

The Timber Trade and Transport in Roman Italy

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The degree, to which wood represented a fundamental material in the Roman period, is difficult to evaluate today due to various factors: the profound technical and technological changes that differentiate our world from ancient times, the perishable nature of wood,¹ and lacunas in the ancient sources regarding its trade and use due to its ubiquity.² In order to investigate timber production and trade in the ancient Mediterranean³ (and, in our case, Roman Italy) one must use a variety of sources to tackle such a complex sector of the market: historical, archaeological, and epigraphical. The latter provides a useful example of speculation on the price of wood, charcoal, and timber at Delos in the first half of the 3rd c. BC. Given the scarcity of trees on the island; the need to import these materials took foreign traders to sell and buy timber in Delos where high demand led to an increased sales and a consequent rise in prices. In order to maintain a reasonable price, a law was enacted (preserved in an inscription)⁴ to control the speculation in wood.

The timber trade represents a substantial slice both of ancient commercial activity due to the volume of material and number of buyers involved. Romans distinguished between *lignum* and *materia*, as is noted in the Digest,⁵ which defines as *lignum* as all wood used *comburendi causa*, and *materia* as *quae ad aedificandum fulciendum necessaria est*.⁶ Timber (*materia*) was used on construction sites, it served as temporary structures such as bridges, theatres, and fortifications, and it was used in shipyards both for shipbuilding and for jetties and wharves. Wood (*lignum*) represented the main source of energy, together with its derivative charcoal. One of the main factors regulating the timber supply network was its transport. It was felled in rural areas but was typically destined for urban areas where it was stored, worked, and put to use. The costs of timber are linked to multiple factors: the distance between the place of production and final consumption, the production times, and the material weight, volume, and perishability.⁷

Timber (*materia*) is the most costly wood product because it must correspond to particular requirements in length, resistance, and volume. For carpentry more attention is paid to choosing a species that is best for the purpose, although there is a tendency to use what is available in the surrounding territory. On the contrary, wood (*lignum*) is a product that is less specialised and is consumed at a much greater rate. It is supplied from branches, logs, shrubs, young trees and other materials of little value, that are more easily available. For fuel wood, the quantity is more important than the quality. Furthermore, non-wood combustible materials, such as agricultural waste products, are often used alongside wood as fuel.

In Diocletian's Price Edict⁸ the prices for *materia* are fixed in reference to the length and volume of the trunk and squared beam. The fir and pine cost almost twenty times more than the wood from other species, given that they are the trees most commonly used for construction and shipbuilding (as they grow taller than other trees in a rela-

