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A Birch Tree as a Witness in a Murder and Cannibalism Case

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Abstract: Fifteen years after a murder and an act of cannibalism, the police in Szczecin have conducted an investigation, in which neither the time of the murder, nor the victim identity were known, no body was found, and the defendants have not confessed. Due to the circumstantial nature of the investigation and the trial, a number of analyses were performed, and expert opinions were requested as part of the inquiry. A dendrochronological study of a birch tree growing on the shore of Lake Żabie was one of the analyses lending credibility to the testimony of one of the defendants and pointing to the murder site. The aim of this study was to determine the age and size of the birch tree in the 1998–2002 period, and to determine whether the tree was a distinctive feature of the landscape through the period in question. Field work was performed in April 2019, under the supervision of the police. The birch tree was measured and samples collected using a Pressler borer. The measurements and observations revealed that the birch tree, due to its size, and the absence of other trees of this species in this segment of the lake shore, may have been a characteristic landscape element in the late 1990s and early 2000s. According to the police officer and the prosecutor in charge of the case, the results of the dendrological analysis have lent a strong credibility to the testimony of one of the defendants and other findings of the investigation.

Keywords: betula; tree-ring width; forensic expert opinion

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1. Introduction

Trees tied to a given habitat through the entire lifespan, record environmental changes in their tree rings. The changes may be natural, but they may also be associated with human activity, e.g., environmental pollution, culturing procedures, earthwork, etc. This record is also archived in the wood, which may be subsequently used for various purposes. Murder weapons or items used during a crime are frequently made of wood, or when trees are present at a crime scene, it is possible to use the information recorded in the wood [1–3]. Such information is often of crucial importance for solving criminal riddles. Dendrochronology-based evidence has been admissible in courts for decades. A textbook example of this is the 1932 "Crime of the Century", case involving the kidnapping and death of the 10-month-old son of the aviator Charles Lindbergh [1]. The child was kidnapped from the first floor of a house using a wooden ladder, which was left behind close to the crime scene. The ladder was examined by Arthur Koehler, who performed remarkably detailed analyses of the wood anatomy, tree-ring width, and woodworking traces. These analyses enabled him to indicate the origin of the wood, close to where Hauptmann (whose identity was unknown at that time) had been living. After the perpetrator was found, Koehler was able to prove that the ladder was made of boards kept at the attic of Hauptmann's house using machines kept in the same attic. Although the suspect never confessed, the evidence provided by Koehler contributed to the conviction, which eventually led to an execution [1].

Illegal burials, or sites where a corpse is hidden, are frequently located close to trees. In such cases, a dendrochronological analysis of tree roots may be useful for indicating a minimum postmortem interval (PMI). This is because roots often grow through human remains, or trees may grow on a grave. Burials in Massachusetts, where tree-ring dating in

the roots of Pinus rigida and Acer saccharum gave an estimated PMI of 27 and 14.5 years [2], may serve as an example.

An analysis of chemical substances comprising wood (of living trees or wood pieces), corroborated witness testimony, e.g., in the case of a missing woman in Chicago in July 1981. As it turned out, she was murdered by her husband, and her body was subsequently burned in a barrel under the tree indicated by the witness. Dendrochronology corroborated the time of the murder, and chemical analysis confirmed that diesel fuel was used to burn the victim's body [3].

Although very complicated, dendrochronological and chemical analyses may reveal the time and place of a discharge of pollutants. An interesting application of tree-ring width examination and genetic analysis is identifying the origin of illegally logged valuable tree species, or trade in protected species [3]. Dating/verifying the authenticity of artwork, such as paintings, furniture or musical instruments, is another application of dendrochronology. An example is the dating of the famous violin nicknamed "Messiah", which is attributed to Antonio Stradivari [4]. This publication actually indicates Jean-Baptiste Vuillaume, a French luthier known for his copies of famous instruments, as the manufacturer of the "Messiah". Publication [4] also points to a number of methodological issues, including those associated with the utilized software, which may lead to erroneous age determinations [4].

