

# An assessment of wine and oil production in Rome's hinterland: ceramic, literary, art historical and modern evidence\*

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## Abstract

This paper presents a model of wine and olive oil production in the area defined as Rome's immediate hinterland. The paper begins with a review of recent ceramic studies that indicate the supply patterns of wine and oil toward the city of Rome. According to these ceramic studies, there is a conspicuous void in supplies – apparently no local wine or oil was consumed in Rome. A review of literary, art historical and archaeological evidence reveals that Rome's hinterland was indeed a major producer of wine and oil, but that these products are “archaeologically invisible” since they were not transported in ceramic amphorae. The writer presents a series of calculations based upon a reading of Cato, scant archaeological evidence and modern records of wine and oil production, suggesting that as much as 33% of the wine and 25% of the oil consumed in Rome may have derived from her agriculturally rich hinterland.

## Introduction

The 1990s witnessed the publication of two important books that have altered conceptions of the ancient Roman economy for many scholars. Steven L. Dyson's *Community and Society in Roman Italy* (1992) and Neville Morley's *Metropolis and Hinterland: the City of Rome and the Italian Economy 200 B.C. – A.D. 200* (1996) were written in the light of extensive surveys in Etruria and Sabina by British, Italian and American researchers that revealed hundreds of rural sites in the Roman countryside and beyond.<sup>1</sup> Until this time many historically and/or ceramologically oriented scholars were focused on the “global” aspects of the Roman economy,<sup>2</sup> whereby issues such as the slave mode of production, sea-borne trade and the economic boom of North Africa were highlighted and, intentionally or not, local economies within the Roman Empire were downplayed. By the 1980s, some scholars began to stress the economic importance of re-

gional economies in Italy, including Rome's hinterland.<sup>3</sup> Together with the books by Dyson and Morley, these studies have convinced many researchers to look closer to home for answers.

The purpose of this paper is to highlight the role of Rome's immediate hinterland in the supply of agricultural goods to Rome and Ostia.<sup>4</sup> That long-distance transport, whether dictated by the State through taxation and the *annona* system or by entrepreneurs, was important in the Roman world is not repudiated in this paper. The writer, primarily a ceramics specialist who follows the work of Carandini, Fulford, Panella, Peacock, Peña and others, has become sensitive to the importance of regional economies in the global system of the Romans and seeks to account for goods not represented archaeologically both qualitatively and quantitatively through a review of several different sources of evidence and modeling.<sup>5</sup> It is hoped that this study might complement the archaeological field surveys, such as the Tiber Valley Project, and re-analyses of survey data by scholars whose work is presented in this volume and elsewhere.<sup>6</sup>

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<sup>1</sup> Duncan 1958; Jones 1962; Kahane *et al.* 1968; Hemphill 1975; Kahane 1977; Dyson 1978; Potter 1979; *Forma Italiae* series.

<sup>2</sup> E.g., Carandini 1970, 1983; Rickman 1980; Whitehouse *et al.* 1982; Panella 1985, 1989; Anselmino *et al.* 1986; Carignani *et al.* 1986; Martin 1989.

<sup>3</sup> Evans 1980; Purcell 1985, Barnish 1987.

<sup>4</sup> Because this paper is largely theoretical the chronological context of this paper is the first half of the second century AD, which has been chosen for two reasons: 1) to indicate that even during the height of trade during the imperial period, there was significant local production; 2) abundance of ceramic evidence from the DAI/AAR excavations at Ostia Antica.

<sup>5</sup> Clarke 1968, 21–22; Aldrete & Mattingly 1999; De Angelis 2000; MacKinnon 2001, 2004; De Sena 2003.

<sup>6</sup> Patterson 1998, 2004; see in this volume papers by Messineo, Di Giuseppe, Volpe & Arnoldus Huyzenveld.

This paper begins with a brief review of ceramic studies, which until now have presented a skewed vision of trading patterns toward the city of Rome and suggest that all staple goods were shipped from abroad. Next, information is presented which indicates that the immediate hinterland of Rome was, indeed, an important producer of fresh and preserved goods and that they are not detected archaeologically because commodities such as wine and olive oil were transported overland in perishable containers. The third part of this paper presents a model for wine and olive oil production in the immediate hinterland of Rome. The suggested volumes of local wine and oil are then considered in the light of statistical information gathered from the recent study of amphorae excavated at Ostia Antica in order to demonstrate a more realistic picture of supply trends.

### Ceramic heresy? Wine and olive oil production in Rome's hinterland

During the height of the imperial period, the city of Rome required enormous quantities of food and drink each year in order to satisfy the needs of her one million inhabitants. Scholars have estimated that 150 million tons of grain, 167 million liters of wine, 20 million liters of olive oil, and 22 million liters of fish sauce were imported to Rome each year.<sup>7</sup> Many studies in the last 20 years have sought to determine the source of foodstuffs consumed in Rome based upon historical and archaeological evidence, with one of the most common bodies of evidence being Roman pottery. Studies of large pottery assemblages excavated at Rome and Ostia have yielded crucial information for the shifting patterns of trade/supply during the imperial period.<sup>8</sup> For example, we are well aware of the fact that oil was imported predominantly from Baetica in the first and second centuries AD and from North Africa in the late Roman period. Similarly, Panella and others have indicated broad shifts from Etruscan, Campanian and Gallic wine in the early imperial period to Umbrian and Adriatic wine in the middle imperial period and, finally, Calabrian and east Mediterranean vintages in the late Roman period.<sup>9</sup> More recently, studies based upon assemblages of pottery excavated in Rome and Ostia have refined our knowledge of supply trends somewhat.<sup>10</sup>

<sup>7</sup> Scholars have estimated the dietary needs of ancient Romans based upon a variety of evidence ranging from the ancient sources to the daily nutritional targets established by organizations of the United Nations: Garnsey 1983, 119; Tchernia 1986, 21–27; Amouretti 1986, 177–96; Curtis 1991, 22–23. Estimates are, of course, subject to debate, but have been accepted by most economic historians given the absence of more reliable information.

<sup>8</sup> E.g., Whitehouse *et al.* 1982; Panella 1985, 1989; Anselmino *et al.* 1986; Carignani *et al.* 1986; Martin 1989.

<sup>9</sup> Panella 1985, 1989; Anselmino *et al.* 1986; Carignani *et al.* 1986.

<sup>10</sup> See also Peña 1999; Martin 2002; De Sena 2002, 2003; Rizzo 2003; Martin & De Sena 2005.

