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Young Generations' Perception of the Role of Deadwood in Forests: Comparison between Italy and Türkiye

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Abstract: The recreational value of a forest is related to the degree of naturalness that can be measured by considering qualitative and quantitative characteristics of deadwood and habitat trees. Forest user groups' knowledge and opinions towards forest naturalness can support decision-makers in defining strategies. Among user groups, the literature shows a knowledge gap regarding the new generations' perceptions and opinions related to biodiversity conservation. The aim of this study is to investigate young generations' perception and preferences towards deadwood in forests. A questionnaire was developed and administrated online—in Italy and Türkiye—to a sample of university students under 25 years old. A total of 407 questionnaires (187 in Italy and 220 in Türkiye) were collected and processed. The results show that students from both countries have a high level of knowledge of deadwood and its role in forests. Most respondents perceive standing dead trees in forests to be aesthetically negative, while large lying deadwood is perceived as aesthetically positive. The attention of young generations towards issues related to biodiversity conservation is confirmed by the significance given in both countries to the management strategy that closely aligns with natural processes of mortality in undisturbed forests, where deadwood is allowed to remain without removal.

Keywords: Generation Z and Alpha; naturalness; lying deadwood; standing dead trees; web-based questionnaire

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Citation: Paletto, A.; Bayraktar, S.; Becagli, C.; De Meo, I. Young Generations' Perception of the Role of Deadwood in Forests: Comparison between Italy and Türkiye. *Ecologies* **2023**, *4*, 426–441. https://doi.org/10.3390/ecologies4020027

Academic Editor: José Ramón Arévalo Sierra

Received: 24 May 2023
Revised: 12 June 2023
Accepted: 16 June 2023
Published: 19 June 2023

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1. Introduction

The recreational attractiveness of a forest depends on many site and stand attributes, such as accessibility (e.g., distance from urban areas, road and path network, parking), the infrastructure for visitors (e.g., trails and hiking tips, picnic areas), and the (perceived) degree of naturalness [1,2]. In particular, naturalness is generally defined as the degree of similarity between the current state of an ecosystem and its presumed natural state before being influenced by human interventions [3]. It is possible to identify five main degrees of naturalness [4]: natural (forests that have never been subject to human interventions or previous impact), near-natural (forests that have experienced weak, irregular, and selective use, with a composition of near-natural tree species), semi-natural (forests moderately modified by anthropic interventions), relatively unnatural (even-aged forests that have been intensively used by humans and highly modified), and artificial (even-aged forest with non-native tree species). In the literature, several authors have defined the main dimensions of naturalness in forests [5,6], including the horizontal and vertical stand structure (even-aged vs. uneven-aged forests), tree species composition (dominance of native or introduced tree species), the origin of the forest (natural or artificial), and the degree of human interventions. Recently, the Ministerial Conference on the Protection of Forests in Europe (MCPFE) introduced deadwood as a further key attribute to assess

the degree of naturalness. Moreover, the Vienna Resolution of the 4th MCPFE underlined that "dead wood in the form of dead standing and dead lying trees is a habitat for a wide range of organisms". Due to the lack of deadwood, many of the dependent species are at risk of endangerment. As a result, the deadwood volume has been included as one of the indicators for Sustainable Forest Management (SFM) [7,8].

Moreover, it is worth noting that deadwood also plays a crucial role in bioenergy production. Therefore, understanding the multifaceted role of deadwood, including its contributions to biodiversity conservation and bioenergy production, is of great importance in contemporary forest management strategies [9].

In the last decades, some studies have highlighted the significant influence of quantitative and qualitative characteristics of deadwood, such as volume, size, components, and decay rate, on biodiversity levels in natural and semi-natural forests, particularly in saproxylic communities [10,11]. Additionally, in the plantations—characterized by a simplified forest system—lying deadwood and standing dead trees play a key role in providing microhabitats, food, and water reservoirs for wildlife [12].

These studies confirm that deadwood is an essential characteristic of the naturalness of forests, and measures related to deadwood characteristics can serve as indicators of forest naturalness. Deadwood is fundamental not only to increase the degree of naturalness of forests but also to increase other attributes such as tree species richness, natural regeneration, and vertical and horizontal structural diversity [13,14]. Furthermore, the structural–functional role of deadwood in forests has been widely recognized by the scientific community and decision makers in the last two decades [15]. Numerous studies have shown the importance of deadwood as microhabitats for saproxylic insects [16], fungi [17], bacteria and actinobacteria [18], bryophytes [19], lichens [20], amphibians [21], small mammals [22], and birds [23].

It is important to point out that, historically, traditional forest management has viewed the presence of deadwood in forests negatively [24–26]. Specifically, a high amount of deadwood was considered detrimental due to the increased risk of forest fires and infestation by pests such as bark beetles. It was also seen as an impediment to silvicultural interventions, a safety hazard for workers, and responsible for diminishing the site's attractiveness and recreational use by visitors.

At present, despite the widespread recognition of the ecological importance of deadwood in forests by the scientific community, people generally perceive deadwood as an indicator of mismanagement and neglect, as indicated by several studies [27,28]. In particular, people tend to prefer forests with higher tree species diversity, color variation, presence of natural regeneration, and without obstacles to human activities. Regarding the latter point, standing dead trees and lying deadwood—the two main components of deadwood—are perceived negatively by people for two main reasons [29,30]: reduced accessibility and safety of forest areas and decreased visual-aesthetic value.

This kind of information is useful to decision makers and managers in the forest sector but also in urban and suburban contexts to better address interventions in recreation areas, considering the individual preferences of visitors and other users. Despite this need, there are still few studies in the literature investigating people's perception and preferences toward deadwood in forest ecosystems [31–35].