Dendrochronological publications focusing on birch trees are rather uncommon. They concern mostly the birch species occurring in Asia (e.g., *Betula utilis* [5–7]; *Betula platyphylla* [8]) and in North America (e.g., *Betula papyrifera* [9]). In Europe, dendrochronological papers on *Betula* spp. are also rather rare, e.g., *B. pendula* from the Spanish Pyrenees [10], Poland [11], Czech Republic: [12], and *B. pubescens* from the southern part of Poland [13], northern Norway [14,15] and Sweden [16].

Betula pendula Roth from northeastern Poland, 70 to 72 years old, from the first bonitation and from the first biosocial class, according to Kraft, the so-called towering trees (the height of the trees was about 22 m) were the subject of dendrometric analyses. These birch trees were characterized by an average annual growth of 2.6 mm, ranging from 0.4 to 6.5 mm. Two growth phases were distinguished according to the annual growth rate: a juvenile phase spanning the first 25 years of the tree's life, and a mature phase, after the completion of the 25th year of life [11]. Tkaczyk and Tomusiak [17] focused only on young birch trees (*B. pendula*) from central and eastern Poland, determining the age vs. breast height diameter relationship. Tomusiak et al. [18], in turn, compiled arrays for the age vs. breast height diameter vs. the height of young birch trees (<23 years old B. pendula) in Poland. Bijak and Jatczak [19] studied the correlation between tree-ring width and the date of the leaves unfolding for the silver birch in northeastern Poland. Dendrochronological studies on *B. pubescens* in Poland were conducted by [13] (on an ombrogenic peat bog in the Sudetes). The annual tree-ring width of birch was between 0.2 and 1.6 mm (mean = 0.42 mm).

Grissino-Mayer [20] distinguished 13 birch species, most of which have a Crossdating Index (CDI) equal to 0, meaning that the "species does not crossdate, or no information on crossdating for this species has been published". Five *Betula* spp. have been assigned a CDI on the order of 1, i.e., the "species is known to crossdate between cores from the same tree as well as between trees from the same site (between-tree Crossdating), representing a species useful for interpreting local site conditions—minor importance in dendrochronology". Both *Betula pendula*, code-named BEPE, and *B. pubescens*, code-named BEPU, have a CDI on the order of 1 [20]. A search for the query "*Betula*" in the International Tree-Ring Data Bank (ITRDB, https://www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets/tree-ring, accessed on 28 March 2023), which contains >5000 data sets from six continents, returns only 13 datasets, including none for *B. pendula* and one for *B. pubescens*, Sweden, Abisko Valley [21].

Two species of birch are the most common in Poland: *Betula pendula* (silver birch) and *Betula pubescens* (white birch). The silver birch is the most common species of the genus. It grows most frequently on dry and sandy substrata, along with the Scots pine,

juniper and heather [22]. The white birch is typical for humid, marshy and peaty soils, and often accompanies the alder and the willow [23]. In Poland, these species often form hybrids [24–26]. Birch trees are regarded as fast-growing, reaching up to 100, rarely 150 years. They are characterized by a shallow root system, are easily wind-dispersed, and considered as pioneer species [25].

The wood of the two birch species native to Poland (*Betula pendula* and *B. pubescens*) cannot be distinguished based on anatomic features alone [27]. The birch wood is diffuse to semi-ring porous, with sparse, fine and medium tracheids, uniformly distributed in a tree-ring. Rays are mostly 2–4 cell wide, and heartwood is absent [27,28].

The present analysis aimed at determining the age of a particular birch tree, determining its size in the period of 1998–2002, and determining whether the tree may have been a characteristic feature of the landscape in that particular segment of the lake shore.

2. Materials and Methods

2.1. The Event Description

In 2017, the police headquarters in Choszczno (NW part of Poland) received a message (an email according to some sources, a traditional letter according to others) with a confession to a murder committed at the shore of Lake Żabie (part of Lake Osiek), along with the description of the circumstances of the event. A police inquiry was started immediately, and control over the investigation was given to the Voivodeship Police Headquarters in Szczecin, Undetected Crime Unit, more widely known as the X-Files (the name originates from the title of a TV series, of which the main theme were investigations into difficult, unexplicable cases). The case was nicknamed "Lecter", an allusion to Dr. Hannibal Lecter, the murder/cannibal antagonist of the well-known motion picture "The Silence of the Lambs", 1991, whose part was played by Sir Anthony Hopkins). The investigation quickly revealed that the author of the message died recently, and the message was delivered to the police posthumously. Accordingly, it was reported by the media as "a letter from beyond the grave".