One of these pottery assemblages, which forms the basis of the present study, derives from the DAI/AAR excavations at Ostia Antica.<sup>11</sup> These excavations, directed by M. Heinzlmann and A. Martin (1998–2001), resulted in the recovery of about 6000 kg. of pottery, a sub-section of which has been studied by the writer following the procedures established by D.P.S. Peacock, M. Fulford, J.T. Peña and others.<sup>12</sup> The pottery studied by the writer was sorted into classes based upon their provenience (identified through examination of the clay) and function (i.e., table/utilitarian wares, cookwares and amphorae). All pottery was quantified according to raw counts and weights of all sherds, minimum and maximum vessel counts and estimated vessel equivalents.<sup>13</sup> The percentages illustrated in this paper represent the average score of these counting methods.

In addition to advances in the methods of classification and quantification in pottery studies, one way by which our knowledge of trade and supply patterns of amphora-borne commodities can be refined is to distinguish between the proportions among amphorae found at a particular site or sites and the volume of the commodities that would have been supplied/traded. This is to say, rather than knowing the shifting percentages of amphora-types over time, it would be of considerable historical interest to indicate the differences in the volume of imported goods. Thus, what does it mean that 17.5% of all wine amphorae found in early second century contexts at Ostia are Gallic? How much wine was imported from Narbonensis at this time?

We can begin to answer this question by considering amphora capacity, addressed by André Tchernia and J. Theodore Peña.<sup>14</sup> As is well known, the Romans adhered to strict volumetric and weight measurements in their calculation of the quantities of liquid and semi-liquid commodities,<sup>15</sup> a task overseen by figures such as the *praefectus annonae ad oleum* or the *coacter vinarius*.<sup>16</sup> The dimensions of the various classes of amphorae were, therefore, not decided casually by the potter, but were established on the basis of units of measurement.<sup>17</sup> A clear example of made-to-measure wine jars is attested in a series of papyri discovered at Oxyrhynchus.<sup>18</sup> These third century documents are contracts between villa owners and itinerant potters in which the former specify that several hundred ceramic vessels be fabricated in three distinct sizes (2-, 4-, and 8-*choes*).

<sup>11</sup> For recent work and bibliography of the DAI/AAR excavations at Ostia Antica, see Martin *et al.* 2002.

<sup>12</sup> Archer Martin (AAR) is currently coordinating the study and publication of the whole pottery assemblage.

<sup>13</sup> For a discussion of quantification in pottery studies, see Orton, Tyers and Vince 1993, 166–181.

<sup>14</sup> Tchernia 1986, 309–20; Peña 1999, 191–198; see also Rizzo 2003, 203–28.

<sup>15</sup> Viedebant 1917.

<sup>16</sup> Palmer 1980; Coarelli 1996; Peña 1999, 10–28.

<sup>17</sup> For units of measurement in antiquity, the classic study is Viedebant 1917; for the procedures involved in regulating the measurement and transportation of olive oil, see Peña 1998b, esp. 153–170, and 1999, 20–28.

<sup>18</sup> Cockle 1981.

Provenience	Raw values (%)	Capacity(sextarii)	Capacity (liters)	Adjusted Values (%)	Maximum volume of imports (liters)
West-central Italy	39.6	32	17.2	38.7	64,600,000
Naples/Phlegrean	1.9	54	29.1	3.1	5,200,000
Adriatic Italy	9.2	32	17.2	9.0	15,000,000
South Italy	1.6	16	8.6	0.8	1,300,000
Narbonensis	17.9	32	17.2	17.5	29,200,000
Tarraconensis	1.9	54	29.1	3.1	5,200,000
Tripolitania	0.8	24	12.9	0.6	1,000,000
Aegean – Crete	2.5	40	21.6	3.1	5,200,000
Aegean – Rhodes	1.9	40	21.6	2.3	3,800,000
Anatolia	8.4	12	6.6	3.2	5,300,000
Egypt	0.3	16	8.6	0.1	200,000
Unknown	14.0	32-54	23.1	18.4	30,700,000
<b>Total</b>	<b>100.0</b>	-	-	<b>100.0</b>	<b>167,000,000</b>

Provenience	Raw values (%)	Capacity	Capacity (liters)	Adjusted values (%)	Maximum volume of imports (liters)
Baetica (Dressel 20)	52.5	144 sext.	77.6	72.5	14,500,000
Lusitania	7.7	54 sext.	29.1	4.0	800,000
Zeugitana/Byzacena	36.4	75-150 lbs.	32.9	21.3	4,300,000
Tripolitania	3.4	125 lbs.	36.4	2.2	400,000
<b>Total</b>	<b>100.0</b>	-	-	<b>100.0</b>	<b>20,000,000</b>

Tables 1a and 1b. Proportion and maximum volume of wine and olive oil imported annually to Rome based on ceramic evidence and considering amphora capacity (DAI/AAR excavations, AD 100-150).

In Roman Italy, the most common units of volume were the *sextarius*, the amphora, the *metreta* and the *culleus*. 48 *sextarii* were equivalent to 1 amphora (= 1 cubic foot; ca. 25.9 liters);<sup>19</sup> 1.5 amphorae were equivalent to 1 *metreta*. The most common multiples of the *sextarius* were 12, 16, 24, 32, 40, 48, 54 and 72, corresponding to ca. 6.5, 8.6, 12.9, 17.2, 21.6, 25.9, 29.1 and 38.8 liters. A single *culleus* is equivalent to 20 amphorae (ca. 517 liters). The contents of oil amphorae, particularly Baetican and North African amphorae, may have also been quantified according to weight and in this case 100 pounds (1 *centenarium*) was equivalent to 54 *sextarii*.

Two recent studies calculate amphora capacity based upon geometric principals.<sup>20</sup> In his work, Peña calculated amphora capacity geometrically, but then relied upon the closest ancient unit of measurement for his final figure. He then used the resulting amphora capacities to determine the amount of wine, olive oil and fish sauce contained in the amphorae discovered at the Palatine East excavations. Giorgio Rizzo followed the same system to calculate the amount of amphora-borne commodities contained in the amphorae unearthed in several early-middle Imperial contexts in the centre of Rome. The same system is relied upon for the purposes of this study, but the capacities indicated by Peña and Rizzo are merged with the statistical evidence from the DAI/AAR excavations in order to determine the maximum volume of imported wine, olive oil and fish sauce to the cities of Ostia and Rome each year.

<sup>19</sup> Volumetrically, one amphora should be equal to one cubic Roman foot (Viedebant 1917). Because there is some range to what scholars maintain comprised a Roman foot, there is also some range of volumes: Duncan-Jones 1982, 371–372, whereby 1 *sextarius* = 0.539 litres; Peña 1999, 194–197 whereby 1 *sextarius* = 0.546 litres; Jones 1964, xv whereby 1 *sextarius* = 0.57 litres.

