activities have also led to the introduction or spread of invasive species [44–46].

Meanwhile, with the loss and deterioration of ecosystem services, there is growing interest in exploring ecosystem-based methods that might contribute to the shared benefits of adaptation and mitigation of climate change [47]. The idea of ecosystem services can be used to more efficiently integrate the numerous parts of natural and social systems, as it represents the relationship between humans

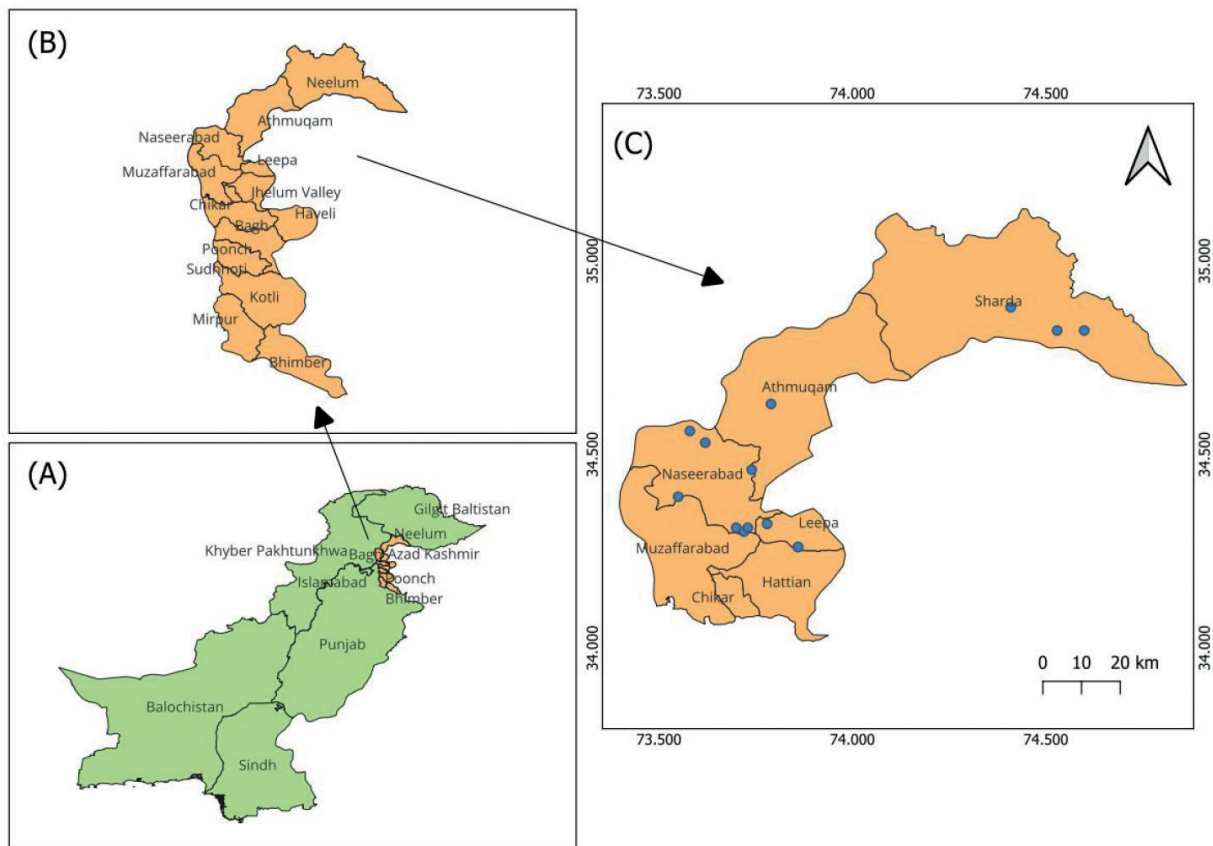


Fig. 1. Study area map: A represents Pakistan, B represents AJK, and C represents Division Muzaffarabad.