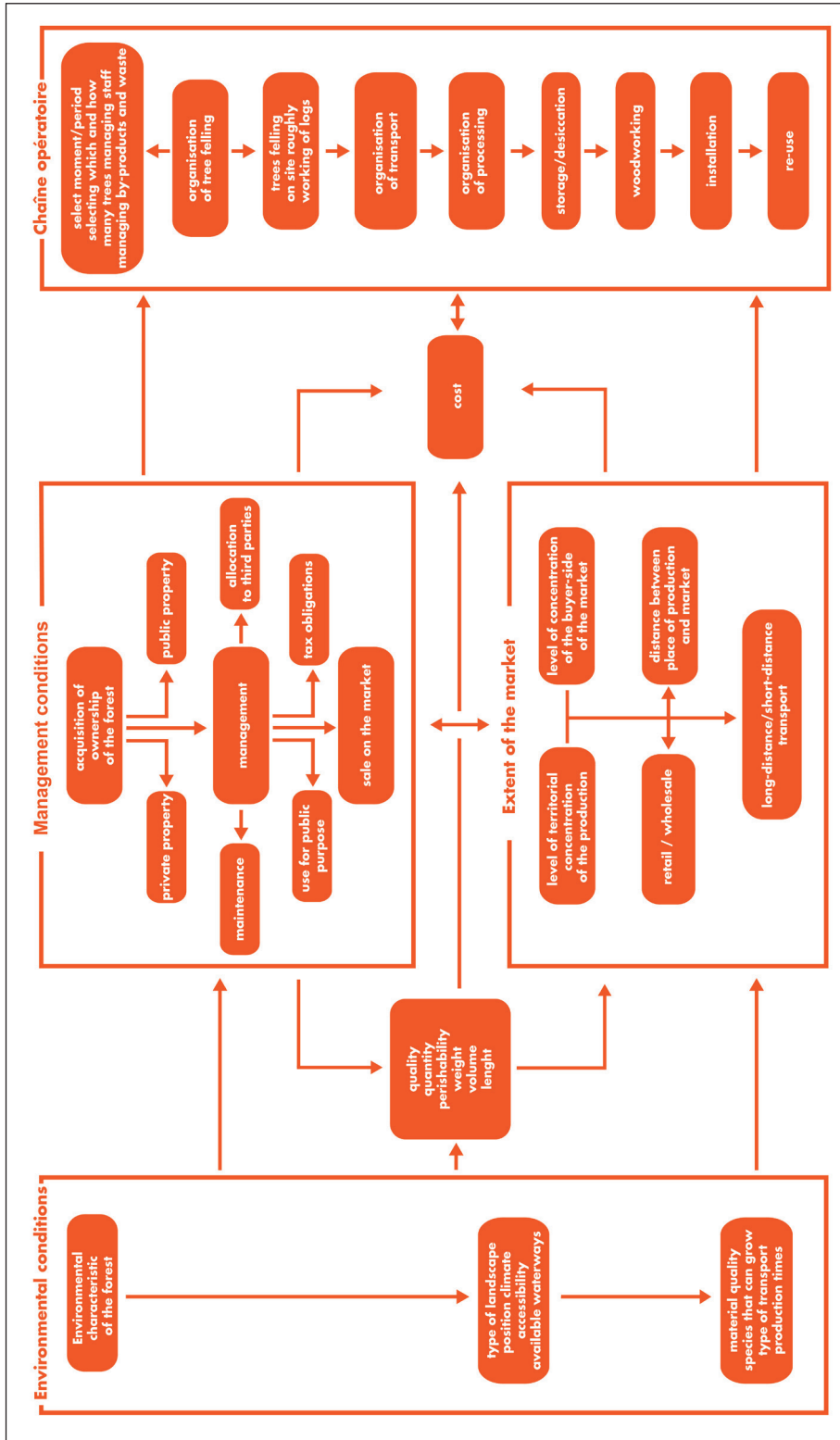


Fig. 1: Timber in Roman economy: production, market and chaîne opératoire.

tively short time and guarantee adequate resistance to bending forces). The prices of *lignum*⁹ simply vary according to weight. Prior to the Edict, we only have the testimony of Pliny, who refers to the price for a raft of timber¹⁰ and the price of precious woods,¹¹ which are however only used in small quantities for the creation of luxury furniture.

Consequently, we can state that wood (*lignum*) was normally supplied by the local market (with the exception of territories with a particular lack of vegetation or where demand exceeded availability, as in the case of Rome), while timber (*materia*) also arrived from forests that were far from the place of use. Therefore, the timber trade was wider ranging and more profitable, but required greater organisation and planning for the selection of the species and the individual trees to be felled, the rough-working on site, the storage for seasoning and, above all, the long distance transport (fig.1).

Production

Timber could come from publicly or privately owned forests. In the Roman period, forests and pasture, as non-agricultural land, were usually common land and destined for use by the local community. According to Cicero, this type of timber supply from public lands dates as far back as Ancus Marcius, to whom he attributes the *publicatio* of the Roman forests.¹² The public forests could be managed by the community for profit¹³ or for the needs of the community itself.¹⁴ For example, the wood for the local baths or timber for repairing public monuments could also come from state or municipally owned forests.¹⁵ Clearly, this could satisfy the needs of medium-small urban centres but not those of large cities. As this was *ager publicus*, Rome probably received an income from its own forests by contracting out their use to *publicani*. E. Rawson¹⁶ has identified a forest in the part of the *ager publicus* rented by Terentia and for which a fee was requested by the *publican*.¹⁷ In a second passage, Cicero¹⁸ refers to violence and murders in the forests of the Sila, where a company of *publicani* managed the extraction of pitch. The imperial administration gradually substituted the system of contracting to *societates publicanorum* and took over the collection and management of revenues from the *ager publicus* destined for the public sphere¹⁹ (perhaps still largely paid in kind)²⁰. Other forests had to be located within the *res Caesaris*. Consequently, the emperor had at his disposal a large quantity of building timber both for his own construction projects and for public ones.

