

## Article

# Assessing Ecotourism Potential of Traditional Wooden Architecture in Rural Areas: The Case of Papart Valley

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**Abstract:** The aim of this study is to reveal the resource values that the rural areas host, and with a very disciplined approach, to discuss opportunities to benefit from those values in terms of ecotourism practices specific to Papart Valley. As a first step in this study, we took an inventory of natural and cultural assets of Papart Valley in Eastern Black Sea Region, Artvin province. Then, a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was conducted with the participation of all stakeholders and the current situation was analyzed in terms of ecotourism practices. In light of SWOT results, along with observed natural resource assets in the region, the traditional wooden houses were seen to have potential in terms of ecotourism and it was detected that there were a large number of wooden homes and home plans suitable for both the settlement of the local people and accommodation of guests. On the other hand, it was determined that there was a lack of information for sufficient protection and care of wooden houses, and despite their potential, there was a lack of regulations and positive attitudes towards accommodation businesses in traditional wooden houses. In order to eliminate these deficiencies, proposals for the protection of traditional building stock were developed, by first determining the causes of material degradation in the wooden houses. Also, to emphasize the worth and importance of these structures, dendrochronology studies were conducted in order to determine the antiquity of the structures and potentially to make them more attractive for eco-tourism.

**Keywords:** rural areas; ecotourism; traditional wooden architecture; wood protection; dendrochronology

## 1. Introduction

Ecotourism, as a sustainable form of tourism, is experiencing a trend of rapid growth in the tourism industry [1–5]. Ecotourism is expressed as a sustainable tourism format where natural and cultural assets are conserved; where environmental impact is minimized, which proposes the participation of stakeholders; where the local culture is respected; and where the locals are provided with socio-economic benefits, which features educational characteristics in terms of environment and culture [6–9]. Rural areas that contain a combination of natural and cultural resource assets are often preferred for the ecotourism practices. These areas attract great attention as ecotourism destinations and are visited by ecotourists [10,11]. In this context, identifying, maintaining and sustaining the

specific values (special characteristics) in rural areas are of importance in terms of the continuity of ecotourism activities.

Turkey is a rich country with respect to the rural areas that may be subject to ecotourism activities. In particular, the Eastern Black Sea region offers a rich diversity of natural and cultural resources which are tied to diverse climatic conditions and terrains. The diversity of natural resources of the region has also shaped people's lifestyles and their production. One of the most important manifestations of this context is the traditional wooden architecture in the region. As wood materials get different interpretations in the hands of different masters, communities attain unique traditional wooden architectures. Moreover, traditional architecture, with its symbolic value and rich artistic embellishments, is one of the measures of the quality of the craftsmanship that exists within a society [12]. In this sense, locals and artisans in the region have built houses that are highly compatible with the difficult geographical conditions, as well as wooden architectures by elaborating them with their own skills and knowledge. Also, fully created by local resources, from building materials to the work force, this original texture creates an ecologically important value [13].

Modernity, changing living conditions and a sense of convenience result in local people abandoning traditional building techniques, building annexes to the traditional structures or demolishing the traditional structures. Especially in city and town centers, it is observed that traditional wood structures have been replaced by modern buildings. In newly built buildings, cheaper and easily accessible modern materials are used instead of local materials and so the traditional texture is gradually deteriorated. These factors affect the orientation of modern builders who produce the architecture in the region today with new techniques, thus challenging the continuity of more historic construction techniques [14]. However, in remote rural areas, there are still traditional wooden buildings that showcase the cultural history of the local people. Nevertheless, for reasons such as safety, comfort, domestic inheritance problems, lack of knowledge and skills in wood care and protection, etc. the protection of traditional wooden structures and their sustainability are at risk [15]. In order to ensure the transfer of traditional wooden houses as cultural assets to the next generations, a set of measures must be taken and new approaches developed. Some of these measures include maintenance, repair and conservation efforts.

In addition, so as to conserve the traditional wooden houses for the future, there is a need for new approaches or methods to facilitate comprehension of the value and importance these houses have by all interest groups. One of these methods is to determine historical values of the houses in question and to investigate ways to benefit from this determination. Dendrochronology, which is defined as the science of determining the age based on the annual rings of trees, allows the dating of wooden buildings or buildings in which wood material is used for its construction [16]. Construction and/or restoration dates of a lot of historic buildings in Turkey are determined using the annual rings of trees [17–24]. Historical values contribute to the works of art history, architecture and archeology.

In this study, the primary inventory of natural and cultural attractions of Papart Valley, located in the Eastern Black Sea Region, has been demonstrated with field work and literature. In order to reveal the current situation of the region, which is rich in resource values and in terms of ecotourism, a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was carried out with the participation of all interest groups. In light of the inventory of natural resource assets and SWOT analysis results, as one of the outstanding values, it was found that great value was attributed to the traditional wooden houses. Therefore, a traditional wooden house and its hayloft in the region were selected as samples and therefore recommendations for their maintenance, repair and protection were developed by determining the causes of degradation of the material in those structures. However, so as to determine the importance of the houses in question as a cultural resource and to facilitate a benefit from that value in the form of ecotourism, dendrochronology studies were conducted and historical values of the selected houses and haylofts were determined.