and nature. Several ecosystem service frameworks are currently available for evaluating vulnerability; these frameworks primarily analyze ecosystem service elements and processes that are associated with social outcomes directly, such as GDP outputs [48–51]. Globally, 2.8 billion people, the world's poorest and most marginalized rural populations, use biomass to cover their daily home energy needs [52]. Biomass extraction may additionally threaten forests' potential to provide a healthy environment for people by contributing to global forest deforestation, degradation, and climate change [53, 54]. The Western Himalayan region has high fuelwood demand, which has resulted in the significant degradation of forest resources near settlements [55]. Fuel, forage, lumber, and other natural resources are becoming increasingly scarce in the region as the population grows [56]. In order to meet future demand, fuelwood production and sustainable use have drawn a lot of attention. For fuelwood utilization to be sustainable, it is critical to comprehend the factors influencing the patterns of fuelwood consumption. Due to regional geographical and metrological peculiarities as well as socioeconomic household variables like size and wealth, data on fuelwood consumption is insufficient [57]. Fuelwood collection, especially in western Himalayas in an unsustainable manner, has drastically reduced the population of woody

species and prevented the production of biomass for bioenergy in a sustainable manner [58].

Many studies have already been done on the Himalayan Yew in terms of diversity, distribution, associated flora, habitat geography, and GIS-based investigations, but there is a lack of study on the ecosystem services of *Taxus wallichiana* from the Kashmir Himalayas [11, 19, 59–62]. To fill this gap, this is the first attempt to thoroughly investigate the ecological services and anthropogenic pressure on endangered populations of *Taxus wallichiana* from the Himalayan Region of Kashmir. The primary objective of the current study is to investigate ecosystem services, anthropogenic pressure on endangered populations of *Taxus wallichiana* among rural communities in Kashmir, and implications for sustainable management.

Materials and Methods

Study Area

The study area is located in the western Himalayan region of Kashmir, spread between longitudes 73° and 74° north and 33° and 36° east (Fig. 1). The landscape of the study area is hilly and rugged, with deep valleys carved out

by numerous streams and rivers and mountainous slopes covered with forests. Kashmir is a hotspot for regional biodiversity that supports a wide range of climatic conditions and ecosystems because of its enamored elevation gradient [8, 16, 63, 64].

Data Collection

Site Selection and Description

14 sites were chosen based on the accessibility and residents' willingness to participate in interviews (Table 1). Earlier discussions with our local representation team members were made to ensure an appropriate representation of the ecological services. All fieldwork was taken out between June and September 2023. The interviews were primarily above the age of 35 and comprised both male and female household members. The survey and participatory rural appraisal were used to collect data on the social structure and the use of wood for fuel and construction. We also documented community members' perspectives on key risks, anthropogenic pressure, and their implications. Plant specimens were collected, identified, and preserved in the Herbarium of Pakistan Quaid-i-Azam University, Islamabad with Voucher number ISL-133809.

Focus Group Discussion

One focus group discussion was held in each of the six communities to identify how ESs are used at the level of households in the study area. Following a description of the study's theme and objectives, participants were asked to list the ESs in the study region. The questions and responses were given verbally, with facilitators utilizing local vernacular to the greatest extent possible to ensure everyone involved understood what was stated. Each focused group discussion lasted no longer than two hours and was handled by a study member of the team, who was from the area and proficient in the local language. The facilitator of the group made sure that all participants participated in the conversation to support the group's perspective [65].

Ecosystem Services Assessment

Fuelwood collection and consumption patterns are influenced by the climatic conditions, availability of resources, and cooking techniques and are thus likely to differ among valleys. A total of 14 sites were selected from 3 districts for the assessment of taxus forest ecosystem services (Table 1). Each household's head member was chosen for an interview, during which they were questioned about the size of the family, the resources available for fuelwood, how fuelwood is collected and used, and other pertinent topics by following the method of Rawat et al.