<sup>20</sup> Peña 1999, 191–198; Rizzo 2003, 203–228.

Tables 1a and 1b indicate that the capacity of most wine amphorae tended to fall within a rather broad range of sizes in the early Imperial period (16–54 *sextarii* = 8.6–29.1 liters). The capacity of amphorae used for the transportation of olive oil was not only larger, but the range of sizes varied considerably (48–144 *sextarii*). Containers manufactured in modern-day Tunisia were manufactured in a fairly broad range of sizes (75–150 lbs.).<sup>21</sup>

The same tables illustrate the differences in proportions between amphorae when amphora capacity is considered as well as the maximum volume of importation. The overall proportions of wine are not significantly affected, except for wine from Anatolia and Calabria, due to the very small size of these wine amphorae compared to Italic, Gallic, Aegean and early Spanish containers. However slight, the differences should be viewed as being closer to ancient proportions than the raw amphora data. Alternatively, calculating the capacity of oil amphorae shifts the proportions radically. For example, according to the ceramic data alone, Baetican oil amphorae represent 52.5% of all oil containers, while oil amphorae from Zeugitana/Byzacena represent about 36.4%. When the capacity of these containers is considered, we note significant differences in the volume of Baetican and North African oil imported to Ostia and Rome (72.5% vs. 21.3%). If we assume that amphorae are an accurate reflection of supply trends, the same tables can be used to establish the maximum volume of wine and olive oil imported to Ostia and Rome from the Roman provinces and more distant areas of Italy. No matter how the ceramic evidence is considered or refined, there is still a conspicuous absence in these supply trends: Rome's immediate hinterland.

<sup>21</sup> Peña 1999, 195–196.

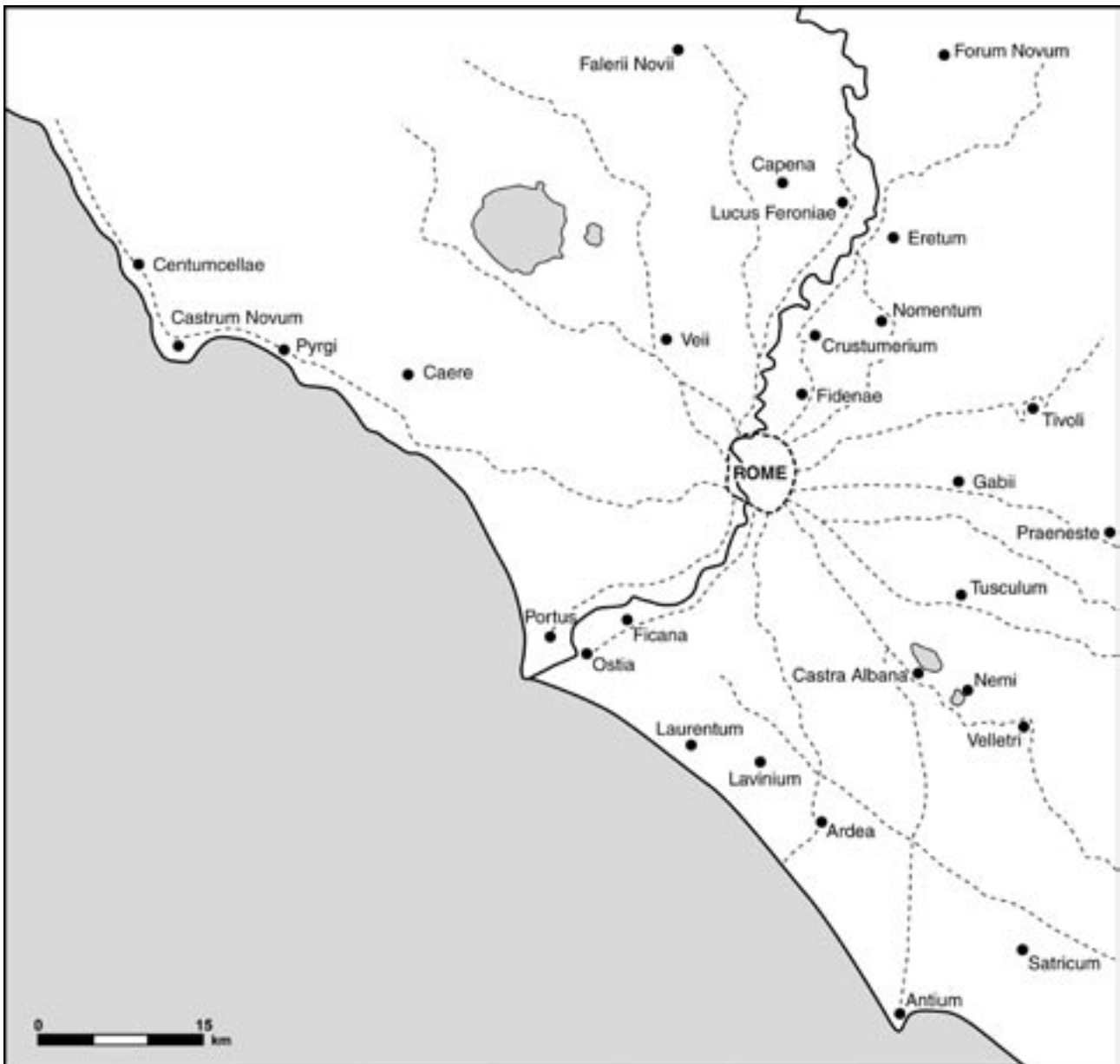


Fig. 1. Rome's immediate hinterland (Drawing by E. C. De Sena, elaborated by J. P. Ikäheimo).

### An appraisal of Rome's Hinterland

The immediate hinterland of Rome has been defined more than once, based upon geographical features, travel times and previous cultural boundaries (*Fig. 1*).<sup>22</sup> It is exponentially larger than a typical *ager*: a stretch of coastline roughly between Centumcellae to the north and Antium to the south that encompasses southern Etruria and the Pontine Plains in Latium, as well as the extended valley of the lower Tiber river up to the level of Falerii Novii and Forum Novum (c. 40 miles upriver from Rome) and an area around the Urbs ca. 30 miles along the consular roads to Sutri, Tibur, Praeneste, the Alban Hills. This territory comprises roughly 1900 square miles (ca. 5000 km<sup>2</sup>) in modern-day Lazio and would have provided Rome and Ostia with fresh alimentary goods, including dairy prod-

ucts, meat, fish, vegetables and fruit; preserved foods, including nuts, legumes, preserves, wine and oil; salt; timber and charcoal; as well as building material: volcanic tuff, limestone and travertine; clay, sand and gravel.