## 2. Study Area

Papart Valley, dealt with in this study, is located in the Şavşat district of Artvin, in the northeast corner of Turkey which borders Georgia. Giving the valley its name, Papart Creek originates in Büyükmera Mountain on the Georgia border and flows northwest from the southeast from Hasta to the Sarıçayır Mountains. In the southern shadow of Mount Büyükmera is Camili region, which was declared to be a biosphere reserve in 2005 by The United Nations Education, Scientific, and Cultural Organization (UNESCO). The eastern slope of Mount Büyükmera, which faces Papart Valley, is covered in Papart Forests, which were declared as a seed stand area by the Ministry of Forestry and Water Affairs. Neighbourhoods and villages located in Papart Valley cluster along the Papart Stream. On the ridges of the surrounding mountains are hamlets and uplands managed by the villagers. The north slope of the Sarıçay Mountains lies in Georgia (Figure 1).



**Figure 1.** The study area, Papart Valley.

Four villages in Papart Valley—Balıklı, Meydancık, Taşköprü and Mısırlı—could be thought of as a destination point for ecotourism activities due to transportation convenience. Transportation can only be provided by land. The destination area, bordered by mountains to the south and north, is about 78 km away from Artvin and 40 km from Şavşat. Traditional houses located in the gardens and haylofts, which spread to almost every point of the settlement, constitute a sporadic configuration [25]. A large part of the town was registered as an urban and natural protected area in 2010 as a result of the application of some people and organizations.

The population in the area is engaged in agriculture and animal husbandry. Being obtained through deforestation, agricultural lands are steep and unproductive. The majority of the working age population are working abroad. There are a number of people involved in beekeeping and forest labour. People living in the region utilize forests for forest products and services, such as grazing.

## 3. Materials and Methods

### 3.1. Determination of Ecotourism Resource Values

Resource assets for ecotourism activities are divided into two types: natural and cultural. Natural resources can be subdivided as follows; topography (mountains, canyons, beaches, caves, volcanoes, fossil areas), climate (temperature, rainfall, sunlight), hydrology (lakes, rivers, waterfalls, hot springs), wildlife (mammals, birds, insects), vegetation (forests, pastures), and location (centrality, remoteness). Cultural resources include location (prehistoric ruins, historical sites), events (exhibitions, fairs, folk ceremonies), handicrafts or gastronomy (embroidery, lace, jewellery, food, beverage) and more [26].

Although it is not expected that all of the above mentioned resources are to be available in all ecotourism areas, it is important to determine which resources are present in order to ensure the sustainability of those assets.

“Ecotourism Status Assessment Form (ESA)” was used (e.g., [27,28]) to determine the ecotourism resource values and ecotourism infrastructure of the study area. By completing an ESA form, an inventory of the above mentioned natural and cultural resource assets is generated. The form is completed by conducting face to face discussions with stakeholders involved in the study area; especially local agriculturalists, foresters, ecotourists, local representatives, etc. The resulting findings are supplemented with forest management plans, maps, tourism master plans of the research area and by the findings of other published scientific studies related to the topic.

### 3.2. Application of SWOT Analysis

A SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is a commonly used tool for analyzing internal and external environments in order to attain a systematic approach and support for a decision [29]. The aim of a SWOT analysis is to take internal and external factors into account, and to then develop plans and strategies to minimize the impact of Weaknesses and Threats and amplify the benefits from existing Strengths and Opportunities [30]. In this study, after determining Papart Valley’s natural and cultural resource values, a SWOT technique was conducted with the participation of all stakeholders in order to demonstrate the sustainable use of these resources in terms of ecotourism activities (e.g., [31,32]).

### 3.3. Investigation of Damage in Wooden Buildings

To evaluate the material damage of the selected house and hayloft in the region (Figure 2), a visual (macroscopic) inspection method was used. This involves making simple interventions using a hammer and a pointed opener to inspect for damage to the wood surface and interior. Rotten parts caused by fungal activity, and possible sources for moisture (i.e., roof, floor, and plumbing condition) were investigated. Flight holes, tunnels resulted from wear, and sawdust-like frass were sought in order to determine the presenece of pest damage. Finally, whether the identified pest activity was presently occurring was determined. In addition to those macroscopic evaluations; microscopic examinations for destruction were carried out using the samples taken for dendrochronological analysis.



**Figure 2.** The traditional wooden house (A) and the hayloft (B), which were selected for damage investigation and dendrochronological dating.

### 3.4. Dating of the Wooden House Using Dendrochroacheological Methods

In order to identify the construction year of the wooden house and its hayloft, we took ten cross-sections, six from the house and four from the hayloft. First, we determined the tree taxa of each



sample by observing microscopic features of woods. This step is important for master chronology selection to compare undated chronologies.

The following steps were applied to date wood samples: (1) Cross sections were fine-sanded and measured to the nearest 0.01 mm using a LINTAB-TsapWin measuring system (Rinntech, Germany); (2) Relative placements of each undated series were found by dating against all of the others (for the house and for the hayloft separately) using a TsapWin program. Relative placements of the series were tested using the COFECHA program [33,34]; (3) Each ring width series was standardized by means of a negative exponential or linear regression [16,35]. We built two separate floating tree-ring chronologies for the house (from six samples) and the hayloft (from four samples) by combining standardized series into single average chronologies. These analyses were performed using the ARSTAN program [36,37]; (4) Geographically, the closest chronologies from the same species were used as a master chronology to date samples. To date floating house and hayloft chronologies, we compared visually with the selected master chronologies. Dating was verified by a statistically significant coefficient of agreement (Gleichläufigkeit -GLK) value [38], and TBP (the t-value adapted to time-series by Baillie and Pilcher [39]) values.