[66]. In accordance with Negi and Maikhuri [67], data on fuelwood consumption and collection were gathered based on family size and subsequently converted into per capita fuelwood usage. A well-designed questionnaire was used for individual interviews regarding fuelwood collection and consumption patterns. A weight survey approach was used to measure the amount of fuelwood consumed during a 24-hour period [68]. The ethnobotanical data of *T. wallichiana* was collected using the questionnaire method. A semi-structured questionnaire was used to collect the data from the rural communities of Kashmir by following the method of Gillani et al. [8].

Disturbance Indicators

Anthropogenic perturbations to the forest structure and *T. wallichiana* populations were explored. The number of yew stumps at each sampling site was used to quantify the degree of deforestation. Grazing intensity was measured using visible indications, such as trampling, hoof markings, and trails [1]. Additionally, a semi-quantitative scale was used to assess the level of anthropogenic disturbance (grazing intensity, and fire) at each sampling site (Table 1). Based on visual assessment at each sampling site, anthropogenic disturbance levels were assessed on a four-point scale (1 = low, 2 = moderate, and 3 = high).

Results

Forest ecosystems are the main source of sustenance for the local population's agricultural and fundamental needs. Cattle, goats, and sheep all enjoy consuming the Himalayan yew tree leaves. Furthermore, Himalayan yew wood is noted for its resilience and attractive color, making it a popular choice for architectural components such as eaves, roofing, and furniture. This application substantially covers the minimum requirement for firewood, which is used for both heating and cooking. However, the frequent harvesting of Himalayan yew bark by local residents for its therapeutic properties has resulted in an enormous decline in its population and viability.

Demography of the Informants

The demographic features of participants were documented during group discussions and personal interviews. The interviews included 106 informants, of whom 19 women and 87 men took part (Fig. 2). The majority of informants (82.07%) were male due to restrictions on women's interactions with strangers in the study area. Women are often restricted from attending markets, cities, or ceremonial sites, resulting in a lower level of female involvement in the current study. According to this current study, those who are older have a better understanding of the ecological services of plants. Those with excellent educational backgrounds are generally

Table 1. Study sites, fuelwood consumption (Kg/capita/day), deforestation, grazing intensity, and Agricultural Expansion in *Taxus* forests.

Site Name	Altitude (m)	Latitude	Longitude	Stay Duration	Number of households	Population	Family size	Fuelwood consumption	Grazing	Deforestation	Extraction of NTFPs	Fire	Agricultural Expansion
Peerchenasi	2626	34°23'27.15"N	73°33'13.79"E	4.5	21	146	6.95	1.58	2	84	2	3	2
Japsar	2445	34°33'51.29"N	73°34'48.29"E	4	13	86	6.62	1.36	2	61	2	2	2
Panjor Gali	2580	34°31'53.47"N	73°37'24.40"E	12	30	216	7.20	1.67	2	72	2	2	2
Boojni Wala	2495	34°17'44.90"N	73°43'7.47"E	5	4	17	4.25	3.76	3	95	2	2	1
Nogazian	2186	34°18'32.05"N	73°42'8.14"E	5	35	240	6.86	2.04	1	46	1	1	2
Khoajy Tarar	2412	34°18'19.86"N	73°43'46.55"E	5.5	31	290	9.35	2.89	3	164	3	2	3
Gydran Behk	2403	34°19'9.45"N	73°46'31.91"E	4.5	9	52	5.78	2.94	2	131	2	1	2
Brithwar 1	2574	34°15'45.47"N	73°51'26.83"E	4	16	73	4.56	3.51	2	115	3	1	1
Brithwar 2	2693	34°15'22.17"N	73°51'41.07"E	4.5	27	225	8.33	2.52	3	146	2	2	2
Leswa	2576	34°27'35.51"N	73°44'34.59"E	12	36	304	8.44	1.78	3	87	2	1	3
Kuiton Naar	2717	34°37'46.87"N	73°47'17.39"E	5	18	103	5.72	2.97	2	124	2	1	2
Kala Ban	2863	34°49'6.72"N	74°36'14.95"E	5	21	88	4.19	5.25	3	143	3	1	2
Shounthar	2762	34°52'33.51"N	74°24'23.79"E	12	42	337	8.02	1.99	2	84	2	1	3
Janwai	2879	34°48'55.58"N	74°31'44.22"E	4.5	15	69	4.60	4.35	2	114	2	1	2