Furthermore, it is worth noting that the scientific literature on the differences between age groups, specifically comparing older and younger generations, is relatively recent and still limited [36–39], However, gaining a better understanding of the perceptions and viewpoints of Generation Z and Alpha regarding critical issues related to the maintenance of natural resources and biodiversity conservation is of great importance, considering that these generations represent the future. Their perspectives and attitudes can provide valuable insights for developing effective strategies and interventions in environmental conservation. Starting from these considerations, the objective of this study is to investigate perceptions and preferences of the younger generation regarding deadwood in forests, with a specific focus on aesthetic and perceptual aspects. This study was developed within

the research activities of the LIFE SPAN project focused on the identification of possible SFM strategies capable of integrating nature conservation measures in production forests. The LIFE SPAN project is aimed at the creation of Saproxylic Habitat Sites (SHSs) and microhabitat trees in two production forests (one in Germany and one in Italy) in order to test their effects on the conservation and improvement of saproxylic biodiversity (e.g., *Dryocopus martius*, *Barbastella barbastellus*, *Lucanus cervus*). To achieve the aforementioned objective, the study addresses the following research questions:

1. How does the young generation perceive the presence of deadwood in forests? Is it viewed as a negative element?
2. Are there any differences in the young generation's perception of different deadwood components, specifically of standing dead trees and lying deadwood?
3. Is the geographical and cultural context explicatory of the differences between individual preferences?

The study was implemented using an online questionnaire submitted to a sample of Italian and Turkish university students, born between 1997 and 2005 (Generation Z and Alpha).

2. Materials and Methods

The young generation's perceptions and opinions towards the presence of deadwood in forests were investigated by conducting the present research in three steps: (1) preparing and pre-testing a semi-structured questionnaire; (2) sampling and administering the web-based questionnaire to Turkish and Italian university students; (3) data processing and interpretation of the results in a comparative way by country and socio-demographic characteristics of the respondents.

As a first step, a preliminary version of the questionnaire was developed in English by the project's research teams. Following that, the questionnaire was translated into Turkish and Italian to make it easier for survey participants to complete. The preliminary version of the questionnaire in national languages was pre-tested with six university students—three in Türkiye and three in Italy—to verify its accuracy and suitability. Taking into account pre-test results, three questions were modified to enhance the questionnaire's comprehensibility and two questions were removed to reduce completion times.

The questionnaire's final version includes nine closed-ended questions divided into three thematic sections. The first section investigates the level of university students' knowledge of the term "deadwood" (Q1); it aimed to determine the sources of information from which they acquired this knowledge (Q2), distinguishing among technical-scientific articles, magazines/radio/television, posts on social networks/blogs, and conferences/workshops/public meetings. In addition, the third question (Q3) of this section focuses on students' opinions regarding the role of deadwood in forests considering six positive and two negative effects provided by the presence of deadwood in forests: bioenergy production (firewood, woodchips); microhabitat for wildlife (shelter); food for wildlife (nourishment); increased risk of forest fires; soil fertilization due to deadwood decomposition; climate change mitigation through the temporary storage of carbon; increase of harmful insects in the forest; and soil protection from water erosion and landslides. Regarding each effect, the students were asked to rate the (positive or negative) importance of each effect using a 5-point Likert scale format, ranging from 0 (not important) to 5 (very important).

The second thematic section focuses on the visual-aesthetic preferences of respondents regarding forest landscapes with two components of deadwood: standing dead trees and lying deadwood. The respondents were asked to assess how the presence of large standing dead trees (Q4) and lying deadwood (Q5) influences the aesthetic value of the forest landscape. For both questions, respondents were provided with three options to choose from: (a) improves the aesthetic value, (b) worsens the aesthetic value, or (c) does not affect the aesthetic value.

Both versions of the questionnaire (in Italian and Turkish) utilized the same set of images depicted in Figure 1 to enable answer comparison. In the last question (Q6) of this section, students were asked to express their opinions on four potential deadwood management strategies designed to promote biodiversity conservation in forests while preserving recreational opportunities for visitors (Table 1). Respondents evaluated the effectiveness of each proposed strategy on a 5-point Likert scale, ranging from 0 (not efficient) to 5 (very efficient).

(**a**) (**b**)

Figure 1. The photos used in the questionnaires to evaluate the aesthetic-visual perceptions of (**a**) standing dead tree and (**b**) lying deadwood in forest landscapes.

Table 1. Description of deadwood management strategies for the biodiversity conservation considered in the survey.

Strategy		Description
Strategy 1	✓	Standing dead trees and lying deadwood are not removed and are evenly distributed throughout the forest [40].
	✓	Attention is paid to forest fires and insect pollution risks.
	✓	Strategy closest to the natural processes of mortality in undisturbed forests.
Strategy 2	✓	Only standing dead trees with a diameter greater than 60–70 cm are left in the forest.
	✓	Lying deadwood and small standing dead trees are removed.
	✓	Conservation of habitat trees that provide ecological niches (microhabitats) [41].
Strategy 3	✓	Deadwood is removed during silvicultural interventions.
	✓	Small quantities of lying deadwood scattered in the forest and some standing dead trees with a diameter greater than 60–70 cm are left.
	✓	Strategy typical of managed forests, where a small amount of deadwood is left in favor of soil fertility and biodiversity conservation [42].
Strategy 4	✓	High biodiversity value areas (saproxylic habitat sites) are implemented where microhabitat trees and deadwood—both standing dead trees and lying deadwood—are conserved and created.
	✓	Strategy based on the biodiversity conservation in specific extended rotation stands characterized by a high amount of standing dead trees and lying deadwood of all decay classes [43].