Despite what the ceramic record suggests, there is ample evidence for the production of wine and olive oil in the territory surrounding Rome.<sup>23</sup> To begin, Tchernia conveniently provides a list of all ancient literary references that refer to wine from different cities in Italy, including

<sup>23</sup> Researchers from the BSR have noted amphora production in the middle Tiber valley (Arthur 1997; Patterson *et al.* 2003); however, Rizzo (2003, 143) indicates that these amphorae were used for local purposes. Moreover, studies of large pottery assemblages in Rome and Ostia (Anselmino *et al.* 1986, Carignani *et al.* 1986, Peña 1999, Panella and Saguì 2000) have not revealed amphorae from the region in question.

<sup>22</sup> Walker 1967, 171–79; Morley 1996, 83–86; Peña 1999, 30.

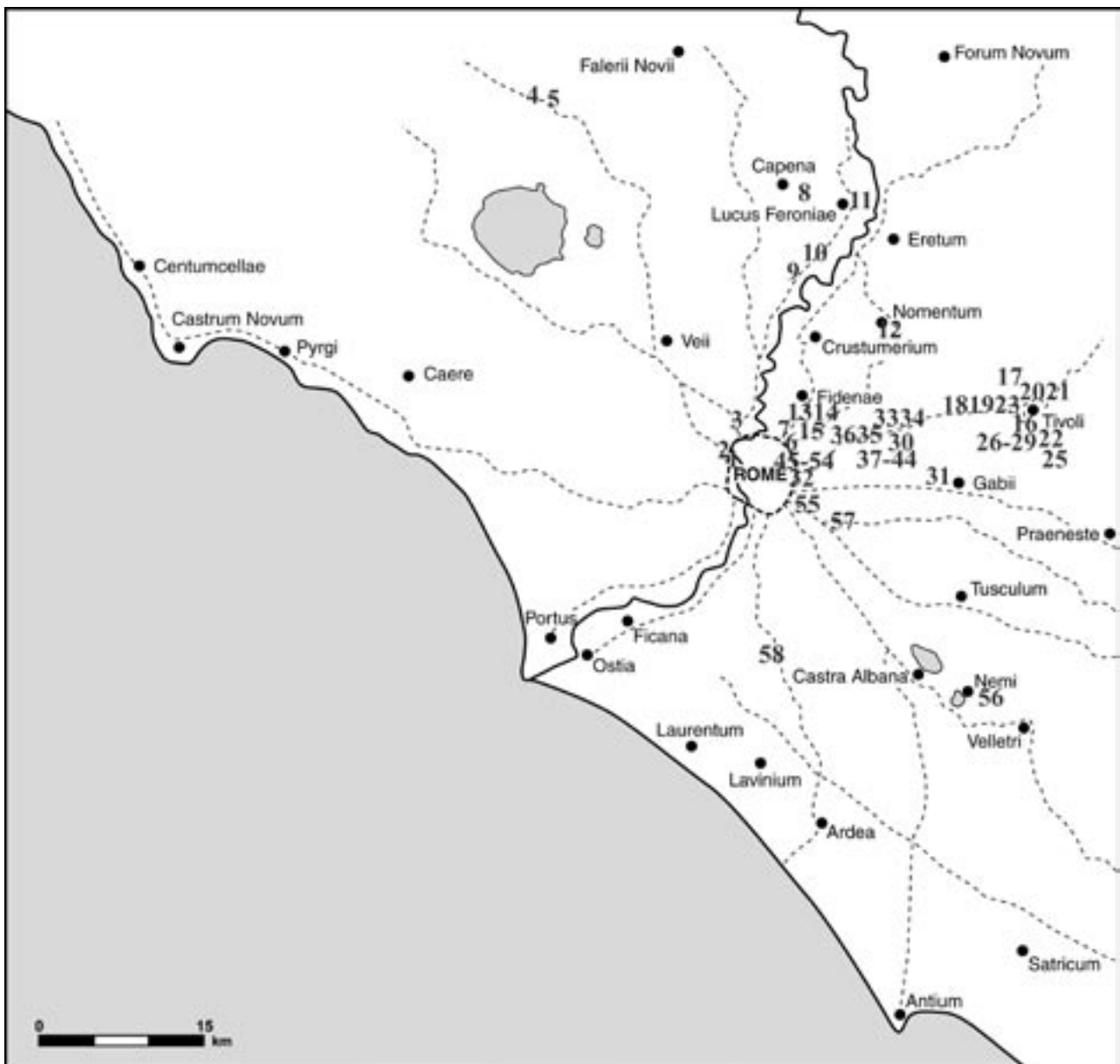


Fig. 2. Rome's hinterland with locations of villas (Drawing by E.C. De Sena, elaborated by J.P. Ikäheimo).

22 towns or territories within Rome's hinterland.<sup>24</sup> Three cities (Caere, Gravisca and Veii) were located in south-western Etruria, while the remainder were on the Pontine Plain, in the Alban Hills, the upper Latina valley, or between the Monti Lucretili and the left bank of the Tiber River (lower Sabina). Nine of the localities are mentioned in both early and late Imperial sources, including the Price Edict of Diocletian (Tiburtini and Sabini).<sup>25</sup> Moreover, thousands of Roman 'sites', many of which are presumed villas, have been identified in southern Etruria, Sabina and the Latina valley by British and Italian researchers.

Of the known villas throughout Rome's hinterland, at least 58 bear unequivocal evidence for olive oil and/or wine production (Fig. 2 and Appendix 1). No true patterns can be detected since there is considerable bias in

the manner in which these sites were identified, published and reviewed for this study.<sup>26</sup> Despite the inadequacies of the distribution of sites, two general observations can be made: the sites are distributed throughout the arable areas of the hinterland and few zones are not represented. Chronologically, 12 have a Republican phase, 18 an early Imperial phase and 12 a late Roman phase, while the full chronology of most villas is unclear. It is likely that many of the hundreds of known villas and farms had similar

<sup>26</sup> The sites were generally discovered because of imminent building activity in certain suburbs of Rome and, hence there is a heavy concentration around what is now the Grande Raccordo Anulare. Of the many sites discovered, some *Ispettori* of the local archaeological superintendency report their work more often than others. There is also considerable bias as to what archaeologists have reported – many were primarily interested in reporting 'artistic' finds, while scholars such as Lorenzo Quilici reported in great detail the nature of utilitarian finds.