## 4. Results

### 4.1. Ecotourism Resource Values of Papart Valley

Significant natural resource values of Papart Valley, in terms of ecotourism and its cultural resources, are shown in Tables 1 and 2. With this study, the natural resource values determined for Papart Valley show that the region has significant potential for ecotourism (Table 1). The region, with its aged woods and wealth of flora and wildlife, exhibits a rich biodiversity. While the springs in the region shape biodiversity, they also offer options for ecotourism activities. Interesting geological formations, plateaus and watch hills are considered to be other spots where eco-tourists could be alone with nature.

**Table 1.** Natural resource values in terms of ecotourism.

Resource Values	Explanations
Flora	Principal tree species in the forest are fir (80%) and spruce (15%) (Figure 3A). Additionally, beech, hornbeam, birch, aspen, wild cherry and cranberry partly are present. Wild strawberry, blackberry, arbutus, bearberry, raspberry, thyme, blueberries and a few rhododendrons are seen.
Fauna	The region is important in terms of its population of Wild Goat ( <i>Capra aegagrus</i> ), Hook-Horned Mountain Goat ( <i>Rupicapra rupicapra</i> ), Brown Bear ( <i>Ursus arctus</i> ), Caspian Snowcock ( <i>Tetraogallus caspius</i> ), and Grouse ( <i>Tetrao mlkosiewicz</i> ). In addition, there are lynxes ( <i>Lynx lynx</i> ). Streams here host a notable brown trout population [40].
Panoramic points	Views of settlements and wild terrain can be enjoyed from the points such as Vela Hill, Autket Ridge of Erikli Plateau, Hasta Ridge (above the Satave Festival Site); Sakart Straight, and Kayabaşı Position.
Rivers, waterfalls, streams	The most important running water of the region is the Papart Stream, a tributary of the river. The stream is fed by Merate Creek, Creek Kamali, Vahat Creek, Azel Creek, Sabzalet Creek, Sariçay Creek, Belkeda Creek and Kalahir Creek. There are some waterfalls in Taşköy Village and Papart forests.
Protected Areas	There are Balıklı and Çağlayan Creeks, wildlife protection areas and seed stands.
Geological formations of interest	In Kakebe, there is a stone which looks like a carved horse. At the entrance of Balıklı is Kanlıkaya Position, where those who died during road work are remembered with respect. The Erikli (Balıklı Kışlası vicinity) and Saçinka (Avazanat mevki) caves are at Erikli. At the entrance of the Balıklı settlement, there is a point, called wailing road, where expats who go abroad are seen off.

The cultural resource values of the region are also summarized in Table 2. Representing local materials and construction techniques, the local architecture, accumulated over centuries, is seen as one of the most important physical indicators which reflect the culture and lifestyle of people in the region. People who have migrated from the region come back to their traditional wooden homes especially between April and October, and spend a long period of time in the region. In the region, besides historic buildings such as castles, bridges, mosques, etc., there are man-made stone caves, called “Daran” [25] that are thought to have been used as indigenous wine production and storage sites.

The necessity to meet people’s needs from surrounding natural resources has, from past to present, improved handicrafts such as weaving and carpentry, and has led to the diversification of the region’s unique food and beverages. It was found that the need for kitchen utensils, agricultural tools, furniture and alike had been completely met with wood in the historical process; and jackets, trousers, aprons, shawls, and rugs had been produced using looms. Rug weaving, albeit rare, still continues today. Similarly, wood craftsmanship has decreased but still continues.

Highland culture and traditional transhumance activities in some villages in the region are still intact today. Highlands are where livestock are grazed in summer, and where people go and live for a certain period of the year. In spring and autumn, when the weather is colder, the herds that are taken to upland pastures at higher altitudes are brought to winter quarters at lower altitudes that are warmer and offer grazing opportunities to the animals. Some areas host festivals and events in appropriate seasons.