The third thematic section collected personal information from respondents, including gender (Q7), degree course (differentiating between Bachelor's and Master's students) (Q8), membership in environmental Non-Governmental Organizations (NGOs) (Q9), and region and city of residence (Q10). Membership in environmental NGOs was investigated as the level of knowledge and perception towards deadwood can be influenced by this variable. It is hypothesized that student members have a higher level of knowledge and more positive perceptions of deadwood than non-members.

In the second step, the questionnaire was distributed to the students in Italy from October to December 2020 and in Türkiye from May to July 2021 (with a three-month dissemination period for each country).

The online survey method was chosen due to several factors that influenced the suitability of the chosen research method. Firstly, it allowed for direct connection with geographically dispersed participants, such as those involved in this study. Secondly, it provided a simple and easily accessible option, especially for young respondents. Finally, it offered the advantage of reducing time and costs [44,45].

The study initially involved students from the University of Florence and Trento in Italy, as well as students from Istanbul University–Cerrahpaşa in Türkiye. The students who were involved in the initial dissemination phase of the questionnaire were enrolled in "Engineering sciences" and "Economic and management sciences" in Italy and "Landscape architecture", "Architecture and Urban planning", and "Social sciences" in Türkiye. In both case studies, the initial dissemination deliberately did not involve students of "Natural sciences" and "Forestry sciences", who had previous knowledge of the subject matter. A snowball sampling method was employed to increase the participant pool from different degree programs and courses of study. The questionnaire link was shared on various social network pages (i.e., Facebook, Instagram, Twitter), and the first group of students spread the link to their personal contacts.

In the third step, the data collected with the questionnaire were stored and processed to produce the main descriptive statistics, including mean, median, and standard deviation, using the 5-point Likert-scale format and percentage of frequency distribution (%) for the other questions. To examine the differences between countries (Italy vs. Türkiye) and assess associations with socio-demographic characteristics of the respondents, such as gender, degree course, and membership in environmental associations, non-parametric statistical tests were employed. Specifically, the Chi-square (χ^2) test was used to analyze the categorical variables and determine statistically significant distinctions, while the Mann–Whitney test was conducted to compare ordinal variables. The significance level was set at $\alpha = 0.05$ for all tests. It is important to note that the choice of statistical tests was based on the nature of the variables and the assumptions associated with each test. The non-parametric tests were applied rather than the parametric test for the following reasons: the sample size is not large enough or the assumption of normality was violated as confirmed by the Shapiro–Wilk test ($p < 0.0001$, $\alpha = 0.05$).

3. Results

3.1. Characteristics of the Sample of Respondents

Upon completion of data collection, a total of 407 questionnaires were collected and processed, with 220 from Türkiye and 187 from Italy.

The results regarding the socio-demographic characteristics of the respondents are presented in Table 2. The majority of the sample consists of female students (60.4% in Italy and 69.1% in Türkiye) enrolled in a Bachelor's degree course (54.0% in Italy and 92.7% in Türkiye). Moreover, only a minority of the students declared themselves to be a member of an environmental NGO: 4.8% in Italy and 8.6% in Türkiye.

Table 2. Socio-demographic characteristics of respondents (% distribution).

Characteristics	Italy (n = 187)	Türkiye (n = 220)
Gender		
Male	39.6%	30.9%
Female	60.4%	69.1%
Degree course		
Bachelor's degree	54.0%	92.7%
Master's degree	46.0%	7.3%
Environmental NGO membership		
YES	4.8%	8.6%
NO	95.2%	91.4%

Regarding the respondents' place of residence, the findings indicate that a majority of Italian students resided in two regions, with 56.9% in the Tuscany region and 20.4% in the Trentino-Alto Adige region. In contrast, the Turkish respondents were predominantly from the Marmara region, accounting for 53.1% of the total Turkish respondents, followed by the Central Anatolia region, with 6.4%. The distribution of respondents within the sample can be attributed to the initial dissemination of the questionnaire link at Florence University in Tuscany, Trento University in Trentino-Alto Adige, and Istanbul University–Cerrahpaşa in the Marmara region.

3.2. Level of Knowledge about Deadwood

The results concerning the level of knowledge about the term "deadwood" indicate that 69.7% of Italian and 48.6% of Turkish university students had already heard/read about deadwood in forests before the survey. With regard to the source of information (Figure 2), the majority of respondents heard/read about the term "deadwood" from technical-scientific articles (24.0% of Italian and 37.9% of Turkish students), followed by social networks/blogs (15.8% of Italian and 33.7% of Turkish students) and traditional media such as magazines/radio/television (10.2% of Italian and 20.0% of Turkish students). In addition, 34.2% of Italian students indicated as the source of knowledge other channels such as university lectures and personal contacts.