Latin authors writing on agriculture advised the owners of agricultural estates on the good practice of having a *silva caedua* (from *caedo*, to cut, which is subjected to regular cutting/coppicing)²¹ on their lands, as it required low investment with a guaranteed revenue²² and almost no costs given that there was hardly any maintenance. Forests were even considered preferable to a vineyard,²³ so much so that a forest is also defined as “the daughter’s dowry”.²⁴ According to Cato,²⁵ the *silva caedua*, which produced both wood and timber, was more profitable than the *silva glandaria* (mast-wood), which was

linked to grazing and primarily to the collection of acorns and beechnuts. The vineyard was a speculative cultivation, whose production depended on the weather and the profits from market demand, whereas the forest guaranteed a conspicuous and constant income because wood (for fuel or construction) did not depend on the quality of the season and was always in demand. Cicero²⁶ called the heir, who sold the forest before the vineyard foolish, given that a forest provides a revenue that also safeguards the patrimony. In fact, a forest represents a form of insurance for a landowner: the *dominus* can go without cutting trees for years, then when extraordinary expenses occurred, the sale of the tree trunks would cover a large part of the losses. Furthermore, the landowner could sell the right to cut trees in his own forest for several years, or sell the trees still standing on his land.²⁷ Pliny defines the income from the sale of timber from the woods he owned as modest but assured;²⁸ in this case, the vicinity of the Tiber made the exportation of wood to Rome one of the most profitable activities in the region. An examination of the ancient sources shows that the presence of *silvae* within a patrimony represented a good option for those interested in diversifying investments, especially for the owners of several and/or extensive *fundi*. Therefore, trade in wood was primarily the domain of economic elites.

Forests were subject to lower taxation than that imposed on agricultural land, given that the immediate earnings were also lower. The Theodosian Codex²⁹ and Siculus Flaccus³⁰ both attest that forest owners were subject to the *munus* of providing wood to the Roman state for the army, fleet, public works, the baths, and imperial workshops. Therefore, the central administration also received wood and timber necessary for public use through taxes paid in kind by private landowners.³¹

Trees were usually felled in the autumn, once the yearly period of growth was over. At that point, the number and choice of specific trees to be harvested was made. The tools of the woodcutter in the Roman period were the axe, the saw, and wedges. Once felled, the tree, still with its bark, was roughly worked in order to facilitate its transport. The waste materials could then be used for faggots, charcoal, wood for burning or to be worked.

Transport

After the tree was felled, the trunk was transported, by means of wagons or boats, to the place where it was to be worked and stored. The trees were cut down at the roots and transported by water to the nearest ports for the creation of beams for shipbuilding whereas trees that were too far from transport routes were cut into sections, carried over land and used for carpentry or as fuel.³² At this point, the wood was dried in large warehouses, and the surfaces were treated to prevent warping and the appearance of marks. The drying process could take years, according to the type of wood. Dionysius of Halicarnassus praised Italy for the number of navigable rivers that facilitated the

transport of its abundant supply of wood.³³ Pliny³⁴ describes trunks 30 metres long, dragged down from the Apennines by ten or fifteen mules to then be transported to Rome on the Tiber. Dionysius, in his description of the transport of timber from the Sila forests of southern Italy, distinguishes between trees that were found near the sea or rivers.

Wood is a commodity often harvested on high land and transported to lower regions by floating them down rivers.³⁵ If the flow was insufficient, rivers were blocked with temporary dams artificially increasing the flow by releasing the accumulated water all at once thus facilitating and accelerating the wood's journey. The free floating of the trunks only occurred on the smaller rivers, whereas on major rivers the trunks were assembled to form rafts and guided downstream or hauled from the bank by animals or slaves³⁶, which was a way of avoiding losses through sudden flooding, of minimising obstructions and backups, and of protecting from theft. Binding the timbers into rafts facilitated passage under bridges and through locks, and helped prevent damage to riverbanks, ferries, mills and other structures along rivers. Moreover, the rafts could be used to transport other heavier commodities such as other wood, *opus doliare*, barrels, brick/tile, stone, and amphorae. The rafts also allowed for the organisation of loads according to ownership, wood type, and trunk dimension. Pliny the Elder³⁷ notes that the only navigation on the upper reaches of the Tiber was by floating timber (*trabes*) and rough, flat *rates*, which according to Festus³⁸ were originally rafts of bound tree trunks.

I have previously proposed³⁹ that the organisation of the transport of lumber by river was largely handled by the college of *dendrophori*. Organised as a religious association and a professional corporation at the same time, the college of *dendrophori* (tree-bearers) was formed under the reorganisation of the cult of the Magna Mater during the reign of Claudius, who linked the cult of the Phrygian goddess of the mountains and waters and that of the tree-god, Attis, to the *dendrophori*, thereby placing the latter under the control of the central administration (*sub cura quindecimvirosum*). Thus, the imperial authority gained greater control over the corporation tied to the exploitation and management of forests,⁴⁰ a large number of which were imperial property or *ager publicus*. The emperor was the largest private owner of forests, and thus administered the exploitation of the State forests by using the *dendrophori* to manage them.

