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Dendrochronological Studies of an Alpine Village (Courbons, Digne-les-Bains, France)

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Abstract

A dendrochronological study of Courbons, a village in the southern French pre-Alps, was conducted to improve our understanding of its history, strengthen the reference chronologies, and reconstruct the outlines of historical forests. A total of 20 buildings were subjected to dendrochronological sampling. The 145 sampled wood pieces were of nine different species, 44 of which are dated from larch, fir, and deciduous oak. Two main construction phases were identified (from the 13th–16th century CE and from the 18th–20th century CE), separated by a hiatus during the 17th century CE. A scarcity of resources could be the cause of the hiatus. We noticed that oak trees were only used before the 16th century CE and that trees felled after the 17th century CE grew better than those that were felled before this period. Based on historical published data, we assumed that demographic variations, trees reserved for shipbuilding, and pressures from pastoralism could explain the dendrochronological results.

Keywords

Alps – timber – oak – palaeo-landscape – medieval period – modern period

1 Introduction

Dendrochronological studies have been carried out on traditional buildings in the southern French Alps for the past three decades to determine their age and understand traditional construction practices (Edouard 2010a, 2010b; Guibal & Meyran 2011; Labbas 2016; Shindo 2016). These dendrochronological studies

are part of an extensive collection of regional archaeological and palaeoecological research (Miramont *et al.* 2000; Talon 2010; Brisset *et al.* 2013; Walsh *et al.* 2013; Py *et al.* 2014). However, for the pre-Alps region and, in particular, the area surrounding the town of Digne-les-Bains, near Courbons (Fig. 1), a significant

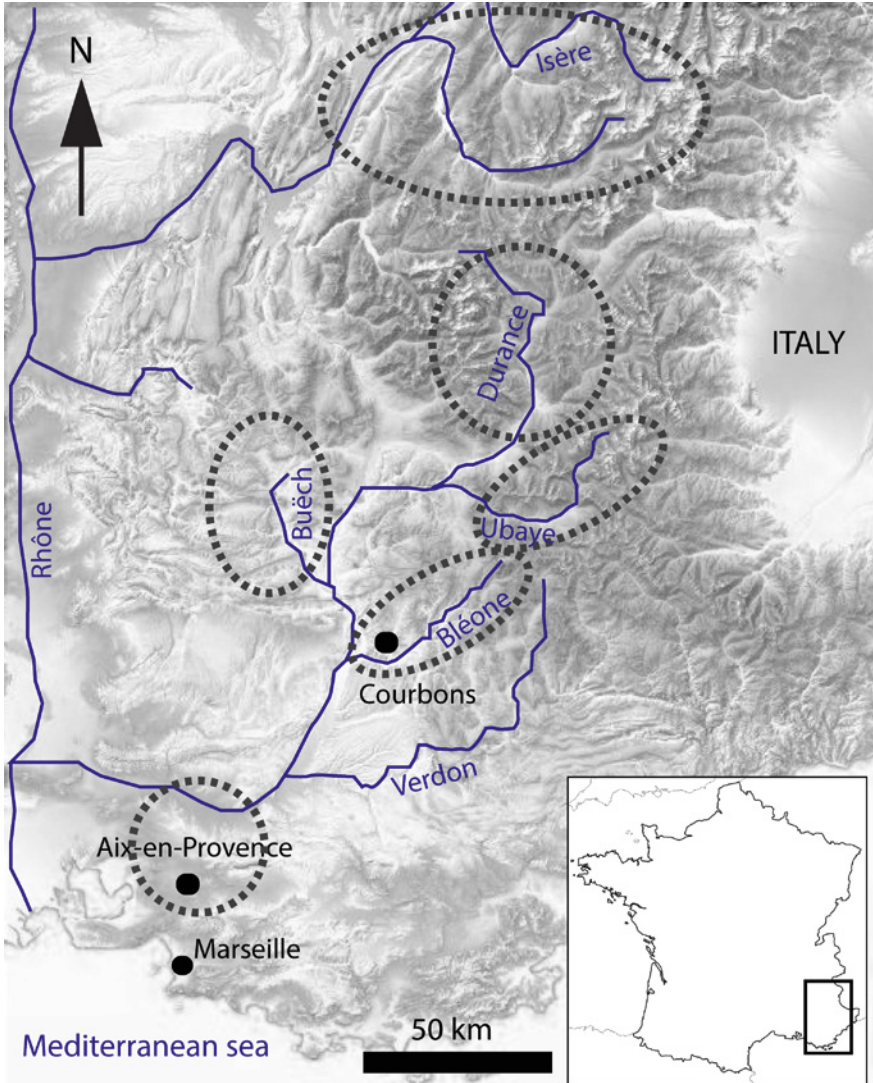


FIGURE 1 Map of southeastern France (from IGN scan25). The dotted lines represent the known wood supply areas for the cities of Aix-en-Provence and Marseille in medieval and modern times (according to Boyer 1983; Bernardi 1995; Shindo & Claude 2019), as well as the rivers linking the Alps to the Mediterranean Sea.