<sup>24</sup> Tchernia 1986, 321–344; see also Carandini 1988, 339–58.

<sup>25</sup> Summarised by Peña 1999, 16–17.

facilities which have either been destroyed through subsequent land-usage or have not been identified and published by scholars. In the Ager Faliscus alone, 207 villas have been associated with the early imperial period,<sup>27</sup> suggesting that the central Italian landscape was akin to the situation that Mattingly and Hitchner identified in North Africa whereby the density of oil presses was approximately 1 press for every 2 km<sup>2</sup>.<sup>28</sup>

The primary reason that the agricultural commodities produced throughout Rome's hinterland are not archaeologically apparent in the *Urbs* is because both the produce and the containers in which they were transported were perishable. There is an increasing amount of evidence that barrels (*cupae*) and skins (*cullei/utres*) were utilized for overland transportation in the Roman world.<sup>29</sup> Proof of such practices is in the form of literature, epigraphic records and examples of visual culture. Among the ancient writers who mention *cupae*, *cullei* and *utres*, Strabo describes the city of Aquileia as an emporium for the Illyrians who came for merchandise that traveled across the sea: "they put their wine in wooden barrels and load their carts" (*Geography* V.1.8). The same writer recounts having seen wooden barrels "larger than houses" for the great quantity of wine produced in the Po valley (*Geography* V.1.12). Cato illustrates the manner in which to construct a four-handled, presumably wooden, container that measures one *culleus* for the transport and decanting of wine (*de Agri Cultura* 154). In his analysis of 32 Imperial-period *ostraka* from North Africa, Peña notes references to two varieties of oilskins that were used to transport oil from inland centers of Byzacena to ports, where the contents were poured into amphorae for overseas transport.<sup>30</sup> The abbreviation *as* (possibly for *ascopa* or *ascopera*) refers to oilskins with a capacity of 504 pounds of oil (ca.182.7 liters); *as a bl* (possibly standing for *ascopera* from Byzacena) refers to a smaller oilskin with a capacity of 72 or 75 pounds (26.2-27.3 liters) – roughly equivalent to one amphora.

In addition to these written references, there are also many artistic sources in which both barrels and skins are depicted. While the contents of barrels being transferred by soldiers on the Danube depicted on Trajan's Column are unknown,<sup>31</sup> the barrels represented on the funerary stele of L. Cantius Acutus, a wine merchant from Aquileia, were clearly used for wine.<sup>32</sup> The relief depicts a pair of men standing at opposite ends of a stack of barrels; they each hold a *paterna* in their right hand, while Acutus also holds a small wine skin in his left hand. From the Bay of Naples are a series of bronze statues of satyrs and silenoi discovered in the Villa of the Papyri in Herculaneum: a drunken satyr enjoys his debauchery whilst reclining upon a half-full *utres*; a pair of silenoi hold small wine skins, possibly offering wine to the visitors of the

villa; the most dramatic statue represents a silenoi riding an overturned *culleus*.<sup>33</sup>

It is presumed that substantial quantities of wine and olive oil were produced in the vicinity of Ostia and Rome and transported in perishable containers or re-used amphorae that are not obvious in the archaeological record. In order to compensate for the "invisible" portion of material culture, I shall rely upon model building.

## A model for wine and olive oil production in Rome's hinterland

Indeed wine and olive oil were produced in Rome's hinterland, but can we approach an estimate of the volume produced on an annual basis? Faced by the absence or lack of solid evidence, archaeologists have frequently built models or have posited numerical estimates of socio-economic systems.<sup>34</sup> It must be borne in mind that the more we extrapolate mathematically, the greater the risk of moving away from reality, but at least such estimates are targets that can be proved or disproved by future research. For the purposes of this paper, it is assumed that the density of vines and olive groves in Rome's hinterland was similar in both the Roman and modern periods. This assumption is based upon archaeological evidence gathered by British and Italian surveyors<sup>35</sup> as well as passages in the ancient sources.<sup>36</sup>

If estimates of ancient yields of wine are based upon modern statistics,<sup>37</sup> we note that an average of 340 million liters of table wine is produced annually from 45,000 hectares of vines in modern-day Latium.<sup>38</sup> Considering that the immediate hinterland of ancient Rome accounted for about 65% of the land used in present-day Lazio for vineyards, we might expect an average of 221 million liters of wine produced on 29,000 hectares. Given the fact, however, that viticultural techniques are far more advanced today than in antiquity, this figure is probably an over-estimation of ancient yields. Perhaps a closer estimate can be extracted from Cato (*de Agri Cultura* 11). In his book on the equipment requirements for a 100 *iugera* vineyard, Cato mentions the need for 800 *cullei* that would be used to store five vintages. If 800 *cullei* amount to 413,600 liters of wine, then a single vintage from a 100 *iugera* estate would have consisted of 82,720 liters of wine. This figure is somewhat more than the annual yield that Andrea

<sup>33</sup> Wojcik 1986, 227–240, Figs. LIX, CXX, CXXI.

<sup>34</sup> See, recently, Aldrete and Mattingly 1999; De Angelis 2000.

<sup>35</sup> *Supra* note 1.

<sup>36</sup> The reader is directed to Tchernia 1986 and Brun 1986 for discussions of ancient texts mentioning the production of wine and olive oil.

<sup>37</sup> For the purposes of this study, it is assumed that the geographic and climatic conditions of ancient and modern Italy were comparable; for an excellent account of the geographic and climatic conditions of ancient Latium see Leonardi *et al.* 1998.

<sup>38</sup> Source: Istituto Nazionale di Statistica ([www.istat.it](http://www.istat.it)).

<sup>27</sup> Potter 1979, 125–40.

<sup>28</sup> Mattingly 1988; Hitchner 1989, 1993.

<sup>29</sup> Marlière 2002; Tchernia 1986, 39 and 285–292.

<sup>30</sup> Peña 1998, 166–171.

<sup>31</sup> Settis 1988, 262, Pl. 4.

<sup>32</sup> Tchernia 1986, 288, fig. 4.

Carandini calculated for the Settefinestre villa. Carandini estimated that vineyards were planted on 230 *iugera* of the Settefinestre estate, producing 4600 amphorae (119,140 liters) of wine per year, or 51,800 liters per 100 *iugera*.<sup>39</sup> Closer to Cato's appraisal, Potter estimated that villa 13 at Boscoreale, whose extent is unknown, could have produced about 93,800 liters, based upon the number of dolia found *in situ*.<sup>40</sup> Finally, excavations of a villa along the via Tuscolana in Rome (Rea 1985) revealed two large cisterns in association with a wine-pressing area whose combined capacity was 102,000 liters. The total extent of this estate's vineyard is unknown, but the similarity of this volume with that of villa 13 at Boscoreale and Cato's figure is interesting. If we employ Cato's figure, the 29,000 hectares (116,000 *iugera*) of vineyards in Rome's immediate hinterland would have yielded an average of 96,000,000 liters of wine per year – somewhat less than half the modern yield. While good and bad harvests occur today as they did in antiquity, the degree of fluctuation is not as great as that for olives.