The *dendrophori* have been defined as woodsmen or carpenters, as carriers of timber and most commonly wood and timber merchants.⁴¹ A. Zamboni⁴² has identified the *dendrophori* of *Berua* and *Feltria* as those who piloted the timber rafts.⁴³ In 415 AD, the Christian emperors Honorius and Theodosius issued a law⁴⁴ against the gathering of pagan religion associations, which also foresaw the confiscation of goods and properties belonging to the *professiones gentiliciae*, including the *dendrophori*, but not the dissolution of such colleges. The latter continued to be useful to the state in their professional capacity and for the *munera* the state obliged them to fulfil.⁴⁵ A high percentage of places where the *collegium dendrophorum* is attested occur in centres situated in for-

ested areas overlooking river valleys or lakes and sea,⁴⁶ thus emphasising their activities in water transport.

The literary sources tell us that timber arrived in Rome from the Apennines along the Tiber⁴⁷ and also by sea on board ships.⁴⁸ Vitruvius⁴⁹ lists the best trees for use in construction: primarily fir, which together with pine provide the longest timbers. He adds that the best trees grow on the Tyrrhenian side, as it gets more sun, but concludes that it is unnecessary to import expensive materials from distant places when adequate local alternatives are available at lower cost because the transport is less onerous. As long as construction development in a town remained modest, the timber was easily found in nearby forests. However, in Rome⁵⁰ the continued growth of public and private building and the expansion of the fleet soon upset the balance between demand and availability in the area. As buildings increased in dimensions, it was necessary to find trees of exceptional size. With the growth in its market, Rome induced the Italic communities to contribute and the local market systems were gradually integrated into the network supplying Rome, thus large quantities of wood products were rerouted away from local markets to supply to the capital. Rome became the greatest centre of timber consumption within the vast production area serviced by rivers and the sea.⁵¹ A symbolic case is the transport of larch from the Alps, described by Vitruvius.⁵² The trunks were tied together to form rafts hauled by slaves or floated on barges made of lighter wood. These were transported along the various valleys as far as the river Po, where once they reached its mouth at Ravenna the timbers were loaded onto special ships that travelled down the Adriatic, through the Straits of Messina and then up the coast as far as Ostia.⁵³

Sale and Use

The distinction between *lignum* and *materia* is also reflected in the names of those who dealt with each: the *lignarius* and the *materiarus*. Plautus⁵⁴ writes of a *materiarus* as a seller of wood products, which is probably the occupation of the *materiarii*⁵⁵ (who are also known *sectores materiarum*⁵⁶ (fig.2) and *negotiatores materiarum*)⁵⁷, whereas those who worked the wood destined for construction and naval carpentry were the *fabri tignarii* and the *fabri navales*. The Digest⁵⁸ refers to a case, in which a college of *fabri* is named as the heir to the woods that *caedere solent*. Gaius⁵⁹ defines *fabri tignarii* (from *tignum*, beam) as *non eos dumtaxat, qui tigna dolarent, sed omnes qui aedificarent*, i.e. those who worked and built with beams, while the *fabri navales* worked in the shipyards. Both were jobs that required a high level of professionalism and skill, organisation and experience, which is also reflected in the complex internal hierarchy existing among those who worked on large building sites. According to Meiggs,⁶⁰ when wood ceased to be the main construction material, the name *fabri tignarii* was used to indicate builders in general.



Fig. 2: Funerary stele of a *negotians materiarius* from *Florentia* (CIL 11, 1620), with representation of professional tools.

The *lignarii* were woodsmen or traders in wood for use as fuel.⁶¹ In the *glossae*⁶² they are defined as *operarii qui ligna caedunt, dolant, vendunt*. Palladius⁶³ and Isidore of Seville⁶⁴ defines them as *fabri* specialised in working small sized wood, thus carpenters. The *lignarii plostrari* in Pompeii are identified with the suppliers who transported timber from the forest to the city on wagons.⁶⁵ Probably, the term *lignarius* was more generic than *materiaris* and could refer both to the sellers of fuel wood and to those who worked wood.