**Table 2.** Cultural resources values in terms of ecotourism.

Resource Values	Explanations
Traditional wooden structures	In the region there are lots of wooden structures built with traditional construction techniques, such as houses (Figure 3B,C), haylofts, mills (Figure 3E), plateau homes (Figure 3I) and winter homes. Traditional homes are located adjacent to gardens of medium and large size. Residential gardens are areas where daily activities are performed.
Historical structures	Among the well-preserved ruins in the region are Parih Castle (Figure 3K), Taş Bridge (Figure 3J), and Balıklı Mosque. Again, there are old commercial buildings in the village squares, named “Camikapı”. Taş Bridge and Karaca Bridge are among the ones that survived until today. In the region, there are man-made stone caves, called “Daran” (Figure 3D).
Handicrafts	Activities such as weaving (Figure 3H), carpentry, wood craftsmanship (Figure 3C), etc., continue to be practiced.
Local food and drinks	“Gevrek” (brittle), “bişi” (bun, a kind of sweet bread), “sinor” (thin sheet of dough with yogurt), “cadi” (unleavened bun from corn flour cooked on iron sheet), borscht, yoghurt soup, “kuruçena soup”, zincar (nettle soup), “narkopova soup”, “hallobia”, bean fries, tomato harşo (harşo = a sort of meal made from corn flour and onions), “hunkal” and one of the symbols of the region, white potato, are among the major culinary riches. The diversity and abundance of fruits in the region (mulberry, pear, apple, plum, cherry, grape, sour cherry, quince, pomegranate, medlar) create opportunities for molasses, marmalade and fruit pulp for sale to tourists. Also, cranberry, rosehip, walnut, chestnut, lime, and nuts that can be counted as non-wood forest products create great opportunities in terms of nutrition. The region is also very rich in herbaceous plants (nettles, mint, thyme, wild sage, blackberries etc.) (Figure 3F,G).
Festivals and events	In some of the highlands, 1 or 2 day events, called “Şantoba”, are held in summer. In Mount Hasta (Satave Position) a festival named “Gevrek” (brittle) Festival is held.
Transhumance	Almost every village has a plateau. Even, depending on neighbourhood groups, some of the villages have multiple highlands and areas of winter quarters. Almost all of the highlands and areas of winter quarters have uniquely beautiful views. At the same time, highlands located above the treeline, and winter quarters in the forests carry a value of cultural landscape value with the traditional wooden houses that they host (Figure 3I).



**Figure 3.** The samples of natural and cultural resource values of Papart Valley. General view (A); A traditional wooden house (B); A wooden bath hidden in the floor (C); Daran (D); A wooden mill (E); Local foods (F,G); Handicrafts (H); Plateau homes and transhumance (I); Taş bridge (J); Parih Castle (K).

#### 4.2. The Results of a SWOT Analysis

A SWOT analysis was used to analyze the current potential of the research area for ecotourism applications. A SWOT analysis, conducted in participation with interest groups, can be divided into two parts, that is, an analysis of internal and external environments. For internal environment analysis (Table 3); Strengths and Weaknesses and for external environment analysis (Table 4), Opportunities and Threats are included.



**Table 3.** Results of internal environment.

Groups	SWOT Factors
<b>Strengths</b>	<ol style="list-style-type: none"> <li>1. The region is rich in terms of natural resource assets (mountains, heights, water sources, flora, fauna, etc.). It is also a rich region with regards to cultural values (traditional wooden structures, upland culture, etc.). Different tourism alternatives (winter, summer, upland, hunting tourism) are available.</li> <li>2. Locals who, in fact, live in metropolises, spend a certain part of the year in the region.</li> <li>3. Bonds of local people with the region are high. The relation of the local people to the nature is strong.</li> <li>4. Local people are friendly and hospitable and the level of education is high.</li> <li>5. There is a food culture and fruit diversity that is unique to the region and organic agriculture is the norm.</li> <li>6. Cool summers offer unique weather conditions.</li> <li>7. There are a lot of wooden houses. House plans are convenient for both the locals to live in, and for the accommodation of visitors.</li> <li>8. The region does not pose any danger in terms of safety.</li> <li>9. The region offers tourism opportunities due to being located near the Georgian border.</li> <li>10. A certain part of the region has been declared to be an archaeological site.</li> </ol>
<b>Weaknesses</b>	<ol style="list-style-type: none"> <li>1. Infrastructure (sewers, solid waste management, means of transport, petrol stations, bank branches, health care, restaurants, etc.) are lacking, the accommodation areas (hostel, hotel, etc.) are insufficient and transport infrastructure is inadequate in winters.</li> <li>2. Despite having the potential, there is lack of regulation and positive attitudes regarding lodging in traditional wooden houses.</li> <li>3. In terms of tourism, an educated and adequate workforce is not available.</li> <li>4. The region is not sufficiently being promoted.</li> <li>5. Less job opportunities and inadequacy of local initiatives lead to the emigration of young people from the region.</li> <li>6. There is inadequate infrastructure and equipment to protect wooden houses against fire all over the region.</li> <li>7. Relevant organizations in the region do not have enough capacity in terms of mountain hiking.</li> <li>8. There is inadequate knowledge for the protection and maintenance of wooden houses in the area.</li> <li>9. Rapid increase in contemporary structures rather than the traditional architecture of the region.</li> <li>10. The absence of sufficient wood craftsmanship.</li> <li>11. Inappropriate use of lodging loans that are given for the improvement of timber structures.</li> <li>12. The decline in the population in winter adversely affects the tourism.</li> </ol>