The investigation found that between July and October 2002 (15 years prior to notifying the police), five male acquaintances met in a bar/fish and chips spot in Łasko (a village in Choszczno district). While the men were drinking alcohol, one of them spotted another acquaintance, a person he held a grudge against (reportedly he lost money because of that person). The men present at the scene beat the newly arrived person, dragged him into a car ("Tarpan" brand), and took him to the shore of Lake Osiek. There, on the orders of the victim's "acquaintance", one of the men (the deceased author of the "letter from beyond the grave"), slit his throat and decapitated him, undressed the body and eviscerating it, and sliced off five pieces of the body. Again, acting on the orders of the victim's „acquaintance", the remaining men baked the body parts over a previously started fire, using previously prepared sticks, and ate them. The remaining parts of the corpse were wrapped in foil, weighed down with rocks, and dumped into the lake from a rubber boat belonging to one of the men present at the scene. One of the participants of the event took part of the meat home and put it in the refrigerator. It was eaten by his flatmate, who was unaware of the provenance of the meat. Due to the unusual taste of the meat, the flatmate was not convinced when he was told that it was rabbit meat. For many years, silence fell among the perpetrators of the murder and the cannibalism act.

Because of the long time that has passed since the murder was committed, the investigators faced numerous problems. Only one of the living co-perpetrators confessed to taking part in the event described above (he withdrew his testimony afterward). Other participants did not confess, but conversations of one of the perpetrators obtained by eavesdropping were used as evidence in the trial. No precise date of the murder was established; it occurred approximately between July and October 2002. The identity of the victim was not determined, despite a search among the reported missing persons and those in conflict with the instigator of the crime. Despite continued search, no remains of the victim were found. The bottom of the lake was searched using acoustic methods,

hydrographic devices, and by divers. It was concluded that the bottom of the lake is silty and unstable, and thus it could not be ruled out that the body was resting deep within the silt. The car used to take the victim to the lakeside spot was not retrieved (it was probably scrapped before). Additionally, the rubber boat used to dump the body parts into the lake could not be found. The suspect who confessed was subjected to psychiatric observation in order to rule out mental illness. He was diagnosed with a mild mental condition, alcohol addiction, and memory disorders. Despite that, his confessions, upon which the whole case of the prosecution was based, were deemed credible.

In 2021, the court of first instance found only one of the defendants guilty, "the instigator of the crime, the acquaintance of the victim, allegedly wronged by the victim financially". He was sentenced to 25 years in prison for initiating the crime and desecrating the corpse. Under the Polish penal code, cannibalism is treated as a form of corpse desecration, punishable by up to two years in prison. Due to the fact that the act of cannibalism took place in 2002, the accusation of corpse desecration made against the remaining three defendants was expired, which is why they were not sentenced. In the course of the investigation, however, they spent about two years under pre-trial detention. In March 2023, the Court of Appeals in Szczecin upheld the ruling of the court of first instance; the verdict is legally binding.

The crime described here is the first trial in a case of cannibalism in post-war Poland. Because of the character of the case and the circumstantial evidence, the case caused a considerable outcry and controversy, both among the investigators and the public.

The description of the events was drafted based on media coverage taken from the following online sources: tvp.pl (accessed on 28 March 2023), o2.pl (accessed on 28 March 2023), gs24.pl (accessed on 28 March 2023), tvn.pl (accessed on 28 March 2023), onet.pl (accessed on 28 March 2023).