Like other commodities and materials, timber was probably also stamped⁶⁶ to indicate the ownership, its commercial or fiscal nature or to guarantee quality. The epigraphic evidence regarding wood comes mainly from harbour structures, in which timber construction elements are preserved underwater: the evidence from Anzio⁶⁷ (fig.3) shows that these marks also provided commercial information, not only indications useful for their positioning.

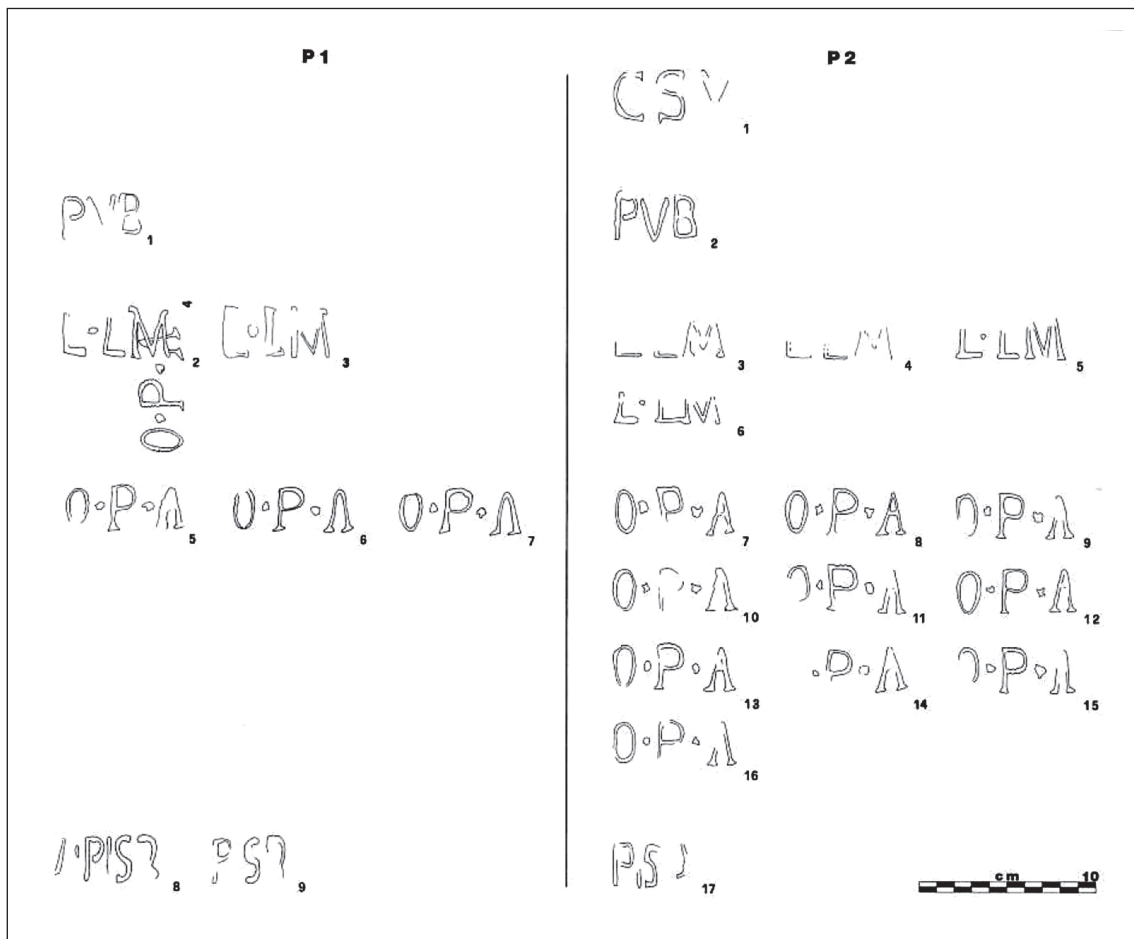


Fig. 3: The marks on the wooden beams of the Anzio wharf.

The Data from Anthracology and Dendrochronology

Laboratory analysis of wood samples has been increasingly employed in recent decades to identify the species, working methods, chronology, and provenance. The two most common methods are anthracology and dendrochronology. Unfortunately, the application of these methods in Roman archaeology has been limited. Regarding Italy, the data is only sporadic, mainly concentrated in the territory of Pompeii and environs.