**Table 4.** Results of external environment.

Groups	SWOT Factors
<b>Opportunities</b>	<ol style="list-style-type: none"> <li>1. The recent development of border relationships with Georgia have caused tourism to flourish.</li> <li>2. Sports and tourism related organizations have significant potential in terms of ecotourism capacity.</li> <li>3. Increased technological possibilities serve to increase the promotional activities.</li> <li>4. It is safe in terms of natural disasters (forest fires, earthquakes, floods, avalanches).</li> <li>5. Presence of people working in important positions in public institutions, municipalities and private sector.</li> <li>6. There are three airports close to the area and the initial investigation into the establishment of a fourth.</li> <li>7. Incentives to rural areas provided by the governments with the growing demand in ecotourism.</li> <li>8. The presence of cooperation opportunities in terms of non-governmental organizations.</li> </ol>
<b>Threats</b>	<ol style="list-style-type: none"> <li>1. The fact that there are numerous projects regarding to the Hydroelectric Power Stations (HPS) threatens the important natural resources in the region, the construction of HPS and structures built for power transmission cause visual pollution.</li> <li>2. The presence of so many water resources in the region attracts major companies operating in this field.</li> <li>3. Intense out-migration from the region.</li> <li>4. The increase in mining permits threatens the values of the resources.</li> <li>5. Wrong practices in forestry activities regarding the productin of raw wood material.</li> <li>6. Reduction in animal breeding for meat production due to policy influence.</li> </ol>

Referring to the first part of Table 3, the fact that the region is rich in natural resource assets (mountains, hills, lakes, flora, fauna, etc.) and cultural resource values (wooden structures, highland culture, etc.) is seen as a Strength in terms of ecotourism practices by interest groups. On the other hand, people of the region who migrated to major cities spend a certain part of the year in the region; and that is one of the signs that people's relationship with the region and nature is strong. The level of education in the region is high. Local people are friendly and hospitable. The region does not contain any safety hazards. The following are expressed as additional Strengths that make a difference in terms of ecotourism: clean, fresh, potable and high quality water resources; cooler summer period with regard to weather conditions; the possibility of implementation of different alternatives to tourism in winter and summer; rich food culture; and the presence of suitable areas for organic farming.

Also, in the second part of the Table 3, Weaknesses are included. In terms of ecotourism practices in the region, there is a lack of residential infrastructure (sewage, solid waste management, transportation



vehicles, petrol stations, banks, health care, restaurants, etc.). Fewer job opportunities cause the migration of young population from the region. The transportation infrastructure is inadequate in winter. There are inadequacies concerning the protection, restoration, and the sustainability of traditional wooden houses. When it comes to the promotion and implementation of potential for ecotourism, problems of human resources are seen.

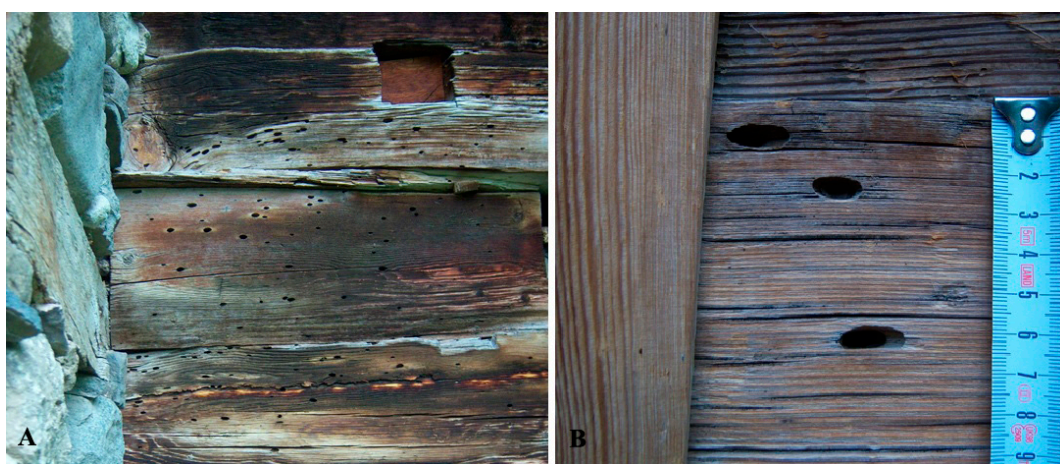
An external environment analysis of Papart Valley in terms of ecotourism is shown in Table 4. Nature tourism began to flourish depending on the development of border relations with Georgia. The cooperation of organizations relevant to sport and tourism, and increasing technological possibilities serve to the increase in promotional activities.

The region's safety in terms of natural disasters such as forest fires and earthquakes reduces the potential risks. Three airports close to the region (Trabzon, Kars, and Batumi) and the initiation of studies for the establishment of a new airport are considered to be positive in terms of accessibility. Additionally, non-governmental organizations operating in the region seem to be open to cooperation in terms of ecotourism practices.

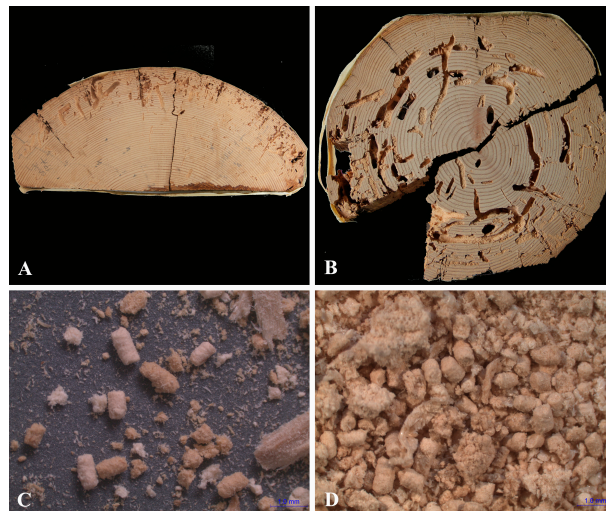
Threats that are the second element of the external analysis of Papart valley in terms of ecotourism are shown in Table 4. A great many water resources in the region are attracting major companies operating in this field. Numerous HPS projects in the region have a negative impact on important natural resources of the region. Structures built for the construction of HPS and energy transmission cause visual pollution. Additionally, the increase in mining licences threatens the resource values. Reduction in livestock management due to wrong-headed policies for meat production is a chief cause of intensive outward migration from the region.