2.2. The Birch and Its Significance

One of the key elements in the case was the examination of the site where both the crime and the act of cannibalism were perpetrated. One of the suspects indicated the shore of Lake Żabie (part of Lake Osiek), and provided a detailed description of the transit route taken and the murder spot (about 800 m from the exit from the paved road). During on-site verification, the suspect led the investigators to a currently strongly overgrown dirt road along the lake (currently impassable), erratic boulders next to the road on the way to the crime scene, and the crime scene itself. According to the description provided by the suspect, and later also according to the on-site verification, a distinctive tree was growing there in 2002. It was a birch tree, the only tree of this species on this side of the lake (52.9412672 N, 15.6784714 E, 52 m a.s.l.). Under the tree (in its immediate surrounding), there was a small clearing with access to water. The local inhabitants used this spot for bivouacs, campfires, and as a wild beach. A search of the surroundings using—among other devices—metal detectors, did not yield the expected results. It confirmed only that the place was frequently used for alcohol consumption. The spot where the fire had been burned was not located either. At present, the lake shore is inhabited by a family of European beavers (*Castor fiber*), who cut down a large number of trees, making the search difficult. The description of the scene and the access road provided by the suspect, and the subsequent on-site verification, both gave credibility to his testimony.

3. Results

Dendrochronological Analysis of the Birch

In April 2019, the police unit in charge of the investigation decided to consult a dendrochronologist regarding the distinctive tree growing at the crime scene. The aims of the examination included: 1. collecting samples (cores) from the tree: a birch growing (…) next to the shore of Lake Żabie, forming part of Lake Osiek, on the opposite side of the beach in Ługi, Dobiegniew commune, Lubuskie Voivodeship; and 2. determining the age and size of the birch tree in the period of 1998–2002, and determining the current

age of the birch tree based on the collected samples. The analysis was given high priority as requested by the police due to the character of the case, and the fact that the suspects remained in custody. The person conducting the analysis was not made familiar with the details of the case.

The field work was conducted in the presence of the police officers leading the investigation on 10 April 2019. At the site, previously identified by GPS coordinates, a tree was located, most likely representing a natural hybrid of *Betula pendula* × *B. pubescens* (visual identification based on the appearance of the trunk and the shape of the crown, with no access to twigs and leaves), growing 5.3 m from the shore and 1.2 m above the base of the scarp (Figure 1D). Sand and gravel occur in the substratum here, but due to the close proximity of the lake shore and low elevation above the water table (20–30 cm), a permanently high ground water level is noted in the soil, as evidenced by the vegetation along the lake shore. Old maps indicate that there was once a gravel path between the scarp and the lake shore (Figure 1C). At present, as a result of decades of neglect and because of fallen trees and beaver activity, the path is no longer visible in the field. The studied tree was growing adjacent to this road or in its immediate surroundings. It was observed that within 800 m in each direction along the lake shore (along the old road), no other individuals of this species (or of other birch species) occur, including both growing and fallen trees (due to beaver activity or broken by wind). The field work involved performing photographic documentation and measuring the tree location relative to the lake shore and scarp base and determining the trunk circumference. As of 2019, the studied tree had a breast height (1.3 m above the ground) circumference of 1.8 m, i.e., a diameter of 57 cm. At the ground level, the circumference equaled 2.3 m (73 cm diameter). The tree is slightly inclined toward the lake shore. The trunk displayed no discernible damage. The crown was located high and well-developed (the observations were performed in the first half of April, then the tree lacked leaves). The birch tree attained large size (>10 m height, thick trunk) and was characterized by good health. Samples for dendrochronological analyses were collected using a Pressler borer, at the breast height. Sample no. 1 was taken on the side of the scarp, sample no. 2 on the side of the lake, and sample no. 3 was taken about 30 cm above ground level on the south-facing side (perpendicularly relative to samples no. 1 and no. 2). The sampling spots were sealed using wooden pegs having the same diameter as the borer, and secured using the fungi- and bactericide, Lac Balsam. The samples were packed in special boxes for protection in transit to the laboratory. Following the transit, the samples were glued onto specially prepared boards. Once stuck to the boards, the sample surfaces were sliced with a knife in order to identify the tree-ring boundaries. Sample no. 1 was 14 cm long (including bark), sample no. 2–32 cm long (including bark), and sample no. 3 was 27.5 cm long (including bark). As the birch wood is diffused to semi-ring porous, the tree-ring boundaries were poorly visible (additionally samples were smeared with chalk in order to enhance the ring boundaries), and core rays mostly 2–4 cells wide or uniseriate. The wood color was yellowish, ranging to brown in the central parts of the trunk. Based on the collected samples, using a cross-dating method [29], it was possible to determine the approximate age of the tree (down to several years), and estimate its size during the period in question. The tree-ring widths were measured using a binocular microscope, down to 0.01 mm, using the Dendrometer software [30]. All abnormalities in ring structure were noted during the measurments.