Anthracology is usually used to identify the species from charcoal samples, but these data have primarily been used to reconstruct the environmental context surrounding the site from which they were gathered. The methodology is based on the premise that the species are local given that wood for fuel and charcoal would not have travelled long distances. However, we have seen from the historical and epigraphical sources that for the Roman world, this was not always the case. Wood for fuel sometimes circulated over long distances; for example, various Italian and African territories were obliged to supply it to the baths of Rome.⁶⁸ Therefore, the analysis of the anthracological remains alone, without the support of other palaeo-environmental analyses, cannot be used to reconstruct the local landscape but rather to understand which species were in use in a particular period on the sites in question.

Most of anthracological studies deal with charcoal from wood used as fuel. At Pompeii, R. Veal has analysed charcoal samples from fire wood (particularly the House of the Vestals and the House of the Surgeon) and has showed how the type of fuel changed in species, quantity, and uses between the 3rd c. BC and 79 AD.⁶⁹ She also identified the range of the supply network based on the altitude, at which the identified species grows and has attempted to reconstruct a model for supply strategies from local forests. Veal's analytic work is accurate, but the reconstruction of the quantitative model of the economic-commercial picture of the wood market goes beyond what the available data allow, both for Pompeii⁷⁰ and for Rome.⁷¹

Data from samples of both fuel wood and timber have been analysed from the late antique phases of two villas at Somma Vesuviana and Pollena Trocchia,⁷² and the results suggest that the extent of the supply network for construction timber (much wider for the first site) can differ according to the resources of the owners. In this case, the identification of the provenance was based on the elevation, at which the identified *taxa* grow with respect to the elevation of the find context (i.e., the presence of trees that grow at over 900 m a.s.l. were identified as long distance importations). Furthermore, dendrochronology showed that the roofs of the buildings were in use and restored for centuries, particularly the supporting elements.

The same methodology of using the elevation, at which the species grow, was used in a reconstruction of the commercial network for timber in the Vesuvian area.⁷³ In this case, most commonly used *taxa* in house building were silver fir, umbrella pine, and cypress (chestnut only in some single buildings), while there were few examples of oak and larch. The authors of this study stressed: "*The frequency of Picea/Larix in Campania*

attests the large trade of timber in the Roman Empire and the circulation of the best wood resources even far from the production areas”.

Recently, dendrochronology has also been used as a method to determine the provenance of timber⁷⁴ by comparing the ring-growth patterns of the same species to create chronological sequences within particular territories as a means of determining provenance, which is now possible due an ever expanding database. Examples of such studies for Dutch territories⁷⁵ have shown that based on the geographical provenance of the timber, the most likely transport routes of imported timber for the Roman period can be reconstructed, especially along the Rhine, Meuse and Scheldt river valleys. This data is then compared with other archaeological materials, to establish the existence of long-distance commercial networks.

Dendrochronological analysis was undertaken at Pompeii and Herculaneum in 2002, and the reports noted that the fir and spruce came mainly from the western Austrian Alps; however, it has been pointed out that other sampled timbers do not fit the Alpine curve and may be local material from high Apennines.⁷⁶ Anthracology and dendrochronology have also been more recently used in the House of the Telephus Relief at Herculaneum:⁷⁷ here the most attested species is the white fir, considered locally sourced. Although in this case too the chronology of the accretion rings analysed showed synchronisation with that of southern Germany and the Alpine areas, the authors however tend to say that this analogy is due to large-scale climatic signals, which overlap with the regional effects and that therefore the hypothesis that the analysed timber is imported cannot be based on dendrochronological evidence alone.

However, more recent evidence also points to long distance transport. During the excavations for the construction of the Metro C Line in Rome at the Lateran, archaeological remains were found of a porch dated to 40–50 AD,⁷⁸ which is probably part of a house. The foundations of the walls revealed extraordinarily well preserved wooden formwork composed of horizontal planks, propped up by poles, on which vertical planks were sometimes superimposed. The dendrochronological analyses showed that these oak planks came from forests in the upper Rhine valley. If, as in other cases, the identification had been based only on the height, at which the species grows, this oak timber would probably have been identified as coming from the Apennines. This indicates that the timber was imported over a very long range, which was only possible thanks to an extremely homogeneous, organised, and secure commercial network. Previously it would have been unimaginable that supply of construction timber in early Imperial Rome came from the forests of central Europe, but now we must re-examine our hypothetical reconstruction of the timber trade and integrate production areas that are further afield than those considered thus far. In the case of the Metro C example (probably a private property), the transport cost over such a long distance and the complex logistics must have been offset by the low cost of felling the trees in lower Germany and by the high demand for the raw material on the Rome market.