#### 4.3. Degradation Results

It was determined that the most significant destruction to the wooden house and hayloft examined was caused by old-house borer (*Hylotrupes bajulus*) and that insect activity was not effective. In the fir and spruce, wooden building elements that were inspected showed oval flight holes of  $5 \times 9$  mm in diameter, and frass powders falling out (Figure 4). It was observed that the tunnels under the solid wood layer are tightly stuffed with a powdery substance. It was determined that almost all of the tunnels were connected with one another to damage the whole sapwood, and that their cross-sections were ovals of 6–10 mm. It was determined that frass powders were cream-coloured, coarse-textured, and also that the pellets were 1 mm long, cylinder-shaped and in granular structure (Figure 5). Also, in the wooden house, brown rot was identified (Figure 6), and the areas destroyed by insects and fungi were identified (Table 5).



**Figure 4.** The flight holes which are formed by old-house borer (*Hylotrupes bajulus*). General view (A) and closer photo of flight holes (B).



**Figure 5.** The tunnels which are formed by old-house borer (*Hylotrupes bajulus*) observed in wooden samples from the house (A) and the hayloft (B); and images of their pellets and frass under stereomicroscope ((C,D), respectively).



**Figure 6.** The wooden house damaged by old-house borer (*Hylotrupes bajulus*) and brown rot fungi. The arrow shows damaged rafter by fungi (A); Decayed wood elements in contact with water leaking (B); The wooden elements and insects in contact with the stone chimney damaged by both fungi (C); The tunnels formed by insects on the wooden wall inside the building (D); Bonding timbers near the foundation damaged by both fungi and insects (E).

**Table 5.** Areas destroyed by insects and fungal damage in the house examined.

Destruction Type	Areas Where the Damage Was Seen
Fungal damage	1. Rafters, areas adjacent to eaves exposed to precipitation before the repair of the roof (Figure 6A).
	2. The outer part of the wood elements in contact with the stone chimney (Figure 6C).
	3. Moisture soak-up from precipitation and soil contact due to structural failures; bonding timbers near the foundation (Figure 6E).
	4. Wood elements in contact with water leaking from the drains depending on the plumbing subsequently added to the structure (Figure 6B).
Insect damage	5. Bonding timbers near the foundation (Figure 6E).
	6. In most of the load-bearing walls, upper surface of the timber elements (usually limited to sapwood with robust texture).
	7. Few wooden walls inside the building (tunnels caused by insects) (Figure 6D).

#### 4.4. Dating of the Wooden House and the Hayloft

To further emphasize the local importance of traditional wooden architecture that arose as a result of the presence of natural resources located in the Parpat Valley, and so as to increase the awareness of that importance, dendrochronology was utilized. The first step of dating with Dendrochronology is to identify the tree species from which samples are taken.

The microscopic analysis showed that samples taken from the house and hayloft were spruce and fir. Villagers transported these timbers from the closest forest, where *Picea orientalis* and *Abies nordmanniana* subsp. *nordmanniana*, respectively, naturally grow. Therefore, we used *Picea/Abies* chronology obtained from Papart Forest [41], as master chronology. We also compared our floating chronologies with *Picea/Abies* chronology from Balcı forest [42], which is more humid than Papart Forest.

Each individual undated measurement series of the house (and the hayloft) were very well cross-dated visually against all the others. Relative placements of the series were verified by COFECHA. Interseries correlation values, which range from 0.31 to 0.58 for the house samples, and from 0.49 to 0.83 for the hayloft samples, were statistically significant for almost all series.

Our floating house and hayloft chronologies showed significant correlations with both master chronologies between 1729 and 1858, and between 1784 and 1863, respectively (Table 6, Figure 7).