At the breast height, the average tree-ring width was 4.1 mm, while 30 cm above ground, it was 4.4 mm (Table 1). The oldest tree-ring was obtained in sample no. 2 (from 1957) (Table 1). The tree was inclined, which probably causes a non-concentric tree-ring pattern and contrasting average tree ring widths (the core is not located in the center of the trunk). The studied birch tree most probably seeded itself at this spot in the early 1950s. In 2018, the tree was almost 70 years old. In 1998, its breast height diameter equaled 41–42 cm, and ground-level diameter, about 62 cm. In 2002, the breast height diameter of the birch tree was about 44 cm, and about 65 cm at the base. In 1998, the birch was about 45–50 years old, and in 2002 it was 49–54 years old.



Figure 1. Location of the study area. Map sources: (**A**,**C**)—www.mapy.cz, (accessed on 28 March 2023) (**B**)—3060 (1566) Woldenberg Planblatt A, 1936 (http://igrek.amzp.pl/details.php?id=11821841 (accessed on 28 March 2023)), (**D**)—the studied birch tree on the shore of Lake Żabie.

Table 1. Tree-ring measurements for the studied birch tree.

Sample No.	Number of Tree Rings	Years	Average Tree-Ring Width
1	39	1980–2018 *	3.2 mm
2	62	1957–2018 *	5.0 mm
3	55	1964–2018 *	4.4 mm

2018 *—the samples were collected in April 2019, before the onset of cambial activity, therefore the last dated tree-ring is the one formed in 2018.

The conducted analysis was the basis for an assertion, and based on its size and the absence of trees of this species at this segment of the lake shore, the studied birch tree may have been a characteristic element of the landscape in the late 1990s and early 2000s. The opinion was formulated on 17 April 2019, and the samples were included with the opinion.

4. Conclusions

Due to the circumstantial character of the trial and the long time that has passed between the crime date and the investigation (unknown victim identity, no victim body, undetermined crime date, lack of confession of the key suspect, scarcity of evidence), the results of the dendrochronological analysis, according to the police officer and the prosecutor in charge of the case, gave strong credibility of the testimony provided by one of the defendants, and other findings of the investigation. The distinctive birch tree actually became a witness of a gruesome crime and an act of cannibalism.

Although it is not the first case of dendrochronology-based approach to reconstructing the circumstances of various crimes and offences, the present study is the first publication regarding a forensic application of dendrochronology in Poland. Frequently, however, various measures are undertaken to avoid the impairment of the investigation, as parts of the case are classified, and thus the publication of dendrochronological results that could aid in solving cases such as this is often impossible.

The use of dendrochronological methods in forensics is markedly increasing. However, persons performing such analyses are required to use reliable and broadly described methods, and to exercise extraordinary caution in generating the data, and in discriminating

between natural processes and human impact on the traces recorded in the wood. The replicability and precision of the results are also required.

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Data Availability Statement: For the sake of the investigation, the data cannot be transferred to an open repository.