To conclude, only further dendrochronological analyses will be able to provide an adequate scientific basis for the reconstruction of timber importation in Roman Italy and in the rest of the Mediterranean. The existing analytical data suggest that the supply network stretched further than the literary and epigraphic sources have indicated, and future research must integrate all these types of evidence to clarify our picture of the trade networks at work for the timber industry.

Notes

¹ Mols 1999, 6f.

² Theophrastus (4th c. BC) wrote about these topics from a scientific point of view. Pliny the Elder (Bk. XVI–XVII) borrows from Theophrastus as well as other writers. Cato, Columella and Palladius mention trees with regard to their economic potential within the management of landed estates. Vitruvius only discusses wood in relation to building.

³ Main bibliography on the wood and timber in the Roman world: Meiggs 1980; Giardina 1981; Meiggs 1982; Nenninger 2001; Ulrich 2007; Diosono 2008a; Diosono 2008b; Antico Gallina 2011; Veal 2017a; Harris 2018.

⁴ *ID* 509 – *SIG*³ 975, 1.2–4. About the price fluctuation of firewood in Delos see also Reger 1994, 185–186 and 290–294.

⁵ Ulp. *dig.* XXXII 55.

⁶ Paul. *dig.* L 16, 168. See Diosono 2008a, 8–11.

⁷ De Neeve 1984, 44; Ziccardi 2000, 138; Destro 2004. A quantitative approach about fuel supply for Roman production and consumption activities in Veal – Leitch 2019. See also Pucci 1986.

⁸ *Edict. de pret.* XII: *De materiis*. Giaccherio 1974, 117 and 160; Crawford-Reynolds 1977, 134f. and 143–146; Meiggs 1982, 367; Delaine 1997, 214f.

⁹ *Edict. de pret.* III.

¹⁰ Plin. *n.h.* XVI 202.

¹¹ Plin. *n.h.* XIII 90–95.

¹² Cic. *rep.* II 18; *de vir.* 5.

¹³ Frontin. *contr.* 54, 17–19.

¹⁴ Hygin. *Grom. limit.* 161 L.

¹⁵ Hygin. *Grom. cond. agr.* 114 L.; Agenn. *Urb. comm. de contr.* 86 L.; Frontin. *contr.* 55, 4. For the State turning to private owners for the timber to repair aqueducts, see Frontin. *acq.* 125.

¹⁶ Rawson 1980, 113.

¹⁷ Cic. *ad Att.* II 15, 4.

¹⁸ Cic. *Brut.* 85.

¹⁹ Maiuro 2012, 18f. with bibliography.

²⁰ Lo Cascio 1986, 38.

²¹ Gaius *dig.* L 16, 30.

²² Cato *r.r.* XLV; Varr. *r.r.* I 7, 10; Colum. III 3. See also Harris 2018, 226–229.