Naturally, the producers would have consumed some portion of the wine and oil produced in this region. The population of Rome's hinterland is not known, but can be estimated. Many scholars suggest that the free population of Roman Italy in the first century AD was around 4.5 million and that the total population was around 7.5 million.<sup>41</sup> Subtracting 1,000,000 for Rome/Ostia and another 1,000,000 for the greater Bay of Naples region, if we assume that the remaining population was spread evenly over the ca. 125,000 square miles of peninsular Italy, we arrive at a figure of 44 people per square mile, or 118,800 people in the 1900 square mile region of Rome's immediate hinterland.<sup>42</sup> Population density may have been somewhat higher around Rome and, thus, for the sake of this paper this figure might be doubled to ca. 250,000. This figure is somewhat arbitrary, but when we consider that the average size of the 400 minor cities in Roman Italy mentioned by Morley was 2000 free inhabitants<sup>43</sup> and that there were no more than 70-100 minor cities in the region in question, an estimate of 250,000 seems reasonable and would also account for slaves. This figure also seems reasonable if we consider that the current population of the provincia di Roma, excluding the city of Rome,

<sup>39</sup> Carandini (1980, 4) suggests that somewhat less than half of the plantation was utilised for the cultivation of grapes.

<sup>40</sup> Potter 1987, 97.

<sup>41</sup> These estimates are based largely upon records from the Augustan census of 28 BC (see Jongman 1991, 66-67 and Morley 1996, 47), which have been interpreted variously. Beloch (1886, 388-443) assumed that this number included all citizens (male, female and children) but subtracted what he believed to be the population of Cisalpine Gaul and added 2 million slaves for a total Italian population of 5,500,000 in 28 BC. Brunt (1971, 124) assumed that a certain number of citizens did not register with the state and inflated the basic sum of citizens to 4,500,000 and assumed 3 million slaves. See also Hopkins 1978, 68-69; Jongman 1991: 67; Morley 1996, 46-50.

<sup>42</sup> Cf. Morley 1996, 33-39.

<sup>43</sup> Morley 1996, 182; for a recent paper on the population of Roman Italy, see Scheidel 2004.

Yield (x1000 lit.)	96,000
Producers' share (x1000 lit.)	42,000
Urban supply (x1000 lit.)	54,000
No. urbanites per year	323,000
Additional annual need (x1000 lit.)	113,000

Table 2. Model for regional wine production and urban supply

is about 1,250,000 (<http://demo.istat.it/bilmens2004>). Modern-day Lazio is certainly more densely populated than the ancient Roman hinterland.

Table 2 presents a scheme for wine production and consumption in Rome's hinterland. Of the 96 million liters of wine produced each year, somewhat less than half of the wine would have been consumed by the 250,000 residents of this region. This left 54 million liters for the urban population of Rome and Ostia, meeting 32% of the urban demand for wine. There still would have been a need for about 113 million liters of wine from external sources.

Modern-day Latium hosts more than 86,000 hectares of olive groves that produce an average of 24,000,000 liters of virgin oil per year, with a ten-year low of about 15,000,000 and a ten-year high of about 37,000,000.<sup>44</sup> The wide variation in yields is dependant upon many factors, including the amount of rainfall, the two-year cycle of olive trees, which will be productive in alternate years, and vegetal or animal infestations.<sup>45</sup> Average, poor and bumper yields are normal in modern olive growing regions as was the case in antiquity. Statistical information regarding olive producing nations in the Mediterranean indicate that in recent decades, there are generally 3 poor yields, 2 bumper yields and 5 average yields.<sup>46</sup> The recent technological advances made in oil presses simply speed up the process rather than producing more oil from a set volume of raw produce.<sup>47</sup> Pliny (*N. H.* 15.4.14) reports that six Roman pounds of oil (1.96 kg) are generally extracted from one *modius* of olives (8.62 kg) for a yield of 22.7%. This figure is significantly higher than the average modern-day yield of 13-18%.<sup>48</sup> Assuming, once again, that patterns of land usage were the same in antiquity as they are at present, the territory defined in this study would have had 56,000 hectares of olive trees and assuming that ancient and modern yields were essentially the same, we should expect an average annual yield of 15 million liters of oil in Rome's immediate hinterland.<sup>49</sup>

Jean-Pierre Brun, however, suggests a lower yield for Roman olive groves based upon yet another reading of

<sup>44</sup> Source: Istituto Nazionale di Statistica ([www.istat.it](http://www.istat.it)).

<sup>45</sup> Mattingly 1988.

<sup>46</sup> Source: International Olive Oil Council – Economics Division ([www.internationaloliveoil.org](http://www.internationaloliveoil.org)).

<sup>47</sup> Curci 2001, 143-147.

<sup>48</sup> For estimates of olive oil yields in Roman Africa, see Mattingly 1993, 484; for modern yields, see Curci 2001, 31.

<sup>49</sup> This is equivalent to 268 liters per hectare or 67 liters per *iugerum*.

Year	Avg.	Low	Bumper
Yield (x1000 lit.)	9,700	6,000	15,000
Producers' share (x1000 lit.)	5,000	5,000	5,000
Urban supply (x1000 lit.)	4,700	1,000	10,000
No. urbanites per year	235,000	50,000	500,000
Additional annual need (x1000 lit.)	15,300	19,000	10,000

Table 3. Model for regional oil production and urban supply.

Cato (*de Agri Cultura* 10).<sup>50</sup> Cato recommends that a 240 *iugera* farm should be furnished with 100 oil *dolia*, which measure approximately the same as a *culleus* (c. 517 liters). These *dolia* would, thus, store 51,700 liters of oil. Although specific mention is not made by Cato in this passage, Brun assumes that these *dolia* would store five-years worth of oil, just as the wine *cullei* in Cato's chapter 11 would store five vintages. This scholar's assumption may be supported by information from the early third century AD. Upon the death of Septimius Severus, the *Horrea Galbana* had been stocked with five-year's worth of oil (*SHA*: Severus XVIII,3; Severus XXIII,2; Clodius Albinus XII.7),<sup>51</sup> indicating that it would not have been unusual to plan so far into the future. According to Brun's estimates, a 240 *iugera* farm would produce an average of 10,340 liters of oil, or 43.1 liters per *iugerum*. If this estimate is multiplied by the amount of land in Rome's hinterland assumed here to have been planted with olive trees, an average yield would be 9.7 million liters.