dearth of research is evident: it is the “poor relation of Provence” compared to the amount of research published on this region. (Fabre and Labadie 2012, p. 9). This may be a result of its geographical position between the inner Alps and the Mediterranean, which, from a dendrochronological standpoint, makes it a complex yet fascinating transition zone. The contemporary vegetation cover of this area is very diverse, mainly consisting of Scots pine (*Pinus sylvestris* L.), fir (*Abies alba* Mill.), and larch (*Larix decidua* Mill.) tree species, signifying a typical association of western alpine plant species. In addition, the pubescent oak (*Quercus pubescens* Willd.), beech (*Fagus sylvatica* L.), holm oak (*Quercus ilex* L.), and Phoenician juniper (*Juniperus phoenicea* L.) tree species in this area, represents a combination of plant species typically found on the northern shore of the Mediterranean (Blanchard 1949; Ozenda 1985). Following reforestation efforts in the 19th and 20th centuries CE, Austrian black pines (*Pinus nigra* R.), hooked pines (*Pinus uncinata* Ramond), and larches were planted on slopes that had been severely deforested. Accordingly, there is a vast selection of species available for construction, and these forests are primarily used as a source of wood for building structures. In this region, urban houses are narrow and up to five storeys high, necessitating an equal number of wooden ceilings (Blanchard 1949; Fabre Labadie 2012; Brunet *et al.* 2019).

The village of Courbons is perched on the foothills of Siron Mountain, whose highest peak (“La Bigue”, 1652 m in altitude) is 4.5 km to the northwest when measured in a straight line. Courbons is located at an altitude of 920 m on a rocky promontory overlooking a north-south oriented agricultural area. It borders the Bléone River and the town of Digne-les-Bains to the south, with which it is now administratively linked. There is presently farmland, moorland, and a few scattered trees (broadleaved and coniferous) within a 1-km radius of Courbons.

Beyond this radius, there is primarily regrowth of black pine trees from the 19th century CE. Currently, the first pure closed stands of deciduous oak can be found 1 km to the northwest after crossing a pass at an altitude of 1100 m. In addition, stands of Scots pine are located 3 km to the north at an altitude of 1390 m, and larch stands can be found 4 km to the north at an altitude of 1550–1650 m.

Numerous buildings in Courbons (80 permanent residents) have not been restored, and their timbers are still in their original positions that are accessible for coring. Moreover, thanks to a local heritage association, the inhabitants were made aware of dendrochronology and agreed to allow us to collect samples from their residences (Fig. 2). Therefore, we were able to conduct research in a vast number of buildings in order to develop the most complete dendrochronological methodology feasible, with three research aims.



FIGURE 2 Selection of exterior and interior views of some of the studied buildings. (A) The village tower, currently the clock tower; (B) and (C) the exterior and interior of the oil press building, respectively; (D) and (E) the southwestern facade of the church and photographic recording of the rings of the planks of the small southeastern door, respectively; (F) the south facade of a house built on the rampart; (G) in the background on the left, one of the studied houses, and in the foreground on the right, one of the last remains of the rampart; (H) some of the deposited timbers were sampled with a chainsaw; (I) an oak ceiling of a former stable; (J) ceilings with visible beams and joists (fir and larch) on the first floor of a house; and (K) core sampling of a joist in a former stable.

The primary objective of this study was to provide absolute dating elements through dendrochronological analysis of timber and to understand the use of wood in construction. Indeed, a few dated elements concerning the history of Courbons are established with certainty: the human occupation of the site dates back to the ninth century BCE (Bérard 1997), and the earliest mention of the settlement in written records dates back to 1191 CE (Vautrin 2020). At least since the 16th century CE, a rampart surrounded the village centre, which was built on a rocky promontory and represented the highest point of the site (Fig. 3) (Vautrin 2020). However, the age of the housing structures is unknown.