- ²³ Cic. *leg. agr.* II 48.
- ²⁴ Plin. *n.h.* XVI 141.
- ²⁵ Cato *r.r.* 1, 6.
- ²⁶ Cic. *leg. agr.* II 18, 48.
- ²⁷ Labeo *dig.* XVIII 80, 2. Pomp. *dig.* XIX 1, 40. See Corbino 2019.
- ²⁸ Plin. *ep.* III 19, 5.
- ²⁹ *CTh.* XI 16, 15 and 17–18; XIII 5, 10.
- ³⁰ Sicul. Flacc. p. 165 L.
- ³¹ See the *pondus lignarium* from Otricoli: *AE* 1994, n. 577. Diosono 2008a, 21–26; Diosono 2008b, 262–265.
- ³² Dion. Hal. XX 15, 2.
- ³³ Dion. Hal. I 37, 4.
- ³⁴ Plin. *n.h.* XVI 197.
- ³⁵ Makkonen 1969, 33–35; Mulliez 1982; Nenninger 2001, 73–81; Diosono 2008a, 75–84; Diosono 2008b; Faleschini 2018. On the difference in costs for transport of goods by sea, land or river cf. Duncan Jones 1982, 361–372.
- ³⁶ Lewin 1983; Meiggs 1982, 337; Diosono 2008a, 75–84; Diosono 2008b. On hauling, see Diosono 2009.
- ³⁷ Plin. *n.h.* III, 53–55.
- ³⁸ Fest. s.v. *rates*.
- ³⁹ Diosono 2007, 65–67; Diosono 2008a, 80–84; Diosono 2008b, 274–276; Diosono 2015, 262–269. Curiously, A. Wilson later presented it as a hypothesis he had formulated himself (Wilson 2012, 140). See also Pavolini 2013, 429–431. Contrary Liu 2009, 52–54. Doubtful but not totally contrary to Harris 2018, 225, 229 f.
- ⁴⁰ Graillot 1912, 268.
- ⁴¹ Waltzing I, 243 and II, 196; Aurigemma 1910, 1684; Graillot 1912, 266; Giardina 1981, 101; Meiggs 1982, 334; Salamito 1990, 164.
- ⁴² Zamboni 1974–75, 85.
- ⁴³ For the refutation of the 19th-century idea that the *tria collegia* of *fabri*, *centonarii* and *dendrophori* acted as municipal firemen, see Diosono 2007, 56–67.
- ⁴⁴ *CTh.* XVI 10, 20, 2.
- ⁴⁵ Salamito 1987; Diosono 2015.
- ⁴⁶ Diosono 2008a, 81 f.
- ⁴⁷ Strab. V 2,5; 28; 35. Dion. Hal. III 44, 1; Sid. Apoll., *pan. maior.* 441–445. Meiggs 1980, 190; Meiggs 1982, 220; Lewin 1983; Diosono 2008b.
- ⁴⁸ Strab. V 2, 23. Meiggs 1980.
- ⁴⁹ Vitr. II 9, 5–9.
- ⁵⁰ Theoph. *h.p.* V 8, 3.
- ⁵¹ Diosono 2008b with bibliography.
- ⁵² Vitr. II 9, 14–16.
- ⁵³ Plin. *n.h.* XVI 204.
- ⁵⁴ Plaut. *mil.* 915–921.
- ⁵⁵ Meiggs 1980, 186; Meiggs 1982, 359; Caldelli 1994, 729–731.

⁵⁶ *CIL* V 815.

⁵⁷ *CIL* XI 1620 (with relief representing woodworking tools – fig.2). See also *CIL* XI 363 and 6212; III 12924; *AE* 1960, 29.

⁵⁸ *Scaev. dig.* XXXII 92, 4.

⁵⁹ *Gaius dig.* L, 16, 235.

⁶⁰ Meiggs 1980, 360.

⁶¹ Waltzing I, 249.

⁶² *CGL* II 378, 28 and 30; 586, 33.

⁶³ *Pallad.* I 6, 2.

⁶⁴ *Isid. orig.* XIX 19, 1: *lignarius generaliter ligni opifex appellatur.*

⁶⁵ *CIL* IV 485. Meiggs 1982, 359.

⁶⁶ On the *signacula bronzea* for marking wood, see Baratta 2007, 102. The practice of marking the beams sold is also found in the Roman legal texts: *Paul. dig.* XVIII 6, 15(14).

⁶⁷ Felici 2002, 111–115, with bibliography. An example of signs carved into the wood related to positioning in the construction of a ship in Radić Rossi et al. 2019; another in the assembly of barrels in Mille – Rollet 2020.

⁶⁸ *CIL* II, 5181; *SHA Alex. Sev.* 24, 5; *cod. Th.* XIII 5, 10 and XIV 5, 1. Diosono 2008a, 85 f. with bibliography.

⁶⁹ Veal 2012; Veal 2013; Veal 2014.

⁷⁰ Veal (2013) reconstructs population, consumption and availability within the territory and the forestry productivity, but all is based on the provenience determined only on elevation. See also De Simone 2016.

⁷¹ Veal 2017b, however, based on the Pompeii model in Veal 2017a. A completely different database from the point of view of the amount of analysed data, for example, was used to reconstruct the economic and geographical picture of the importation of timber in ancient Palestine (Liphschitz – Biger 1995).

⁷² De Simone et al. 2013.

⁷³ Di Pasquale et al. 2012.

⁷⁴ Bernabei et al. 2019a.

⁷⁵ Jansma et al. 2014; Domínguez Delmas et al. 2014; Van Lanen et al. 2018.

⁷⁶ Kuniholm 2002. See Harris 2018, 222 for doubts in this regard, mainly due to the fact that there is little data available with which to carry out checks.

⁷⁷ Kastenmaier et al. 2015, 294 f.

⁷⁸ Rea et al. 2017; Bernabei et al. 2019b.

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Fig. 1: F. Diosono. – Fig. 2: S. Guerrini, *CIL* XI, 1620: un *negotians materiarius* ritrovato, *Epigraphica* 37, 1975, 213–216. – Fig. 3: Felici 2002.

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