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

References

1. Graham, S.A. Anatomy of the Lindbergh kidnapping. *J. Forensic Sci.* **1997**, *42*, 368–377. [CrossRef]
2. Pokines, J. Two cases of dendrochronology used to corroborate a forensic postmortem interval. *J. Forensic Identif.* **2018**, *68*, 457–465.
3. Balouet, B.; Burken, J.; Martelain, J.; Lageard, J.; Karg, F.; Megson, D. Dendrochemical forensics as material evidence in courts: How could trees lie? *Environ. Forensics* **2021**, *24*, 21–27. [CrossRef]
4. Grissino-Mayer, H.D.; Sheppard, P.R.; Cleaveland, M.K.; Cherubini, P.; Ratcliff, P.; Topham, J. Adverse implications of misdating in dendrochronology: Addressing the re-dating of the "Messiah" violin. *Dendrochronologia* **2010**, *28*, 149–159. [CrossRef]
5. Bhattacharyya, A.; Shah, S.K.; Chaudhary, V. Would tree ring data of Betula utilis be potential for the analysis of Himalayan glacialfluctuations? *Curr. Sci.* **2006**, *91*, 754–761. Available online: https://www.jstor.org/stable/24093904 (accessed on 29 March 2023.).
6. Monoldorova, A.; Hailiang, X.; Bakhtiyorov, Z.; Xinfeng, Z. Comparison Growth Situation of Tree-Ring Width between *Poplars* and *Betula* at the Floodplain Irtysh River, Altai, China. *Asian J. Plant Sci. Res.* **2017**, *7*, 124–132.
7. Bista, R.; Chhetri, P.K.; Johnson, J.S.; Sinha, A.; Shrestha, K.B. Climate-Driven Differences in Growth Performance of Cohabitant Fir and Birch in a Subalpine Forest in Dhorpatan Nepal. *Forests* **2021**, *12*, 1137. [CrossRef]
8. Gradel, A.; Ganbaatar, B.; Nadaldorj, O.; Dovdondemberel, B.; Kusbach, A. Climate-growth relationships and pointer year analysis of a Siberian larch (*Larix sibirica* Ledeb.) chronology from the Mongolian mountain forest steppe compared to white birch (*Betula platyphylla* Sukaczev). *For. Ecosyst.* **2017**, *4*, 22. [CrossRef]
9. Bumann, E.; Awada, T.; Wardlow, B.; Hayes, M.; Okalebo, J.; Helzer, C.; Mazis, A.; Hiller, J.; Cherubini, P. Assessing responses of *Betula papyrifera* to climate variability in a remnant population along the Niobrara River Valley in Nebraska, U.S.A., through dendroecological and remote-sensing techniques. *Can. J. For. Res.* **2019**, *49*, 423–433. [CrossRef]
10. Montero, X.C.; Merino, E.G. Phenology and Stem Growth Dynamics of *Betula pendula* Roth. In *The Spanish Pyrenees*, 1st ed.; Research Square: Durham, NC, USA, 2022. [CrossRef]
11. Dobrowolska, E.; Wroniszewska, P.; Jankowska, A. Density Distribution in Wood of European Birch (*Betula pendula* Roth.). *Forests* **2020**, *11*, 445. [CrossRef]
12. Giagli, K.; Vavrčík, H.; Fajstavr, M.; Černý, J.; Novosadová, K.; Martiník, A. Stand factors affecting the wood density of naturally regenerated young silver birch growing at the lower altitude of the Czech Republic region. *Wood Res.* **2019**, *64*, 1011–1022.
13. Obidziński, A.; Kloss, M.; Cedro, A. Is spontaneous regeneration of raised mire vegetation possible? A case study of the 'Czarne Bagno' mire in the Bystrzyckie Hills, southern Poland. *Holocene* **2009**, *19*, 229–239. [CrossRef]
14. Opała, M.; Migała, K.; Owczarek, P. Two centuries-long dendroclimatic reconstruction based on Low Arctic *Betula pubescens* from Tromsø Region, Northern Norway. *Pol. Polar Res.* **2016**, *37*, 457–476. [CrossRef]
15. Harr, L.; Esper, J.; Kirchhefer, J.A.; Zhou, W.; Hartl, C. Growth response of *Betula pubescens* Ehrh. to varying disturbance factors in northern Norway. *Trees* **2021**, *35*, 421–431. [CrossRef]
16. Stridbeck, P.; Bjorklund, J.; Fuentes, M.; Gunnarson, B.E.; Jonsson, A.M.; Linderholm, H.W.; Ljungqvist, F.C.; Olsson, C.; Rayner, D.; Rocha, E.; et al. Partly decoupled tree-ring width and leaf phenology response to 20th century temperature change in Sweden. *Dendrochronologia* **2022**, *75*, 125993. [CrossRef]
17. Tkaczyk, M.; Tomusiak, R. Określanie wieku młodych brzóz *Betula pendula* Roth rosnących na gruntach porolnych [Determining the age of young silver birch (*Betula pendula* Roth) trees growing on former agricultural]. *Leśne Pr. Badaw. (For. Res. Pap.)* **2013**, *74*, 357–363. [CrossRef]
18. Tomusiak, R.; Ludwisiak, Ł.; Bronisz, K.; Baran, E.; Bronisz, A.; Wojtan, R.; Bijak, S.; Czajkowski, M.; Zasada, M. Tabele wiekowe dla drzew z wczesnosukcesyjnych drzewostanów brzozy brodawkowatej (*Betula pendula* Roth) na gruntach porolnych [Age tables for silver birch (*Betula pendula* Roth) trees for early succession stands on abandoned agricultural lands]. *Sylwan* **2014**, *158*, 579–589.
19. Bijak, S.; Jatczak, K. Relationships between tree-ring width and date of phenophases: A case study with silver birch (*Betula pendula* Roth.). In *Trace—Tree Rings in Archeology, Climatology and Ecology*; Kaczka, R., Malik, I., Owczarek, P., Gärtner, H., Heinrich, I., Helle, G., Schleser, G., Eds.; Scientific Technical Report STR 09/03; GFZ: Potsdam, Germany, 2009; Volume 7, pp. 116–120.