Based upon these estimates, we can work out a scheme (*Table 3*), which illustrates hypothetical yields in average, poor and bumper years with the number of people that the yields could satisfy in one year. Assuming that the producers of this oil (250,000 rural folk) kept enough oil for themselves (5 million liters), the surplus oil for the urban market would have been 4,700,000 liters in an average year, enough oil to satisfy the annual needs of 235,000 people in Rome and Ostia or the needs of 1,000,000 urbanites for about 12 weeks. With a bumper yield the surplus was 10,000,000 liters, which would have satisfied half the urban needs. Poor yields would have filled a far smaller portion of the urban demand. If the producers kept their share of the yield, only one million liters would have been available for the urban market (5% of the total demand); thus, nearly all the olive oil consumed in Rome and Ostia had to have been imported from extra-regional sources. Considering Brun's assessment, producers of olive oil in Rome's immediate hinterland may have stockpiled oil from bumper years in provision of poor yields.<sup>52</sup> In this way, they still may have been able to provide 4,700,000 liters of oil to the *Urbs* and its port city despite

poor yields. Assuming that 4,700,000 liters was an annual target, this still left somewhat more than 75% of the urban supply to satisfy through importation.

When these estimates are confronted with the ceramic evidence from the DAI/AAR excavations at Ostia, the picture of supply trends is quite different (*Figs. 3-4*). Mathematically, the percentages of amphorae are re-partitioned to account for the percentage not covered by regional production, namely 67.7% of the wine supply and 76.5% of the olive oil supply. In this way, the proportions among the amphorae remain constant, but the volume of imported commodities is reduced (cf. *Table 1*). As for olive oil, Baetica still appears as the principal supplier with nearly 12 million liters being imported to Rome/Ostia, while North African oil accounts for 3.5 million liters. As for wine, this experiment suggests that Rome's hinterland was actually the main source, while Tuscany/Umbria, Gaul and the northern Adriatic region were the principal suppliers with a combined 64 million liters imported each year to Rome/Ostia. These figures seem to corroborate estimates posed by scholars based upon a variety of factors. For example, Garnsey and Saller estimated that 4 million liters of Baetican oil (transported in 55,000 amphorae) were consumed annually in Rome based up the Monte Testaccio evidence.<sup>53</sup> The authors did not take into account the fact that Dressel 20 amphorae were discarded in many other parts of Rome and Ostia; thus, we should take their estimate to be a minimum volume. In fact, Rodríguez Almeida estimated that in the second century AD 10 million liters of olive oil were imported to Rome on an annual basis.<sup>54</sup> Moreover, Bruce Hitchner estimated that about 300,000 Dressel 20 amphorae were produced annually in the Guadalquivir region.<sup>55</sup> When the 10-12 million liters of Baetica oil suggested in *Fig. 4* are divided by the capacity of a typical Dressel 20 oil amphora, the result is that ca. 130-156,000 amphorae were required for the transport of oil to Rome/Ostia each year, roughly 33-50% of Hitchner's estimate (the remaining 144-170,000 amphorae would have been used to transport oil to other centers throughout the Mediterranean). David Mattingly suggested that 1 million liters of Tripolitanian oil were shipped to Rome each year,<sup>56</sup> whilst 300,000 liters are proposed here. This discrepancy may be due to the fact that Tripolitanian amphorae may be underrepresented at the DAI/AAR excavations, due to reasons such as the possibility that many body sherds may not have been distinguished from Tunisian amphorae. There are no comparable estimates for the volume of foreign wine to Rome in the archaeological literature.

<sup>50</sup> Brun 1986, 280.

<sup>51</sup> Reported by Andrea Carandini (1970, 99). There are, of course, difficulties with this source. As Allan Klynne (personal communication) has rightly indicated, if we take this passage at face value, the *Horrea Galbana* and other nearby facilities would have had to house 100 million liters of olive oil.

<sup>52</sup> Under normal conditions oil can be stored in closed containers for at least two years (Curci 2001, 182-183).

<sup>53</sup> Garnsey & Saller 1987, 58.

<sup>54</sup> Rodríguez Almeida 1984, 29.

<sup>55</sup> Hitchner 1993, 504.

<sup>56</sup> Mattingly 1993, 153.

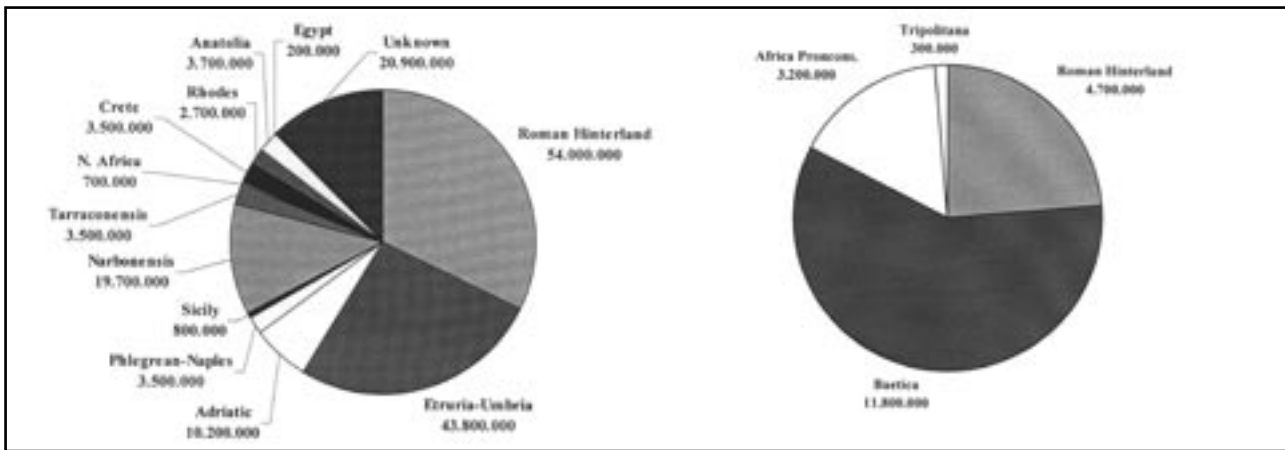


Fig. 3-4. Proportions of wine and olive oil consumed annually in Rome, AD 100-150, considering ceramic evidence and estimates of local produce.