Courbons village is situated 3 km from the Bléone River, and 18 km northeast of its confluence with the Durance River, which flows into the Rhône River and the Mediterranean Sea (Fig. 1). These rivers comprise a comprehensive water transportation network that links the pre-Alp region to the Mediterranean Sea.



FIGURE 3 Aerial view of the village of Courbons (from Geoportail.fr). The studied buildings are marked in green (four are located outside of the plan). The dotted line denotes the location of the old ramparts (from Vautrin 2020).

Archaeological discoveries and historical manuscripts demonstrate that wood has been extensively utilised for naval and terrestrial construction, as well as fuel, on the northern and eastern shores of the Mediterranean since antiquity as well (Thirgood 1981; Meiggs 1983). However, palaeo-environmental studies indicate that the forests had already been altered by humans in antiquity, necessitating the importation of wood from mountain source forests on a grand scale (Laval-Triat 1985; Guibal & Tessier 1998). From at least the medieval period onwards in southeastern France, lowland and coastal towns had a strong demand for timber and imported it from at least six regions spanning from the hinterland to the northern Alps (dotted areas on the map in Fig. 1) (Boyer 1983; Bernardi 1995; Shindo & Claude 2019). The supply areas (source forests) above an altitude of 1000 m are well known and documented in dendrochronology (Serre 1978; Tessier 1984; Belingard & Tessier 1997; Edouard & Thomas 2008; Edouard *et al.* 2009; Saulnier 2012), but this is not the case for supply areas at lower altitudes, particularly the Bléone River area. However, in order to trace the wood trade routes between the Alps and the Mediterranean, dendrochronological references are needed for all potential source forests. Therefore, our second objective was to contribute to the dendrochronological references reinforcement of one of these zones, the Bléone River, where the village of Courbons is located.

Finally, our third objective was to investigate the history of the heavily forested Courbons environment. Complete dendrochronological studies of prehistoric wet archaeological circum-alpine villages have already yielded considerable quantities of wood in a perfect state of preservation (see, for example, Winiger 2008; Billamboz 2010; Martinelli 2013; Bleicher & Harb 2018). It is considered that the wood used in these prehistoric villages was locally sourced, and we have access to all sizes utilized. This has allowed for the detailed reconstruction of the historical appearances of forests and the investigation of silvicultural practices that were applied to manage them. These studies are authoritative in the field of dendroarchaeology. In contrast, during the medieval and modern periods, there are considerably fewer dendrochronological studies of rural villages (except, for example, in Italy and Switzerland: Boccaleri 1985; Donati 1988; Orcel & Orcel 1988), and their purpose is not to establish a link with the environment. However, a little further north in the Jura Mountains, A. Billamboz (1990, 2021) studied a village by combining dendrochronological dating (80 oak beams from 12 buildings), historical sources, and an analysis of the growth patterns of living trees in the vicinity to reconstruct part of the forestry history of this region. Drawing on these studies and a large corpus of dry timber from standing buildings, we intended to reconstruct the appearance of the medieval and modern forests surrounding Courbons,

as well as outline the potential anthropogenic impacts that prevailed. For this purpose, we propose a dendroecological analysis of timbers in the Courbons region. We examined to what extent dendrochronology can contribute to this issue. Moreover, to interpret and discuss these dendrochronological results, they were compared with previously published historical research.

2 Material and Methods

We collected dendroarchaeological samples as part of various research projects on the buildings of the Southern French Alps and human-environment relations in this region. Since 2014, a productive relationship with the local inhabitants and official heritage institutions has allowed us to work in 18 private buildings (17 houses and an oil press), as well as in two public buildings (a church and a tower) (Fig. 2). Apart from the church, tower, and oil press, these buildings combined agricultural or livestock activities (stables, granary) with residential function. Seven buildings were located within the historic ramparts in the heart of the village, nine were directly outside the ramparts, and the remaining four were up to 2 km away (Fig. 3).

A total of 145 pieces of wood were collected and sampled. We used a Pressler manual increment borer (Haglöf, Sweden), a Rinntech electric core drill (Rinntech, Heidelberg, Germany), and occasionally a chainsaw while removing timbers from the structures. Where it was not possible to collect samples, such as on furniture, the transverse planes of the wood pieces, where the ring boundaries were apparent, were photographed (Fig. 2E, H and K).