Fig. 2. (a) *T. wallichiana* in natural habitat; (b) Fruit; (c) Bark; (d) Herbarium specimen; (e) Principal author: Syed Waseem Gillani is collecting the bark for herbal tea; (f) Interactions with local inhabitants; (g) Homogenizer made from the wood of *T. wallichiana*; and (h) Deforestation in the study area.

unaware of the cultural norms and local ecological services provided by plants (Table 2).

Medicinal

The bark is used as a substitute for tea during the winter to feel warm. Tea from *Taxus* bark is also believed to increase vitality and cure other health-related problems. The bark is also considered an anti-cancerous agent among the locals.

Herbal Tea

The bark of the *T. wallichiana* is used to make herbal tea. Indigenous people take the bark from this tree and boil it in water for 20–30 minutes before adding sugar and milk and boiling for another 5–10 minutes to make herbal tea.

Cultural Uses

The bark of *T. wallichiana* is used for the preparation of homogenizers among the local inhabitants of the Himalayan region of Kashmir. This has been a cultural practice among the locals for decades, but over time, the trend of this practice is declining day by day because of the low interest of younger generations in such practices (Fig. 2).

Fuelwood Consumption

The highest value of daily fuel wood consumption per capita was 5.25 kg at Kala Ban, whereas the lowest value of daily fuel wood consumption per capita was 1.36 kg at Japsar (Table 1). Rural communities mostly rely on *T. wallichiana* wood as a source of fuelwood for cooking and heating their homes because upper temperate zones are dominated by mostly coniferous trees like *T. wallichiana* forests and other tree species like *Pinus wallichiana*, *Picea smithiana*, and *Abies pindrow*. Some other trees and shrubs are also used as fuel, like *Juglans regia*, *Aesculus indica*, *Quercus semecarpifolia*, *Viburnum grandiflorum*, and *Paratiopsis Jacquemontii*. The linear correlation analysis revealed that fuelwood consumption values increase along the altitude of the study area (Fig. 3). This relationship showed the dependency level of the rural population on *T. wallichiana* as fuelwood due to harsh environmental conditions. As the altitude increased, the rural population used more fuelwood for heating to sustain their lives in harsh environmental conditions (Fig. 3, 4). One of the important points in terms of fuelwood consumption of *T. wallichiana* is that the wood of this species takes more time to burn, so a small quantity of wood of this species produces more heat and is longer lasting as compared to some other species. The local inhabitants of the study area like to burn the wood of *T. wallichiana* and *Quercus* species as compared to other species. So there's huge anthropogenic pressure on the endangered populations of *T. wallichiana*.