20. Grissino-Mayer, H.D. An updated list of species used in tree-ring research. *Tree Ring Bull.* **1993**, *53*, 17–43.
21. Hoogestergar, J. *Abisko Valley—BEPU—ITRDB SWED329*; NOAA National Centers for Environmental Information: Asheville, NC, USA, 2008. [CrossRef]
22. Tree Factsheet—Betula pendula Roth. Forest Ecology and Forest Management Group. *Wageningen University.* Available online: https://www.wur.nl/upload_mm/2/6/1/d1d6328c-7721-4210-a041-2794ea5caeb3_betpenf.pdf (accessed on 24 March 2023).
23. Tree Factsheet—Betula pubescens Ehrh. Forest Ecology and Forest Management Group. *Wageningen University.* Available online: https://www.wur.nl/upload_mm/d/5/1/e12efea4-976c-49c7-932e-63a8c756f51e_betpubf.pdf (accessed on 24 March 2023).
24. Seneta, W.; Dolatowski, J.; Zieliński, J. *Dendrologia [Dendrology]*; Wydawnictwo Naukowe PWN: Warszawa, Poland, 2021; p. 832.
25. Vakkari, P. Silver birch (*Betula pendula*). In *EUFORGEN Technical Guidelines for Genetic Conservation and Use of Silver Birch (Betula pendula)*; Bioversity International: Rome, Italy, 2009; 6p, ISBN 978-92-9043-803-8.
26. Beck, P.; Caudullo, G.; de Rigo, D.; Tinner, W. Betula pendula, Betula pubescens and other birches in Europe: Distribution, habitat, usage and threats. In *European Atlas of Forest Tree Species*; Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A., Eds.; Publication Office of the European Union: Luxembourg, 2016; pp. 70–73. [CrossRef]
27. Schweingruber, F.H. Microscopic Wood Anatomy. In *Swiss Federal Institute for Forest, Snow and Landscape Research*; WSL: Birmensdorf, Switzerland, 1990; pp. 1–226.
28. Godet, J.-D. *Atlas Drewna (Wood Atlas)*; MULTICO Oficyna Wydawnicza: Warszawa, Poland, 2008; p. 127.
29. Cook, E.R.; Kairiukstis, A. *Methods of Dendrochronology*; Kluwer Academic Publishers: New York, NY, USA, 1992; pp. 1–394. ISBN 0-7923-0586-8.
30. Mindur, B. *Dendrometer 1,0*; Mindur B.: Kraków, Poland, 2000.

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