Wood species were determined in the laboratory (Schweigruber 1990), and ring widths were measured with 0.01 mm accuracy using an incremental measuring table (Lintab, Effretikon, Switzerland) and TSAP-Win software (Rinntech 2014). In each instance, several rays were measured per sample and averaged to obtain a series suitable for dating. Then, using Dendron IV software (Lambert 2006), tree-ring series data were indexed using the “Corridor”, a polynomial indexation that accounts for the amplitudes of inter-annual variations while preserving the average frequency variations (Durost 2005; Lambert 2006; and presentation in English in Shindo & Giraud 2021). Following indexing, the curves were cross-dated using Student’s *t*-test. The dendrochronological references used for dating were derived from aged forest stands and archaeological woods, created by laboratories in Marseille and Aix-en-Provence (France), over the past 30 years. As is common in dendroarchaeology, the vast majority of these references are unpublished. Only a small portion of these references are accessible on the international tree-ring

database, hosted by the National Oceanic and Atmospheric Administration in the USA (<http://www.ncdc.noaa.gov/paleo/treering.html>).

From the average ring-width series of the four most represented species (i.e., larch, fir, Scots pine, and oak), we calculated the mean diameter of the trees, their mean segment length, and their mean ring width over the total duration of their series and over the first 100 years. Thereafter, age trends were determined for two time periods (i.e., before and after the 17th century CE) for all dated series, particularly for larch (the species with the greatest representation). The age trends were smoothed to make them more comprehensible using 20-year moving averages. This explains why the curves do not appear until the 20th year (Fig. 7).

3 Results

3.1 Species

Of the 145 pieces of wood collected, 54 were larch (*Larix decidua* Mill.) (26 planks and 28 timbers), 39 were deciduous oak (*Quercus* sp.), 20 were Scots pine (*Pinus t. sylvestris* L.), and 17 were fir (*Abies alba* Mill.). Moreover, there were nine pieces of elm (*Ulmus* L.), two pieces of ash (*Fraxinus* L.), two pieces of willow or poplar (*Salix/Populus*: the anatomical distinction between these two species is complicated, Schweingruber 1990), one piece of walnut (*Juglans* sp.), and one piece from a fruit tree (*Rosaceae maloide cf sorbus crataigus*, Anatomical determination by Carine Cenzon-Salvayre, associate researcher of the Centre Camille Jullian (UMR CNRS 7269), Aix-en-Provence, France) (Fig. 4).

Scots pine and mountain pine (*Pinus uncinata* Ramond) were anatomically identical and indistinguishable (Schweingruber 1990). However, mountain pine does not exist in its natural state in the Bléone Valley (Douguedroit 1976). All of the stands visible today are the result of reforestation efforts in the 19th century CE. The timbers sampled from the buildings appeared to be from structures prior to the 19th century CE; therefore, we assume that they are Scots pine rather than mountain pine.

3.2 Quality of the Timber

The oak beams were 3–4 m in length, with the longest measuring 5.5 m. They were predominantly straight for approximately 1 m and often exhibited curvatures after this point. Many were knotted or twisted. The softwood beams (fir, larch, and Scots pine) were 4–5 m, with the longest measuring 6 m. The thread was more regular, and these beams had fewer knots than those in the oak beams.

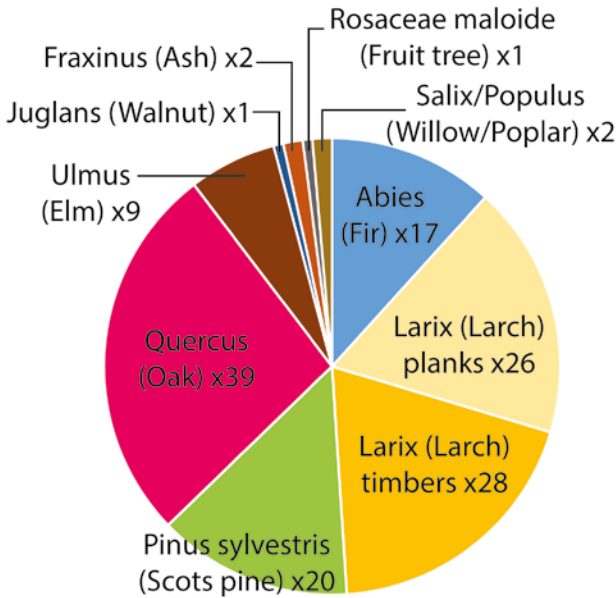


FIGURE 4 Distribution of the nine species among the 145 samples analysed. The 54 pieces of larch wood were separated into planks and timbers.