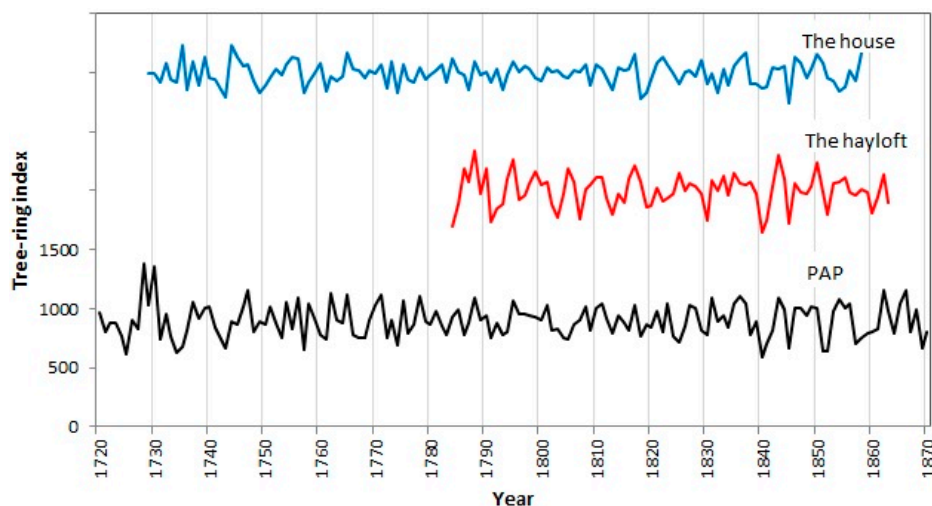
The calculated GLK and  $T_{BP}$  values between floating chronologies and Papart chronology were higher than Balcı chronology, which is expected due to the proximity of Papart Forest to the village. We could establish cutting dates (1863) for the logs obtained from the hayloft, by analyzing the outermost ring present on the samples. However, the outermost parts were removed in all sampled logs from the house. Therefore, we could not find out the exact cutting date (later than 1858).

**Table 6.** The cross-dating results of historical house and hayloft chronologies against the master chronologies.

	PAP			DUP		
	Glk	$T_{BP}$	Overlap	Glk	$T_{BP}$	Overlap
The house	0.75 ***	6.6	130	67 ***	5.1	130
The hayloft	0.67 ***	3.7	80	65 *	3.0	80

PAP: *Picea/Abies* chronology obtained from Papart Forest [41]; DUP: *Picea/Abies* chronology from Balcı forest [42]; “\*\*\*” and “\*” indicates statistically significant values,  $p \leq 0.001$  and  $p \leq 0.05$  respectively.





**Figure 7.** Comparison of the floating house (in blue) and hayloft (in red) chronologies with PAP chronology (Picea/Abies chronology obtained from Papart Forest [41]).

## 5. Discussion

Natural and cultural resource values of the area were identified in order to assess Papart Valley potential for ecotourism and so a SWOT Analysis was conducted. Natural resource values such as forests, flora and fauna, water sources and highlands; and cultural resource values such as historic structures, mosques, bridges, and man-made stone caves called “Daran” are listed. Accordingly, we find that the research area is rich in natural and cultural resource values. Climatic conditions, topography and variety of natural resources offer options for potential ecotourism activities that can be implemented in the region. A SWOT Analysis, which supports decision-making and planning processes with a systematic approach, cannot measure the significance level of the factors quantitatively [29,43]. Therefore, in this study, although the Strengths and Weaknesses, Opportunities, and Threats of Papart Valley are listed in terms of ecotourism, priorities of these factors could not be determined quantitatively. Although its priority could not be specified numerically, it is confirmed by all of the interest groups that traditional wooden architecture is one of the Strengths of Papart Valley. The Strength attributed to traditional wooden architecture is that a large number of wood structures built for housing, trade and other needs, being derived from local forests, still feature prominently today and form the unique texture of today’s settlements. Almost all of the houses located in villages, highlands and winter quarters were made entirely using wood. In this sense, these uncommon settlements can also be used as ecotourism attractants in terms of quality and quantity. At the same time, these structures are considered to have significant potential as hosting facilities for eco-tourists. Thus, whereas eco-tourists visit the traditional wooden architecture, they will be able to enjoy cultural heritage value which is considered as one of the indicators of the region’s culture and which is still available today.

In order to be able to transfer the region’s resource values to the next generations, sustainability should be the first principle of all kinds of applications to be carried out in these areas. The increase in the number of Hydroelectric Power Plants (HES) and increasing mining licences in the region are the most important factors threatening the resource values. However, the attitude of local people on this issue reveals the existence of a consciousness towards the conservation of nature, as in the Cerattepe case, in which residents resisted the construction of a copper and gold mine in Artvin. Just focusing on the protection of natural resource values will not be sufficient to achieve the ideal solution. The protection of natural resource values, together with the natural environment that embraces those values, is crucial for ecotourism to be carried out in Papart Valley. However, the lack of adequate knowledge for the protection and maintenance of wooden houses in the region,



the lack of sufficient wood craftsmanship, the lack of adequate infrastructure and equipment for the protection against fire of wooden houses, and the inappropriate use of government funds for the improvement of the wooden structures are among the main Weaknesses. This situation also constitutes a constraint for the use of traditional wooden houses to help overcome the deficiency of accommodation (hostel, hotel, etc.) areas for eco-tourists. Successful examples in Turkey where historic settlements are conserved along with the unique presence of traditional architecture, and where interest in traditional wooden workmanship is revived, are available. In this regard, Kastamonu, Muğla, Göynük, İbradı, Taraklı, Safranbolu, Beypazarı, Şirince, Cumalıkızık, etc. are important cases [44,45].

The year of construction for the traditional wooden structures in the region is not often known by owners. This is why, when determining historical value of the homes sampled in the study, methods of dendrochronology were used. Accordingly, cut-off date of those trees used for the hayloft was defined as 1863. However, in the samples taken from the house, it is observed that rings of the last few years were removed while the wood was being processed. Since these samples did not include the previous year's ring, a cut-off date of the trees could not precisely be determined. The last ring that was dated overlapped the year 1858, thus, the building can be said to have been made after that date. It could be possible that both the house and the hayloft were built in the same year, in 1863, during the few years after tree cutting. The owners of the house thought that the date written on the wall near the door in Hijri (Islamic) calendar, which is equal to 1835/1836 according to the Gregorian calendar, is the construction date of the house. But our results showed that the house was built at least 26 years later than this date. Dendrochronological dating methods are seen to give clearer information about the date of construction than oral statements and estimated records.