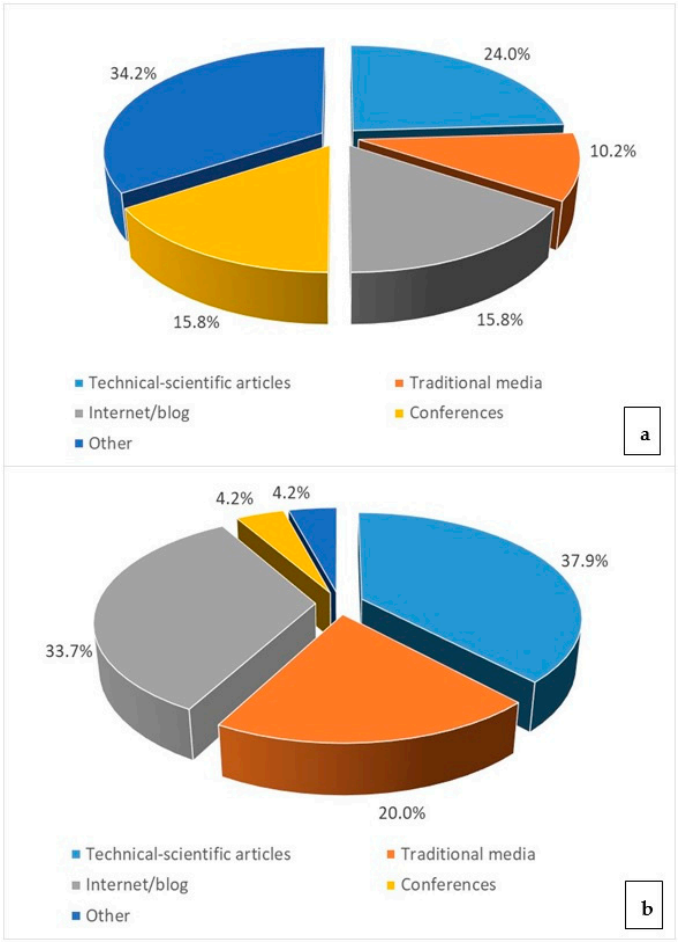

Figure 2. Distribution (%) of the source of information regarding the term "deadwood" as distinguished by country: (**a**) Italy; (**b**) Türkiye.

Considering the socio-demographic characteristics of respondents, it is interesting to highlight that the level of knowledge regarding deadwood is higher for the male students compared to female students (77.3% of males and 64.6% of females had heard/read about

deadwood in forests in Italy and 60.3% of males and 43.4% of female students in Türkiye). In addition, in Italy, Master's students had a higher level of knowledge than Bachelor's students (83.7% of Master's and 57.8% of Bachelor's students had heard/read about deadwood in forests). However, in Türkiye, there were no significant differences in the level of knowledge between Master's and Bachelor's students (43.8% of Master's and 49.0% of Bachelor's students had heard/read about deadwood in forests before our survey). Membership in environmental NGOs was not an explanatory variable of the level of knowledge about deadwood in forests, as shown by the following results: 55.6% of members and 70.4% of non-members in Italy and 57.9% of members and 47.8% of non-members in Türkiye had heard/read about deadwood in forests before the survey.

3.3. Perception of the Effects Generated by the Presence of Deadwood in Forest

The results reveal that the two most important effects generated by deadwood in forests, as perceived by both Italian and Turkish students, are soil fertilization after decomposition (with a mean value of 3.36 ± 0.85 for Turkish students and 3.79 ± 0.50 for Italian students) and provision of microhabitat for wildlife (3.27 ± 0.96 for Turkish students and 3.74 ± 0.57 for Italian students). Conversely, respondents in both countries considered bioenergy production as the least important effect (with a value of 2.68 ± 1.05 for Turkish students and 3.15 ± 0.92 for Italian students) (Figure 3).

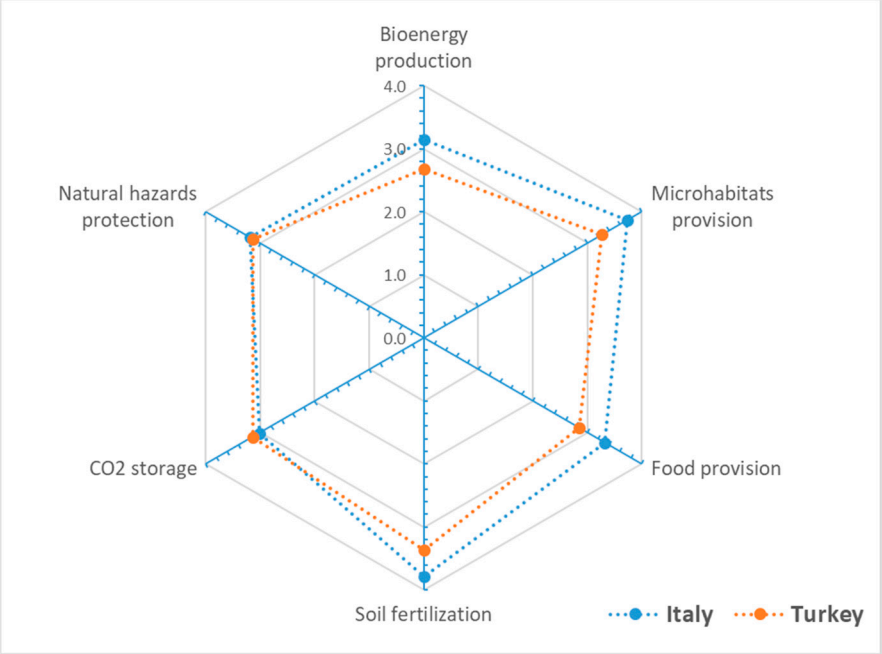

Figure 3. Comparison of the perceived importance of the positive services performed by deadwood in forests by country (mean value in a 5-point Likert scale format).

Regarding the perceived negative effects, Italian students placed greater emphasis on the risk of forest fires due to the presence of deadwood (with a value of 3.56 ± 0.72) compared to the Turkish students (with a value of 2.84 ± 1.14), while the perceived risk of pest infestation was similar in both contexts (with value of 3.09 ± 0.87 for Italian students and 2.70 ± 1.14 for Turkish students).

The non-parametric Mann–Whitney test revealed statistically significant differences between Turkish and Italian students for the following four positive effects generated by the presence of deadwood: bioenergy production ($p < 0.0001$), microhabitats ($p < 0.0001$) and food provision for wildlife ($p < 0.0001$), and soil fertility after decomposition ($p < 0.0001$). Additionally, the non-parametric Mann–Whitney test showed statistically significant differ-

ences between Turkish and Italian students for the negative effect of increasing the risk of forest fires due to the presence of deadwood in forests ($p < 0.0001$).