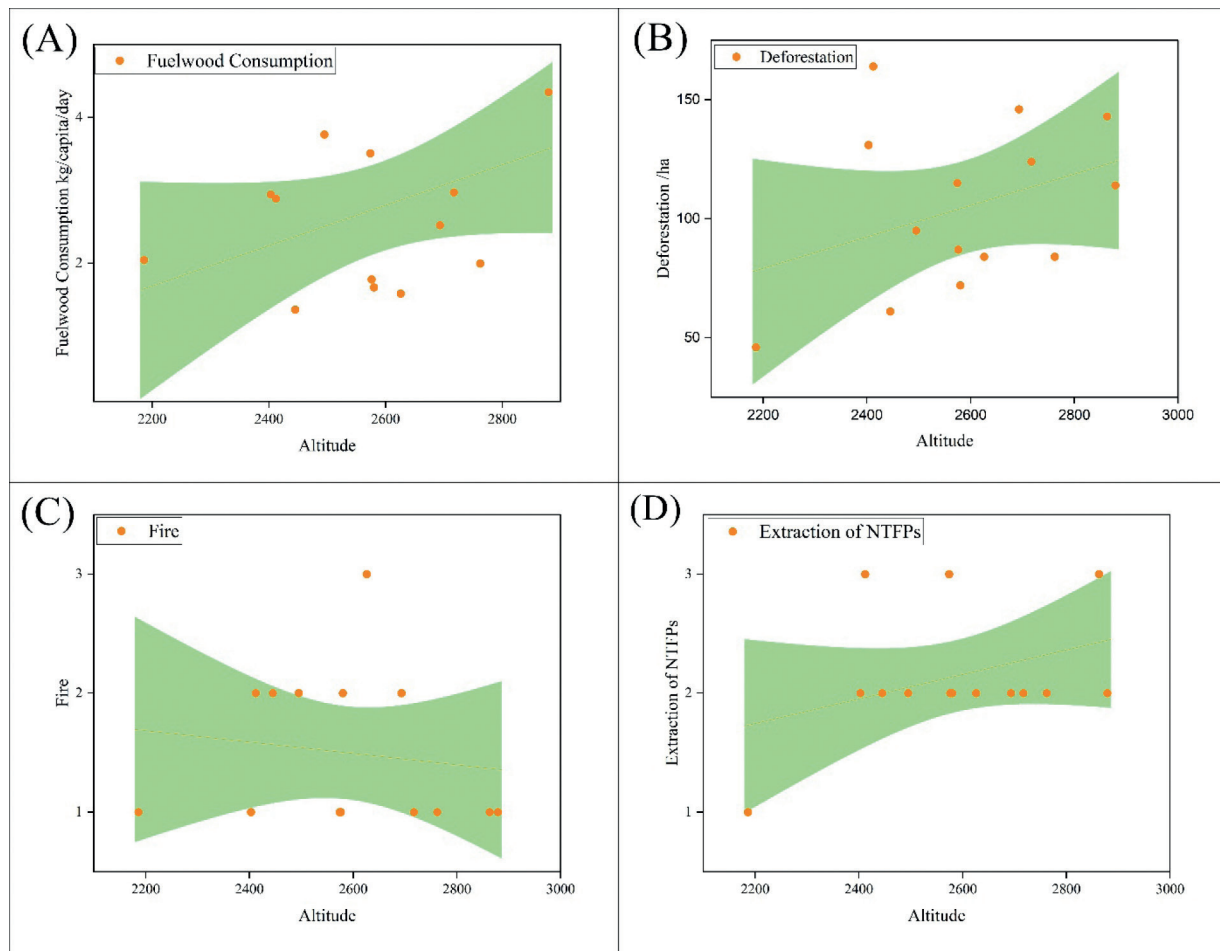


Fig. 3. Linear regression analysis between altitude and different aspects.