Only the widest part of the timber, which corresponds to the base of the tree, was approximately squared so that the diameter of the timber was practically identical at both ends. Some softwood beams had a circular cross-section along their entire length and were not squared at all. In contrast, a minority of softwood beams had all three visible faces perfectly squared with sharp edges.

3.3 Diameter and Age of Rings

The mean minimum diameters were between 22 and 26 cm, and larch and Scots pine were considerably larger than fir and oak. Larches were the oldest trees (115 years, $\sigma = 74$) and had the slowest mean annual growth (0.61 mm per year, $\sigma = 0.48$) (Table 1).

3.4 Dendrochronological Dating

Thirty larch series from 11 buildings were dated from 948 to 1927 CE (with a hiatus between 1541 and 1633 CE) (Fig. 5). This average correlated with more than 40 alpine reference chronologies in rank 1 ($t_{\max} = 9.53$; $r_{\max} = 0.49$). The t_{\max} and r_{\max} values were the highest t - and r -values achieved, respectively, when cross-dating with the reference chronologies.

TABLE 1 Number of series, dated series, tree mean diameters, mean segment lengths and mean radial growth of larches, Scots pine, firs and deciduous oaks

| | Number of series | Number of dated series | Mean diameter (cm) | Mean segment length and median (years) | Mean radial growth (mm/year) over the total length/over the first 100 years |
|--|------------------|------------------------|--|--|---|
| Larch (<i>Larix decidua</i>) | 54 | 30 | 26 ($\sigma = 4$) (without the 28 planks) | 115 ($\sigma = 74$) 92 (without the 28 planks) | 0.61 ($\sigma = 0.48$) 1.22 ($\sigma = 0.48$) (without the 28 planks) |
| Scots pine type (<i>Pinus t. sylvestris</i>) | 20 | 0 | 25 ($\sigma = 5$) | 78 ($\sigma = 27$) 87 | 1.34 ($\sigma = 0.92$) 1.46 ($\sigma = 0.93$) |
| Fir (<i>Abies alba</i>) | 17 | 5 | 2.2 ($\sigma = 6$) | 62 ($\sigma = 25$) 67 | 1.60 ($\sigma = 0.48$) 1.62 ($\sigma = 0.48$) |
| Deciduous oak (<i>Quercus</i> sp.) | 39 | 9 | 2.3 ($\sigma = 7$) | 75 ($\sigma = 35$) 72 | 1.00 ($\sigma = 0.58$) 1.42 ($\sigma = 0.52$) |

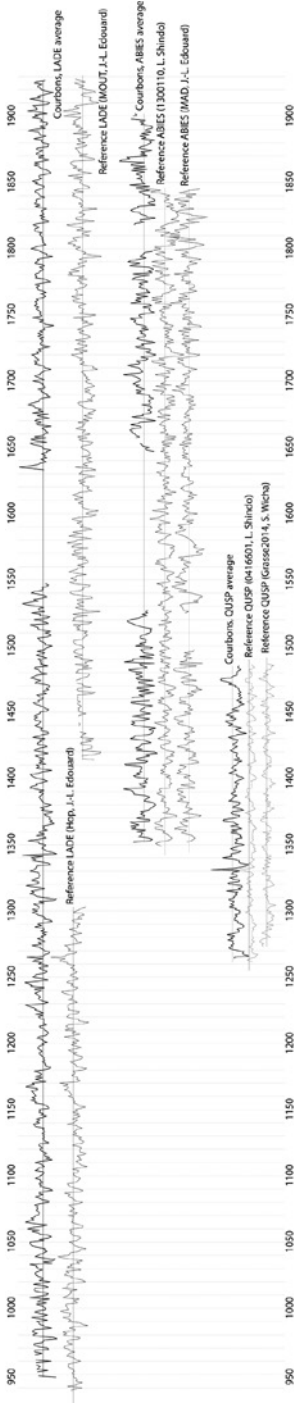


FIGURE 5 Graphical representations of the dendrochronological average chronologies for dated larches, firs and oaks, in their synchronisation position with a selection of reference curves (indexed by the Corridor method, Lambert 2006). With this method, extreme years are removed in order to maintain the average frequency (on a ten-year scale), which is why some rings are missing on the graph).