The results analyzed by socio-demographic characteristics are presented in Table 3. It is interesting to highlight that females emphasize the importance of deadwood for CO_2 storage, natural hazard protection, and bioenergy production more than males in both countries. In contrast, males assign a higher score to the role of deadwood in the provision of food for wildlife. However, the non-parametric Mann–Whitney test does not reveal statistically significant differences between males and females for all positive and negative effects of deadwood in forests. The results evidence that Bachelor's students put greater emphasis on the importance of bioenergy production, CO_2 storage, and natural hazard protection compared to the Master's students in both countries, while the latter underline the importance of provision of microhabitat for wildlife. This difference is supported by the non-parametric Mann–Whitney test, which reveals statistically significant differences between Bachelor's and Master's students for the following three positive effects performed by deadwood in forests: provision of microhabitats ($p < 0.0001$), provision of food ($p = 0.003$), and soil fertility after decomposition ($p < 0.0001$). Conversely, the non-parametric Mann–Whitney test does not reveal statistically significant differences for the two negative effects considered in the survey.

Table 3. Perceived importance of positive functions provided by deadwood (mean ± SD).

Country	Characteristics	Bioenergy	Microhabitats	Food	Soil Fertilization	CO_2 Storage	Natural Hazard Protection
			Gender				
Italy	Male ($n = 74$)	2.95 ± 0.98	3.77 ± 0.51	3.35 ± 0.91	3.81 ± 0.51	2.96 ± 1.01	3.03 ± 1.10
	Female ($n = 113$)	3.28 ± 0.86	3.72 ± 0.60	3.31 ± 0.93	3.78 ± 0.50	3.06 ± 0.98	3.29 ± 0.88
Türkiye	Male ($n = 68$)	2.56 ± 1.10	3.15 ± 1.07	2.91 ± 1.10	3.35 ± 0.93	2.90 ± 1.22	3.00 ± 1.20
	Female ($n = 152$)	2.73 ± 1.03	3.33 ± 0.91	2.82 ± 1.16	3.36 ± 0.81	3.25 ± 0.97	3.19 ± 0.98
			Degree course				
Italy	Bachelor's degree ($n = 103$)	3.32 ± 0.82	3.64 ± 0.66	3.23 ± 0.96	3.70 ± 0.58	3.12 ± 0.95	3.25 ± 0.95
	Master's degree ($n = 84$)	2.95 ± 0.99	3.85 ± 0.42	3.44 ± 0.86	3.90 ± 0.38	2.91 ± 1.04	3.12 ± 1.01
Türkiye	Bachelor's degree ($n = 204$)	2.72 ± 1.01	3.27 ± 0.96	2.86 ± 1.13	3.39 ± 0.84	3.17 ± 1.04	3.15 ± 1.04
	Master's degree ($n = 16$)	2.13 ± 1.36	3.38 ± 1.02	2.69 ± 1.30	3.00 ± 0.89	2.81 ± 1.38	2.94 ± 1.24
			Environmental NGO membership				
Italy	YES ($n = 9$)	3.56 ± 0.73	3.89 ± 0.33	3.89 ± 0.33	3.89 ± 0.33	3.67 ± 0.71	3.78 ± 0.44
	NO ($n = 178$)	3.13 ± 0.93	3.73 ± 0.58	3.30 ± 0.93	3.79 ± 0.51	2.99 ± 1.00	3.16 ± 0.99
Türkiye	YES ($n = 19$)	2.47 ± 0.77	3.53 ± 0.61	3.00 ± 1.20	3.58 ± 0.69	3.21 ± 0.98	3.11 ± 0.94
	NO ($n = 201$)	2.70 ± 1.07	3.25 ± 0.98	2.84 ± 1.14	3.34 ± 0.86	3.13 ± 1.08	3.13 ± 1.07

As expected, the members of the environmental NGOs both in Italy and Türkiye assign a higher value to the effects related to biodiversity conservation (i.e., provision of microhabitats and food for wildlife) and climate change mitigation (CO_2 storage). In addition, it is important to emphasize that, in Italy, the student members of environmental NGOs assigned a higher value to all deadwood functions as compared to the non-members of environmental NGOs. However, the non-parametric Mann–Whitney test shows no statistically significant differences between the two categories for all positive and negative effects related to deadwood presence in forests.

3.4. Visual-Aesthetic Preferences for Deadwood in Forest Landscapes

Considering the visual-aesthetic perception of the presence of deadwood in forest landscapes, the results show that the majority of respondents from Türkiye perceive standing dead trees to have a negative aesthetic impact (42.7% of total Turkish respondents), while for the majority of respondents from Italy, this component has no aesthetic impact (56.7%). However, in both countries, and particularly in Italy, only a small percentage of respondents perceive standing dead trees as having a positive effect on the forest landscape (29.5% of Turkish students and 7.0% of Italian students). Conversely, the majority of respondents in both countries consider the effect of lying deadwood as positive for the

forest landscape (50.0% of Turkish students and 37.1% of Italian students). Overall, Turkish students demonstrate a stronger positive inclination towards the presence of deadwood in forests (both standing dead trees and lying deadwood) as compared to Italian students. This difference is confirmed by the Chi-square (χ^2) test for both deadwood components, although with varying levels of significance: standing dead trees ($p < 0.0001$) and lying deadwood ($p = 0.012$).

Regarding the socio-demographic characteristics of respondents (Table 4), the results indicate that males consider the presence of lying deadwood in forests more aesthetically pleasing than females. In the case of Turkish students, the degree course (Master's or Bachelor's) influences the perception of deadwood, with Master's students having a higher positive perception of lying deadwood and Bachelor's students of standing trees. The members of environmental NGOs consider both deadwood components more attractive compared to non-members.

Table 4. Distribution (%) of visual-aesthetic preferences for deadwood (standing dead trees and lying deadwood) in forests by country and socio-demographic characteristics of respondents.