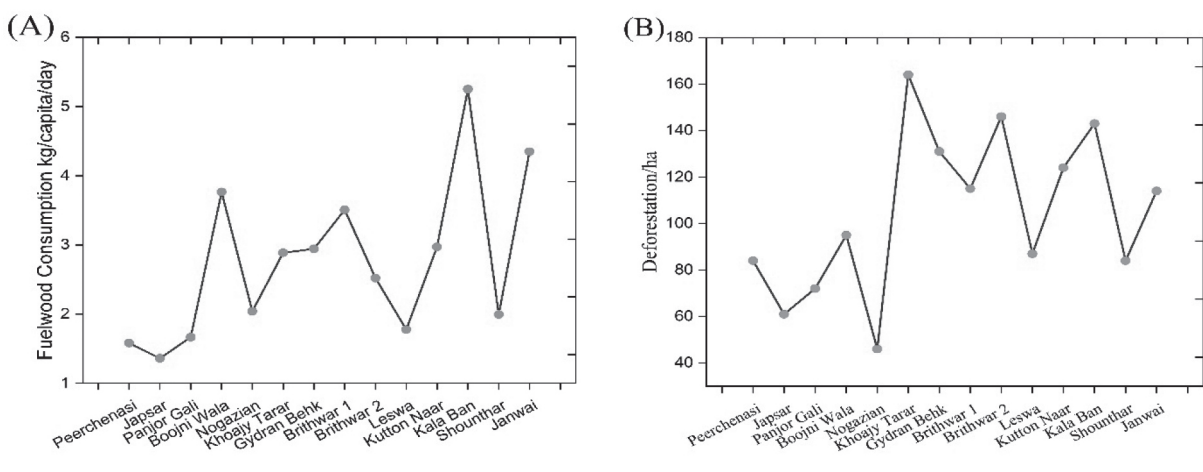


Fig. 4. Graph representing the fuelwood consumption and deforestation patterns in the studied sites.

Bedding

Branches are used as bedding for humans as well as for animals in mountainous areas and summer pastures among the indigenous communities of Kashmir Himalaya. Leaves and branches are also used to make soft beds (locally known as Danga).

Household Tools

Wood is used to make wooden utensils and wooden tubs, used as troughs for pet animals.

Table 2. Demographic information of the local inhabitants.

Demographic Features	Number of Interviewed Persons	Percentage
Gender		
Male	87	82.07
Female	19	17.92
Informant category		
Indigenous people	98	92.45
Hakims	08	7.54
Age of informants		
20–35 years	11	10.37
36–50 years	29	27.35
51–65 years	43	40.56
66 and above	23	21.69
Educational background		
Illiterate	56	52.83
Elementary school level	25	23.58
Secondary school level	12	11.32
High school level	08	7.54
Higher education	05	4.71

Fodder

Young branches are used for fodder, and yew leaves are supposed to benefit the local animals' health.

Timber

Particularly in temperate-alpine regions, pillars, and beams are the most often used as yew wood for building homes.

Some Major Threats

A major threat to our forest resources is being created by human interference, which is causing habitat loss and a decrease in biodiversity in the studied area. It is happening at a rate never seen before as a result of the growing demand for natural resources brought on by human needs.

The primary source of the extreme pressure on *T. wallichiana*'s habitat is human activity, and overexploitation of the plant's parts is causing the species' natural numbers to decline. The increasing number of people and their need for local farming, coupled with the expansion of animal husbandry practices, unsustainable commercial extraction, development projects, and other factors, have all contributed to the stress on the habitat and regeneration of this economically significant plant species. However,

indigenous tribes' frequent collection of Himalayan yew bark for medicinal purposes has significantly reduced the species' growth and survival rates. The bark is traditionally utilized in local remedies to treat a range of health issues, putting further strain on the species' survival. As a result, the natural population of this species has decreased and faces a serious threat of extinction. *T. wallichiana*, known for its cancer-fighting properties, has been listed as endangered due to over-harvesting of its leaves, bark, and whole trees. The species faces severe risks since its wood is also exploited for fuel, construction, fencing, agricultural expansion, climate change, and other uses, putting pressure on its native ecosystem. The decreasing population of *T. wallichiana* is a major problem caused by the overuse for timber, and medicinal, furniture, and cultural purposes by the local inhabitants of the rural areas of the Kashmir Himalayas (Table. 1).