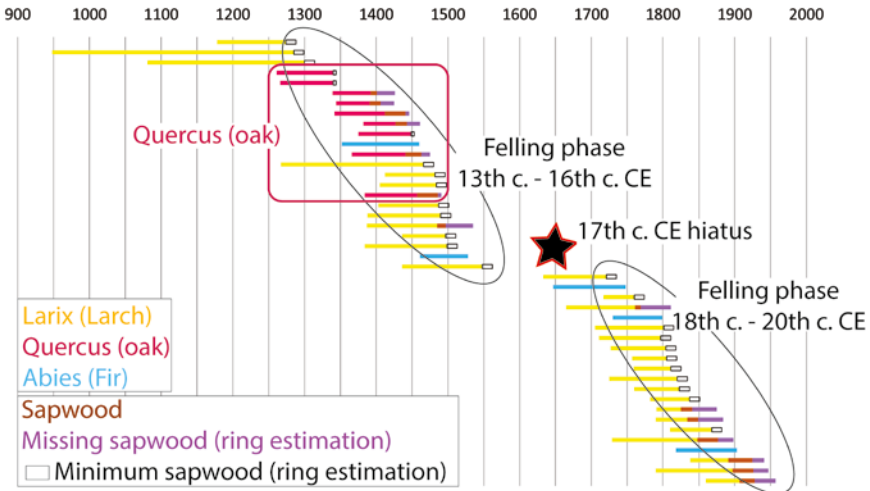


FIGURE 6 Bar diagram of the dated series. Each horizontal line represents a piece of wood. Two estimated felling phases are highlighted by the 44 dated series: from the 13th–16th century CE and from the 18th–20th century CE. Larch sapwood ring estimate: 32 ± 18 (confidence level = 2σ) (Shindo 2016), oak sapwood rings estimate: 19 ± 15 (confidence level = 2σ) (Durost & Lambert 2006). When sapwood (brown) is preserved but not the last ring, the maximum number of missing sapwood rings were estimated (purple, 50 rings for larch, 34 rings for oak). When no sapwood rings were preserved, the minimum number of missing sapwood rings was added (white rectangles, 14 rings for larches, 4 rings for oaks). Dated oaks are present until the 15th century CE. No dated trees were felled in the 17th century CE.

Five fir tree series from four buildings were dated from 1352 to 1902 CE (with a gap between 1527 and 1730 CE). This average correlated with 18 reference chronologies from southeastern France in rank 1 ($t_{\max} = 9.72$; $r_{\max} = 0.52$).

Finally, nine oak series from five buildings were dated between 1261 and 1485 CE. This average correlated with three reference chronologies from southeastern France in rank 1 ($t_{\max} = 9.77$; $r_{\max} = 0.5$). This is the first chronological reference to deciduous alpine oak in France.

The 44 dated series revealed two main felling phases: the 13th–16th century CE (23 series) and the 18th–20th century CE (21 series) (Fig. 6). Since none of the dated series originated from trees felled in the 17th century CE, we compared the growth of trees felled before and after this century (see “growth pattern” section below). While larches and firs were prevalent in all periods, the nine dated oak series were from trees felled prior to the 16th century CE. However, 30 non-dated oak series remained in the study. These may be from oaks felled from the 17th century CE onwards; however, it is not yet possible to

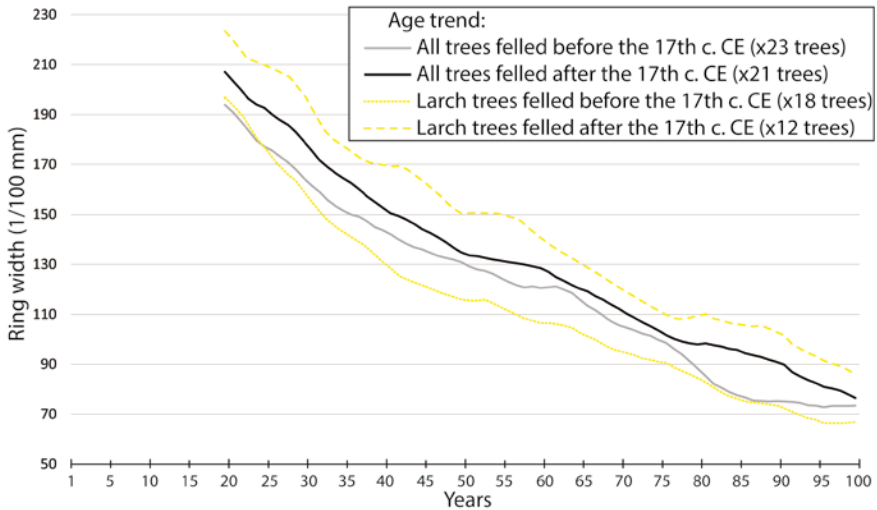


FIGURE 7 Age trends of trees felled before and after the 17th century CE (all the dated trees are represented in black and grey; larches are denoted in dotted yellow lines). The age trends were smoothed using 20-year moving averages to make them easier to interpret. This is why the curves only start at the twentieth year. After the 100th year, the quantity of dated rings decreases and the age trends become less representative. We have therefore decided not to calculate them.

establish this. Therefore, the current results and their interpretation should be taken with caution, pending the dating of the last oak series.