Country	Characteristics	Standing Dead Trees			Lying Deadwood		
		Positive	Neutral	Negative	Positive	Neutral	Negative
		Gender					
Italy	Male (n = 74)	6.8	62.2	31.1	50.0	21.6	28.4
	Female (n = 113)	7.1	53.1	39.8	29.2	30.1	40.7
Türkiye	Male (n = 68)	36.8	32.4	30.9	60.3	19.1	20.6
	Female (n = 152)	26.3	25.7	48.0	45.4	15.8	38.8
		Degree course					
Italy	Bachelor's degree (n = 103)	5.8	55.8	38.4	46.5	26.7	26.7
	Master's degree (n = 84)	7.9	57.4	34.7	29.0	27.0	44.0
Türkiye	Bachelor's degree (n = 204)	30.4	25.5	44.1	47.5	17.6	34.8
	Master's degree (n = 16)	18.8	56.3	25.0	81.3	6.3	12.5
		Environmental NGO membership					
Italy	YES (n = 9)	36.8	21.1	42.1	63.2	15.8	21.1
	NO (n = 178)	28.9	28.4	42.8	48.8	16.9	34.3
Türkiye	YES (n = 19)	11.1	55.6	33.3	44.4	33.3	22.2
	NO (n = 201)	6.7	56.7	36.5	36.7	26.6	36.7

Statistical analysis was performed using the χ^2 test to examine these differences, which revealed statistically significant distinctions between males and females for both deadwood components—standing dead trees ($p = 0.027$) and lying deadwood ($p = 0.003$)—and between Master's and Bachelor's students for standing dead trees ($p < 0.0001$).

3.5. Deadwood Management Strategies Aimed at Biodiversity Conservation

The results regarding the students' preferences towards deadwood management strategies show that the preferred strategy is Strategy 1 for Italian respondents (mean value of 2.30 ± 1.11) and Turkish respondents (2.57 ± 0.98), while the second choice is Strategy 3 for Italian students (2.01 ± 1.01) and Strategy 2 for Turkish students (2.32 ± 0.98) (Figure 4). The non-parametric Mann–Whitney test revealed statistically significant differences between Italy and Türkiye only for Strategy 2 ($p < 0.0001$).

The results, analyzed by socio-demographic characteristics, are shown in Table 5. Regarding gender, females from both countries assigned a higher value to Strategy 4 compared to males (mean 2.00 vs. 1.78 in Italy and 2.30 vs. 1.99 in Türkiye), while Italian and Turkish males preferred Strategy 2 compared to females (mean 1.88 vs. 1.79 in Italy and 2.37 vs. 2.30 in Türkiye). However, the non-parametric Mann–Whitney test did not yield statistically significant differences between males and females for any of the deadwood management strategies considered in the survey.

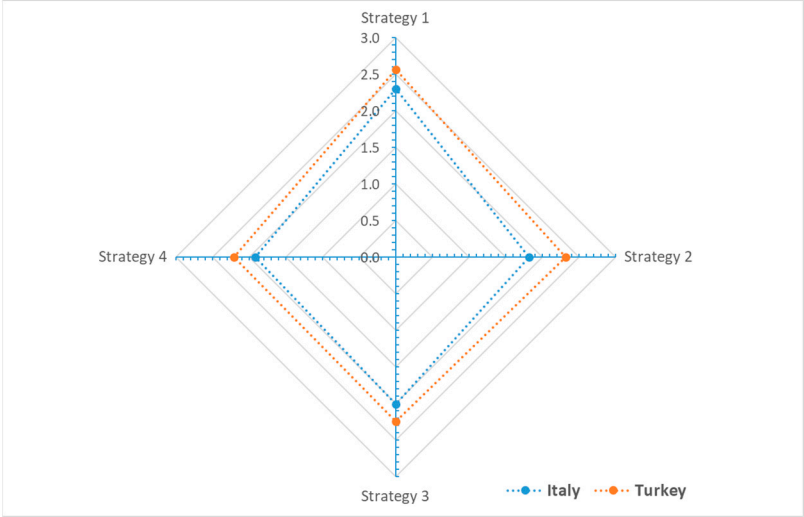

Figure 4. Comparison of the perceived importance of the deadwood management strategies by country (mean value in a 5-point Likert scale format).

Table 5. University Students' Opinions on Deadwood Management Strategies for Biodiversity Conservation (Mean ± SD).

Country	Characteristics	Strategy 1	Strategy 2	Strategy 3	Strategy 4
		Gender			
Italy	Male (n = 74)	2.31 ± 1.17	1.88 ± 0.95	1.95 ± 0.93	1.78 ± 1.16
	Female (n = 113)	2.30 ± 1.07	1.79 ± 1.01	2.05 ± 1.05	2.00 ± 1.32
Türkiye	Male (n = 68)	2.60 ± 0.95	2.37 ± 0.90	2.40 ± 0.85	1.99 ± 1.23
	Female (n = 152)	2.55 ± 1.00	2.30 ± 0.96	2.18 ± 0.96	2.30 ± 1.19
		Degree course			
Italy	Bachelor's degree (n = 103)	2.27 ± 1.08	1.82 ± 1.01	1.93 ± 1.04	2.02 ± 1.26
	Master's degree (n = 84)	2.35 ± 1.15	1.83 ± 0.96	2.10 ± 0.96	1.79 ± 1.27
Türkiye	Bachelor's degree (n = 204)	2.58 ± 0.96	2.33 ± 0.95	2.26 ± 0.95	2.25 ± 1.21
	Master's degree (n = 16)	2.44 ± 1.26	2.19 ± 0.83	2.06 ± 0.68	1.69 ± 1.08
		Environmental NGO membership			
Italy	YES (n = 9)	2.33 ± 1.58	2.00 ± 1.00	1.89 ± 1.05	2.33 ± 1.00
	NO (n = 178)	2.30 ± 1.08	1.81 ± 0.99	2.02 ± 1.01	1.89 ± 1.27
Türkiye	YES (n = 19)	2.84 ± 0.90	2.26 ± 0.87	2.21 ± 0.98	1.84 ± 1.12
	NO (n = 201)	2.54 ± 0.98	2.33 ± 0.94	2.25 ± 0.93	2.24 ± 1.21