Discussion

The Himalayan ecosystems' forests are thought to be the reservoir of biodiversity. In addition, they serve as carbon sinks and offer protection against flooding and soil erosion in low-lying areas [8, 69, 70]. However, the ecosystems of forests are declining [71]. According to the United Nations Environment Program's Millennium Ecosystem Assessment Report, almost 60% of ecosystem services that sustain life are being degraded or used up more quickly than they can be regenerated [72]. The ecosystem

of the Himalayan Forest is particularly vulnerable to human activities, such as urbanization, industrialization, and so forth. These activities can have serious repercussions, such as the degradation of forest land, changes in climate, and the loss of forest cover. Eventually, these problems can lead to major problems like soil erosion, a reduction in soil fertility, slope failures, a decrease in fuelwood and fodder, a decrease in groundwater recharge, increased overland flows, and siltation of riverbeds in the lowland areas [58, 73–77]. Deforestation, degraded soil, and habitat fragmentation induced by anthropogenic disturbances in the Himalayan Forest ecosystem have resulted in uncontrollable weed flora proliferation in this region [1, 74]. Another issue with the lack of manure and animal bedding is forest fires in the Himalayan biodiversity. The quality of maintaining land has decreased as a result of disintegration and lack of consideration for the common people [5, 78–80]. In order to prevent environmental degradation in favor of economic expansion and development, common policies and legislation for the preservation of natural resources such as forests, biodiversity, water, organic food, and ecotourism should be promoted.

The severe impact on the quantity of seedlings may be explained by the intense anthropogenic and grazing load in the study area [81]. *P. wallichiana* needs a lot of sunlight to flourish, as supported by previous studies [11, 25]. The highest value of daily fuel wood consumption per capita was 5.25 kg, whereas the lowest value of daily fuel wood consumption per capita was 1.36 kg. One of the important points in terms of fuelwood consumption of *T. wallichiana* is that the wood of this species takes more time to consume itself, so a small quantity of wood of this species produces more heat and is longer lasting as compared to some other species. Our current results are comparable with previous studies [55, 82]. The amount of firewood consumed varies with family size; larger households use more firewood. So, the highest fuel wood consumption was observed among the larger family households as compared to the families with a smaller number of people. This phenomenon is also noted by Shaheen et al. [55]. The bark of the *T. wallichiana* is used to make herbal tea among the indigenous communities of the Kashmir Himalayas. *T. wallichiana*, known for its cancer-fighting properties, has been listed as endangered because of over-harvesting of its leaves, bark, and whole trees. The current study findings are supported by some other studies in the same area by some other researchers as well [8, 11, 16, 63]. *T. wallichiana* grows relatively slowly, and its low seed yield and production rate are the main causes of its poor natural regeneration. The species' relative intolerance of fire contributes to the effects of exploitation and habitat deterioration.

T. wallichiana habitat decline is caused by home encroachment on forest areas for agricultural production, such as tea and pepper cultivation. Sanctions to combat unlawful extraction are inadequate to protect this endangered, valuable, and rare plant species from habitat loss. There is an increasing demand for wood, fuel, and medicinal purposes; illegal cutting and smuggling of trees, as well as conversion of forests for farmland,