In total 101 dendrochronological series had not been dated. There were two explanations for this: the dendrochronological series were too short to correlate with certainty at a single position on the reference frames (this applies to elm, juglans, ash, fruit tree, willow/poplar, and some larches, firs, and oaks), or there was a lack of references (Scots pine, see Shindo & Giraud 2021 for the difficulties of correlating this species in an archaeological context in Southern France).

This indicated that more than 50% of the sample was undated. This average is frequently found in dendrochronological studies in southeastern France (Shindo 2016), a region where the species used in buildings are more varied than in Northern Europe, for example, and where dendrochronological references are still under development.

3.5 Growth Pattern

The hiatus in the distribution of felling dates in the 17th century CE prompted us to compare tree growth prior to and following this period (Fig. 7). The 23

trees felled before the 17th century CE grew slower than the 21 felled after the 17th century CE (mean annual radial growth of 0.62 mm and 1.14 mm for the time periods prior to and following the 17th century CE, respectively). This difference is exacerbated in the case of larch, as the 18 larch trees felled before the 17th century CE grew significantly slower than the 12 larch trees felled after the 17th century CE (mean annual radial growth of 0.60 mm and 1.23 mm for the time periods prior to and following the 17th century CE, respectively).

4 Discussion

4.1 *Diversity of Species*

In contrast to previous dendrochronological studies in the Southern French Alps, the diversity of species is more important in Courbon buildings (Fig. 4). Although larch, Scots pine, and fir are regularly found in alpine buildings (Edouard 2010b; Labbas 2016; Shindo 2016), we have never previously documented oak and elm. However, the actual vegetation maps reflect this diversity in the area surrounding the village. Courbons is located between the inner Alps and the Mediterranean Sea, and its climate permits a greater variety of vegetation than that at higher altitudes. Nowadays, within a few kilometres from Courbons, the majority of the studied species can be found. Consequently, it seems plausible that this species diversity dates back to the construction of some of the studied buildings. Fir and elm are the main exceptions, as they are no longer available in the local forests. The closest natural fir stands grow approximately 20 km to the southeast (in the Haut-Verdon area). Since the first half of the 20th century CE, many European elms have died as a result of the graphiosis fungal epidemic (Gibbs 1978). Thus, there were no large elms suitable for timber in the area. Palynological studies would provide information on the evolution of regional vegetation over time; in particular, to indicate whether there could have been closer stands of fir in the past.

This is the first time elm timber has been documented in the French Alps. However, it is occasionally used in construction in southeastern France (Blanc & Wicha 2019; Shindo & Tissot 2019), most likely because of its good mechanical properties similar to those of deciduous oak (<https://tropix.cirad.fr/en/technical-sheets-available>, accessed 30 April 2022). Elm species were detected in three buildings at Courbons and displayed very rapid growth (mean annual radial growth of 2.25 mm, $\sigma = 1.32$), which indicated favourable growing conditions. Here, opportunistic applications of trees that are not traditionally used for construction are possible, such as trees that have grown near the village and

were easily accessible. The same might be said for walnut, ash, willow/poplar, and fruit tree timber.

4.2 *Trees Grown under Diverse Environmental Conditions*

The minimum average diameters of the timbers from Courbons were comparable to those timbers found in other areas (Shindo *et al.* 2022), indicating consistency in the selection of timber sizes for medieval and modern mountain buildings. This is certainly related to the fact that 20–30 cm segments were sufficient to make effective joists in these buildings.

Among the four most commonly used species (larch, Scots pine, oak, and fir), larch was the oldest and had the lowest average annual growth, regardless of its total growth or only the growth during the first hundred years (Table 1). This could be explained by the fact that this tree grows at the highest altitude and, therefore, in more challenging growing conditions. Other site conditions, such as stand density and forestry operations, may have played a role in the observed growth variations. However, no such information was available for the period before the 19th century CE. At the time of felling, other species (elm, ash, willow/poplar, walnut, and fruit tree) were less than 50 years old and had substantially rapid growth rates. Therefore, they grew in less constrained environments (lower altitudes, as well as open and less competitive environments).