Analyzing the data by degree course, the results evidence that Master's students from both countries assigned a lower value to Strategy 4 compared to Bachelor's students (mean 1.79 vs. 2.02 in Italy and 1.69 vs. 2.25 in Türkiye), while Bachelor's students assigned a higher value to Strategy 2 compared to Master's students. This is confirmed by the non-parametric Mann–Whitney test, which revealed statistically significant differences between Master's and Bachelor's students of both countries for Strategy 2 (p = 0.008) and Strategy 4 (p = 0.004).

In addition, the results show that students who are members of environmental NGOs assigned a higher value to Strategy 1 compared to non-members, while the latter assigned a higher value to Strategy 3. However, the non-parametric Mann–Whitney test did not yield statistically significant differences between members and non-members of environmental NGOs for all four strategies.

4. Discussion

The present study aims to investigate the perception, preferences, and opinions of a sample of university students in Italy and Türkiye regarding deadwood in forests. The

research focuses on young people belonging to Generation Z and Alpha due to the identified knowledge gap in this specific research area. In the literature, several authors have examined Generation Z across various research domains, as it represents the first generation born after the emergence of the Internet and is recognized as a multicultural and global cohort compared to previous generations [46]. Nevertheless, these studies primarily focus on examining the attitudes and behaviors of the new generations concerning the consumption patterns and social aspects associated with the socialization process [47]. Regarding the association between Generation Z and the environment, Malikova [48] emphasizes that individuals belonging to this generation exhibit a heightened sensitivity towards environmental and social issues compared to previous generations (Baby Boomers, Generations X and Y). As a result, members of Generation Z hold a pro-sustainable attitude attributed to their heightened awareness of sustainability and exposure to formal and informal education on environmental matters [49,50]. Beyond these general considerations, the international literature is lacking in studies on the attitudes, perceptions, and preferences of the new generations on natural resources management in general and in particular on forest management. Furthermore, the differences in perception between young and old generations concerning these issues have not been investigated.

To address this knowledge gap, the present study presents preliminary data on the knowledge, perceptions, and preferences of Italian and Turkish university students under 25 years old regarding the presence of deadwood in forests. The results indicate that a majority of the students (69.7% of Italian and 48.6% of Turkish students) had previous knowledge or exposure to information regarding deadwood and its role in forests prior to the survey. Students had primarily acquired this knowledge through university education (courses, conferences, and technical-scientific articles) as well as new media platforms (social networks and blogs). In contrast, traditional media channels (magazines, radio, and television) had a limited role in disseminating this knowledge, with only 10.2% of Italian and 20.0% of Turkish students acquiring information about deadwood in forests through these sources. The present results support previous studies indicating the increasing significance of social networks/blogs over traditional media as a means of dissemination of scientific information among younger generations [51,52]. However, it is important to acknowledge that the dissemination of scientific knowledge through social networks/blogs is accompanied by certain limitations, such as reduced depth of the conveyed information as well as reduced attention among readers [53].

The results of this research indicate that a significant proportion of young people are aware of the importance of deadwood for biodiversity conservation, specifically in terms of providing microhabitats and food for saproxylic species. In fact, the services provided by deadwood to saproxylic species in offering microhabitats and food are considered two of the three most important functions of this ecological component of forests. In addition, a high percentage of respondents perceives the presence of standing dead trees (18.2% of total respondents) and lying deadwood (43.5%) in forests in an aesthetically positive way. Interestingly, Turkish university students exhibit a more positive perception towards both components of deadwood compared to Italian students, with higher proportions (29.5% vs. 7.0% for standing dead trees and 50.0% vs. 37.1% for lying deadwood). The observed ethnic differentiation in the perception of deadwood components between Turkish and Italian university students can be attributed to cultural factors and varying levels of environmental awareness. Studies conducted in Italy have revealed a cultural perception that views "clean" forests, free of shrubbery and deadwood, as the desired outcome of forest management [34,54]. Italian visitors tend to perceive such forests as more accessible, usable, and safer, as they exhibit a prominent human influence. Comparatively, a study on visitors' perception of deadwood in Italy and Bosnia–Herzegovina by Pastorella et al. [27] indicated that Italian respondents, in contrast to Bosnian respondents, prefer intensively managed forests, where deadwood is removed during silvicultural interventions.

Conversely, a study conducted in Türkiye by Varol et al. [54] highlighted that Turkish respondents perceive old-growth forests with deadwood positively, as they contribute to the

forest's natural appearance. Furthermore, it is important to note that in recent years there has been increased environmental awareness and appreciation for nature among youth in Türkiye. This heightened sensitivity can be attributed to significant events that began with the defense of trees, such as the Gezi Park protests and ongoing discussions surrounding infrastructure projects, such as the construction of the third bridge (Yavuz Sultan Selim Bridge), which was built in forest areas. These events have sparked strong reactions and defense from young individuals, contributing to their heightened environmental awareness and concern. As a result, Turkish students exhibit a heightened respect for the integrity of forests and a positive evaluation of their various components. Based on these factors, it is plausible to hypothesize that the observed ethnic differentiation in the perception of deadwood components is influenced by the cultural perception of an ideally managed forest. Regarding deadwood management strategies, both Turkish and Italian students prioritize the approach that aligns with natural processes observed in undisturbed forests. More specifically, the management interventions involve silvicultural practices that preserve both standing dead trees and lying deadwood in the forest, while also considering the risks associated with forest fires and insect infestations. This finding aligns with the positive aesthetic and functional perception of deadwood in forests reported by the participants in the current study.