lead to habitat loss and environmental degradation [9, 11, 23, 56, 60, 83, 84]. Yousaf et al. [85] also stated that habitat degradation caused by human activities reduced the occurrence of *T. wallichiana* and hampered species restoration. Other risks include medical exploitation, such as taxol extraction, fuelwood harvesting, timber for roofing materials, and climate change. The main cause of poor regeneration, especially at lower elevations, is herbivores trampling on the bark and leaves of trees that the locals excessively exploit for medicinal purposes. Apart from human causes, natural forces also exert a considerable influence on the growth and development of regenerated plants. Therefore, it is crucial to develop and implement laws, regulations, and appropriate management in order to safeguard and enhance this plant species [26, 61, 62, 85]. *T. wallichiana* populations' habitats will alter dramatically in the future as a result of human activity and climate change. As a result, this species has difficulty spreading and regenerating organically. It has been categorized as an endangered species due to trade, habitat loss, and degradation [11, 81, 86–89]. The *T. wallichiana* population declined mostly as a result of unsustainable extraction, illegal harvesting, cutting, and seedlings being exposed to direct sunlight, which negatively impacts their ability to grow and survive, as well as a lack of awareness and understanding of sustainable management techniques. The Himalayan yew tree produces durable, gorgeously colored wood. It is therefore frequently used as a building material for furniture, roofing, and eaves. The study's interview subjects likewise believed that this use played a significant role in the species' rapid decline and was also inconsistent with the previous finding [13]. The results of this study showed that agricultural land expansion from upper temperate to alpine regions, particularly in the summer pastures, is a major contributing factor to the reduction of Himalayan yew. The slow-growing seeds cannot naturally flourish in regions cleared for agriculture when people produce crops and build homes in areas of the forests that once supported them. The main issues facing this species have been determined to be its poor regeneration and the decline of older populations in its native habitat. Numerous studies have determined that one of the primary causes of this species' extinction is the expansion of agricultural land inside forests [90–100].

The habitat of the Himalayan yew has been degrading at an alarming rate due to overexploitation, which has resulted from the plant's many beneficial uses. Effective conservation and effective management techniques have not yet been the subject of any ecological research on *T. wallichiana* in the Kashmir Himalayan region. Proper conservation measures, such as in-depth research, species-specific initiatives, site- and habitat-based actions, policymaking, communication, and education, can limit the loss of a species. The main objectives of any conservation effort should be to identify, record, and explore the species' ecological significance. Protected area networks can be used to restore habitats and ecosystems in situ or ex situ while including the local population. By creating parks, reserve forests, sanctuaries, and other areas, in situ conservation

can be practiced for the conservation of *T. wallichiana* in their natural habitats. Only with strong habitat protection and well-supported species conservation efforts will these species be able to survive climate change.

Conclusions

Taxus wallichiana has enormous ecological and societal significance, as evidenced by a diverse range of ecosystem services and products in the Kashmir western Himalayan region. The current study provides insightful information on the ecosystem services and anthropogenic disturbances that affect the *T. wallichiana* forest. Ethnobotanically, *T. wallichiana* is an important species. The bark is used as a substitute for tea during the winter to feel warm. The bark is also considered an anti-cancerous agent among the locals. The highest value of daily fuelwood consumption per capita was 5.25 kg at Kala Ban, whereas the lowest value of daily fuelwood consumption per capita was 1.36 kg at Japsar. The species faces severe risks since its wood is also exploited for fuel, construction, fencing, agricultural expansion, climate change, and other uses, putting pressure on its native ecosystem. The decreasing population of *T. wallichiana* is a major problem due to overuse for timber, medicinal, furniture, and cultural purposes by the local inhabitants of the rural areas of the Kashmir Himalayas. Ecosystem services should therefore be protected and conserved by implementing important integrated management and conservation techniques that incorporate the concepts of value addition, evaluation, and compensation for ESs. Understanding the value and interactions between forest ecosystem services on a regional, national, and international scale is always crucial. We suggest proper conservation measures, such as in-depth research, species-specific initiatives, site- and habitat-based actions, policymaking, communication, and education, which can limit the loss of *T. wallichiana* forest.

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Ethical Approval and Consent To Participate

All the experiments were performed in accordance with relevant guidelines and regulations.

Author Contributions

Syed Waseem Gillani: Field Collection, Writing-Original draft preparation, Mushtaq Ahmad, Muhammad Zafar: Supervision and Review Editing, Muhammad Manzoor: Statistical analysis, Syed Waseem Gillani: Field Collection, Methodology and Data analysis, Investigation, Hamayun Shaheen, Muhammad Manzoor, Naveed Abbas: Interpretation of Results, Dunia A Al Farraj, Mohamed S Elshikh: Funding acquisition & data curation.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

All the data has been presented in this article.

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