4.3 *Linking Dendrochronological Results with Historical Data*

Despite the fact that only 44 of the samples could be dated, a number that might seem low, we could make various assumptions regarding the local forest environment. We have discussed these results with caution. Future samples from buildings in the immediate vicinity of Courbons, as well as the future dating of currently undated wood, would aid in the development of this preliminary assessment.

The demographic changes since medieval times for the Courbons region were not available. They were either not compiled or published. Therefore, we used regional data. In the Digne-les-Bains region, which includes Courbons, the demographic decline linked to the crises of the 14th century CE (epidemics, famine, and conflicts; see, for example, Le Roy Ladurie 2004; Ljungqvist *et al.* 2018) continued until the end of the 15th century CE, and it was not until the middle of the 16th century CE that a demographic increase was documented (Baratier 1961). This population decline, at least until the end of the 15th century CE, could be linked to fewer impacts on the environment and, consequently, the disappearance of the forests. This may partially explain the

delayed growth of the trees (Fig. 7), even though other factors, such as climate, could also have influenced their growth at that time.

The 17th century CE hiatus (Fig. 6) could be interpreted as a bias in the dendrochronological data, or it might reflect a reality that few, if any, trees were felled during the 17th century CE for use in the houses of Courbons (although reuse of older trees remained possible). However, this time period also coincides with the development of *la Marine Royale* (French Royal Navy) in Marseille, 110 km from Courbons, and only 2–3 days journey by boat (Baume 2011). Habert de Montmort, Intendant of the Galleys of Marseille, officially inventoried Provence trees suitable for shipbuilding from 1682 to 1683. Thus, thanks to his efforts, we know that, at that time, there were eight immediately usable curved oaks in the Courbons region, 46 that could be utilized within a few years, and 2100 that were unusable. No trees of the species straight oak, “white pine” (Aleppo pine and Scots pine), elm, fir, spruce, beech, or larch trees were inventoried (Pichard 1999). Therefore, at the end of the 17th century CE, there were very few trees in the forests in the Courbons region that were suitable for shipbuilding, and the same could have been true for trees of the same species for terrestrial construction (except for curved oaks). Therefore, a scarcity of resources could have been the cause of the hiatus in the 17th century CE.

Historical records (disputes and regulations) contain references to the damage caused by bovine and caprine pastoralism in this region at the onset of the 17th century CE (Baume 2011). Thus, in 1690, the Parliament of Provence published a list of towns where goats were no longer permitted because they grazed on young tree shoots (Douguedroit 1976). However, in 1730, there were still 210 goats in the territory of Courbons, and the parliament demanded their removal (Pichard 1999). These prohibitions, as well as those on timber harvesting, were repeatedly renewed, implying that they were not respected. These regeneration difficulties led to the establishment of an open landscape, in which the remaining trees had better access to nutrients and their growth rate improved relative to that of trees that were felled prior to the 17th century CE (Fig. 7).

However, 30 non-dated oak series remained in the study. These may have originated from trees felled after the 17th century CE, but this has not yet been determined. Therefore, the current results and their interpretations must be interpreted with caution, pending the dating of the last series.

Finally, all nine dated oak samples were felled before the 16th century CE, with no oak being felled beyond that time in the dated sample group (disregarding the dating of the 30 oak beams that remain pending) (Fig. 6). A reservation of trees for the Navy could explain the absence of oak felling for use in the construction of buildings in Courbons at the onset of the 16th century CE, but as we have established, the Navy only reserved trees from the 17th century CE onwards, a century later. In addition, in his inventory of trees in Provence

at the end of the 17th century CE, Habert de Montmort did not list any straight oak trees in the Courbons region, such as those located in the vicinity of the old local buildings. Moreover, nowadays it is still difficult to locate living oaks with straight trunks that are of sufficient height to make beams. It appears plausible that oaks suitable for construction disappeared from the forests as early as the 16th century CE. At present, no plausible hypothesis can be presented, but the anticipated expansion in the regional dendrochronological corpus of oak towing to new studies, as well as the examination of new textual sources, would likely make it feasible to better define the modalities of this disappearance in the coming years.

In conclusion, dendrochronology provides dates and detects signals in the growth of trees, whereas history explains and interprets the data to reconstruct the exploitation of forest resources. The two disciplines complement one another.

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