The owners of the house think that the hayloft was made from spolia-material. Spolia-material means; re-use of entire or half of those materials previously used, for another structure. Dendrochronological results showed that the hayloft was not made before the house was, and that it might even have been built in the same year. In this sense, the house that has more than 150 years of history bears the traces of the life of its owners in its every corner. The preservation and sustainability of the traditional wooden structure does not only represent the preservation of architecture. According to Sözen [46], "a wooden house seen in the highlands is a concrete example of how to live in harmony with the snow, the cold, the rain, the tree and the fruit". This destruction of cultural values means the disappearance of the evidence left by the master who shaped the wood in using the ax and adze. Therefore, the case in point is not only the preservation of a cultural asset, but also to protect the fund of knowledge. In the SWOT analysis conducted, the lack of adequate knowledge for the protection and maintenance of wooden houses in the region is one of the most prominent Weaknesses. The reasons for the damage identified in the wood construction material for the house and hayloft that we analyzed were grouped as insect damage and fungal damage. When the shape of the damage and the parts where it is found are considered, a series of measures can be taken to protect the buildings, as listed below:

When examining the points in which fungus destruction is found, it is seen that the most important reason for the occurrence of such damage is the moisture increase in these areas. In order to be able to keep moisture level below 20%, the isolation of moisture introduced through soil contact and improper plumbing; repairs of roof, chimneys and the others must be carried out.

Insect damage in the bearing walls is generally seen to be limited to the sapwood. It is seen that the robust texture is at a sufficient level, and the load-bearing elements fulfil their function. Although no alterations or repairs are required in these areas, acrylic resins can be used to prevent dust problems caused by insects' galleries which appear on wooden surfaces; that is one of the most important problems for the users, especially inside the building [47]. However, consolidation and replacement are required in order to correct the damage seen on wood elements where the damage is at its advanced level.

So as to eliminate the damages caused by the destruction occurred in wooden elements, especially in joints, strengthening procedures must be carried out. In this context, a related wooden element

should be included into the construction again by making inserts from wood materials belonging to the same tree species or by using metal fastening elements. Near that region, in areas where heavy fungal and insect damage occur, necessary rigidity and resistance can be achieved by using epoxy resin [47–49]. For determined insect damage and areas exposed to an advanced level of brown rot, resins of urea-formaldehyde and melamine formaldehyde, epoxy resins, as well as shellac use, will help obtain sufficient stiffness and resistance [50].

Taking the precautions listed above for the prevention of damage occurred in wooden buildings would extend the life span of the structures and bring its historical and financial value into the present and future. However, wooden buildings are destroyed by living organisms. Therefore, in the structures, it is required to identify the causes of all significant damages by making regular checks, and timely counter measures should be implemented. In wooden elements where damage is detected, on-site maintenance, strengthening or replacement procedures should be carried out; and when necessary, on-site maintenance operations should be performed with suitable impregnated materials containing insecticides and fungicides based on EN 335-1 Hazard Class. Facilitating the understanding by the public of all the measures listed above are both economic and feasible, and would prevent the abandonment of the wooden structures in areas with historical value. This and other recommendations may increase the experience of value of wooden culture assets.

In the face of contrasting opinions that ecotourism does not contribute to the welfare of local people in many cases and it cannot be successful in protecting nature [51], and that it commodifies the local culture [52], we think that ecotourism activities in Papart Valley would create the effect needed for the protection of traditional wooden architecture and cultural heritage, and for the revival of handicrafts that are on the verge of extinction. However, in planning ecotourism activities carried out in fragile cultural and ecological systems such as those in Parpat Valley, environmental assessment and monitoring must be conducted [53], conflicts between interest groups should be managed [54], and environmental, social and economic dimensions should be evaluated together holistically [27,55].

## 6. Conclusions

In this study, natural and cultural resource values of Papart Valley were evaluated in terms of ecotourism. Historical value of the traditional wooden architecture was identified with dendrochronological methods. Finally, proposals for protection were developed to help facilitate the local maintenance of traditional architecture. People adopting our recommendations for the protection of wood, developed in the course of this research, may support ecotourism applications. Thanks to ecotourism activities, local people will be offered alternative sources of income and thus the outmigration of the younger population will be stemmed. The next important step for research in Papart Valley will be the development of a holistic ecotourism plan which takes ecological, cultural and socioeconomic perspectives into account. To achieve this objective, we would like to acquire more detailed information about local culture with sociological research activities. Moreover, prescriptions for damage prevention will be listed for each remaining traditional wooden house. Likewise, dating the other wooden structures in the region is going to provide a scientific basis for the architects and art historians who are interested in the region by revealing similarities and differences in the construction dates of the buildings. Additionally, communicating the importance of traditional wooden architecture to community stakeholders will also contribute to the sustainability of cultural heritage.

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