The results of the present research partially align with the international literature on this topic and confirm that, currently, there is some disagreement among studies and further knowledge is required in this field. Firstly, in a study involving a larger sample of the Italian population (1292 respondents) and encompassing all age groups, Paletto et al. [35] found that young people exhibit a greater appreciation for the presence of deadwood in forests from an aesthetic perspective as compared to older individuals. Similarly, a study conducted in Finland Tyrväinen et al. [29] discovered that young people tend to view dead and decayed trees in a more positive light compared to older individuals. These studies are consistent with the results of the present research, providing further evidence that young individuals perceive the presence of deadwood in forests in a positive manner. Conversely, contrasting findings with the aforementioned studies and with the present research are observed in a study conducted in Central Italy by Paletto et al. [34]. The authors emphasized that young people under 25 years of age assign less significance to the biodiversity and cultural values of forests compared to other age groups. Similar observations were made by Pelyukh et al. [55], who examined the preferences of Ukrainian citizens regarding forests with varying amounts of deadwood. The authors found that mature individuals assign greater importance to all positive functions associated with deadwood in forests, such as its contribution to regeneration and stand dynamics, biodiversity conservation, carbon storage, bioenergy production, regulation of the nitrogen and phosphorus cycles, and the stabilization of steep slopes and stream channels, compared to younger individuals. Additionally, people of young generations assign a higher importance to all the negative functions provided by deadwood (i.e., increasing risk of forest fire, obstacle for recreational activities, loss of aesthetic value, increasing risk of insect damage) than mature people.

In light of the results of the present research and the existing literature in the field, it can be asserted that perception and preferences of young generations towards deadwood and biodiversity conservation varies from context to context, also in relation to economic, environmental, and social characteristics.

Other studies on the social perception of deadwood in forests reveal intriguing findings related to the socio-demographic variables of the respondents. For instance, in a study conducted in Latvia, Jankovska et al. [30] demonstrated that males exhibit a more positive perception of dead branches and deadwood in urban forests compared to females. Furthermore, contrasting results are observed in two studies conducted in Sweden. In fact, Golivets [32] discovered that deadwood is one of the significant factors contributing to a negative attitude towards forests, whereas Bakhtiari et al. [56] evidenced that leaving deadwood in forests was considered an acceptable approach to preserving the naturalness of the ecosystem by Swedish citizens. Finally, a positive perception of deadwood was evidenced

in a recent study of Kovács et al. [57]. The research examined the perception of Japanese visitors towards natural deadwood compared to cut wood using a photograph evaluation method. The authors highlighted that Japanese visitors associate the photographs of natural deadwood with aesthetic and spiritual values.

5. Conclusions

5.1. General Remarks

In conclusion, this study presents preliminary findings on the perception of the new generations regarding the role of deadwood in forests, providing insights into their priorities and opinions concerning the aesthetic and ecological significance of this forest component. The findings of the research provide preliminary insights into the attitudes and opinions of Italian and Turkish university students under 25 years old. The results indicate that a significant portion of the participants were aware of the importance of deadwood for biodiversity conservation, recognizing its role in providing microhabitats and food for saproxylic species.

The study revealed that both Italian and Turkish students had a generally positive perception of deadwood in forests, with a higher aesthetic preference for lying deadwood compared to standing dead trees. Furthermore, the majority of respondents preferred management strategies that emulate natural processes, emphasizing the importance of preserving deadwood as an integral component of forest ecosystems.

5.2. Limitations

It is important to acknowledge the limitations of this research. The sample size was relatively small, with participants primarily concentrated in specific geographic areas (Tuscany and the Trentino-Alto Adige region in Italy and the Marmara region in Türkiye), which may limit the generalizability of the findings. The survey dissemination method, relying on personal contacts and social networks, could have introduced biases. Therefore, it is crucial to interpret the results within the context of an exploratory study conducted through convenience sampling. Despite these limitations, this study contributes to the existing literature by shedding light on the perceptions and preferences of young generations regarding deadwood in forests. The insights gained from this research can inform decision makers and managers in making sustainable choices regarding forest management and conservation. Additionally, it addresses a knowledge gap related to the visual-aesthetic perception of deadwood in forest landscapes.

5.3. Future Findings

Further research with larger and more diverse samples is needed to validate and expand upon these preliminary findings. By exploring the attitudes of different demographic groups and considering a broader range of socio-cultural contexts, future studies can provide a more comprehensive understanding of societal perspectives on deadwood and its significance in forest ecosystems. Furthermore, it is worth noting that previous research has highlighted the importance of investigating perceptual differences, particularly in recreational forests or forested areas with high tourist activity, as these contexts may introduce unique perceptual dynamics and expectations among visitors.

Author Contributions: I.D.M. and A.P. conceived and designed the study. S.B. and C.B. coordinated and performed the sample collection. I.D.M. and A.P. analyzed the data and interpreted the results. I.D.M., A.P. and S.B. contributed to the writing and editing as well as review of the relevant literature. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study, due to the regulations of the institutions of the authors, which do not require the approval of the Ethics Committee for anonymous surveys with aggregated data processing.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: In the present study, the methodology of the LIFE SPAN "Saproxylic Habitat Network: planning and management for European forests" (LIFE19 NAT/IT/000104), aimed to identify possible sustainable forest management strategies capable of integrating nature conservation measures in production forests, was applied. This study was conducted in the context of the networking activities of the LIFE SPAN project.

Conflicts of Interest: The authors declare no conflict of interest.

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