## Conclusion

The immediate hinterland of Rome (*Fig. 1*, above), an area of some 5000 km<sup>2</sup> between Centumcellae and Antium on the Tyrrhenian coast and the cities of Falerii Novii and Forum Novum in the middle Tiber Valley, was an important source of agricultural commodities for the city of Rome during the imperial period. Wine and olive oil were two goods produced in this broad region, yet these regional goods have been largely ignored by modern scholars in the light of the 'global' system of trade in the Mediterranean.

This paper has sought to determine the volume of wine and olive oil that was produced in Rome's immediate hinterland at the height of the imperial period and to merge these estimates with ceramic evidence from recent stratigraphic excavations at Ostia Antica in order to propose a more nuanced vision of supply trends toward Ostia and Rome. A review of archaeological, textual and modern information suggests that the Roman hinterland was capable of producing 96 million liters of wine (54 million liters surplus for the *Urbs*) and 9.7 million liters of olive oil (nearly 5 million liters surplus for the *Urbs*). In the light of this volume dedicated to suburban villas one final calculation is posited: if we consider that a 100 *iugera* vineyard would have produced 82,720 liters of wine and a 240 *iugera* olive grove will produce 10,340 liters of olive oil, we should expect about 940 villas/farms involved in oil production and 1160 villas/farms involved in wine production in Rome's immediate hinterland. Of course, the villas/farms may have been one in the same, producing both wine and oil; thus, we should expect between 1160 and 2100 villas/farms in the region.

The estimates posited throughout this study are provisional, but are a further step in the direction of understanding the organization of agricultural systems in Roman Italy. The figures should be considered to be targets that can be refined through the continued programs of study which focus upon the remains of villas, landscape archaeology and archaeological materials. The application of GIS would be of particular importance in this regard in order to consider three-dimensionally the location and size of

villas and farms over time, their produce, their access to roads and rivers, and even to calculate transport friction (the cost of transport considering factors such as terrain, road surfaces, river currents and type of vehicles).

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## Appendix I. Wine and Oil Production Sites

58 villas and farms surveyed or excavated within the immediate hinterland of Rome bear clear evidence of olive oil and/or wine production (*Fig. 2*, above). While it is beyond the scope of this paper to describe or even assess all evidence for villas within Rome's immediate hinterland, a documentary sampling procedure was followed. Rossiter listed all known wine and oil producing sites in this region that had been published up to the late 1970's – a total of 10 sites. For sites published after ca. 1980, a number of journals and other publications were browsed: *Notizie degli Scavi*, *Bolletino Comunale*, *Archeologia Laziale* and the *Forma Italiae* series. This list is not meant to be exhaustive, but indicates to some extent the geographic and temporal distribution of such sites in the Roman hinterland. Many additional villa sites were described as having "mill stones", but whether these stones were for grain or olives could not be determined from the brief descriptions and such sites are not included here.

1. Via Boccea (Casalotto) – wine or oil – several rooms of a villa rustica were excavated; one was a large storeroom containing 8 perfectly preserved *dolia in situ*; another *dolium* was discovered in an adjacent area; the contents of the *dolia* are unknown. References: Romanelli 1933, 246–48; Rossiter 1981.
2. Via Boccea (Casalotto) – wine – the *pars rustica* of a villa dating to the 2nd-4th centuries AD was excavated in

- the Casalotti district outside of Rome; the stone base of a *torcularium* was discovered in association with a basin and drainage channels. References: Santolini and Ciufferi 1986, 754–759.
3. Casale Ghella – wine or oil – large villa along the via Cassia dating generically to the Imperial period (a coin of Alexander Severus was found); the *pars rustica* contained basins lined with *cocciopesto*, related channels and the base of a *torcularium*. References: Messineo *et al.* 1985, 177–184; Messineo and Vigna 1987–88, 504–09.
  4. Sutri (Poggiolo Suligano) – wine or oil – remains of a Roman villa; one area contained two large rectangular blocks of tuff carved in the centers – possibly the bases of *arbores*. References: Morselli 1980, n. 157.
  5. Sutri (fattoria Contea Flacchi) – oil? – Roman villa; among the surface finds was a peperino millstone. References: Morselli 1980, n. 179.
  6. Via delle Vigne Nuove – wine – early Medieval decanting tank discovered in a large villa with origins in the Roman period. References: Messineo and Sorella 1989–90, 218–222.
  7. Castel Giubileo – wine – villa whose chronology appears to be limited to the 1st century AD; the *pars rustica* bears a floor paved in *cocciopesto* with depressions where *dolia* had been; traces of a *torcularium* with part of the *ara* preserved in association with a basin lined with *cocciopesto*. References: Ammannato and Belemi Marchesini 1987–88, 465–467.
  8. Ager Capenas (Monte Canino) – oil – villa rustica with a roughly square plan dating between the early and late Imperial periods; rich decoration, including mosaics and marble architectural members and sculpture; a pair of at the west end contained a *calcatorium* paved in *cocciopesto*, a rectangular basin lined with impermeable plaster and the base of a *torcularium*, presumed for pressing grapes. References: Pallottino 1937, 7–28; Rossiter 1981.
  9. Via Tiberina (Fosso di Valle Lunga) – oil – modest villa rustica with a well preserved *atrium*, bath complex and cisterns; dates from the Republican period until at least the 2nd century AD; a portion of the villa containing the base of a *torcularium* was renovated in the late 1st or early 2nd century; in addition to the *torcularium*, two sunken basins and associated channels were excavated as well as an inclined floor lined with impermeable plaster interpreted by the excavators as a *calcatorium*. References: Felletti Maj 1955, 206–216; Rossiter 1981.
  10. Via Tiberina – wine – large villa dating to the 1st century BC to 5th/6th century AD; phase 4 (5th century) witnessed the construction or reconstruction of a treading floor (*calcatorium*) and a decanting basin; steps lead into the *calcatorium* and a hole at one end allowed must to drain into storage tanks; 11 *dolia* were discovered *in situ* – semi-buried – some of which may date to the Augustan period, suggesting that wine was always produced on this estate. References: Mancinelli 1989–90, 197–209.
  11. Lucus Feroniae (Villa dei Volusii) – oil – a large and sumptuous villa whose main building had a surface area of about 6400 m<sup>2</sup> stood in close proximity to the town forum; the villa was occupied between the mid first century BC and the fifth century AD; the *pars rustica* set apart from the main structure contained the base of an oil press; this villa has not been published in full and the working spaces not described in detail. Two other nearby villas discovered through salvage excavations also contained oil presses, but have not been properly published. References: Sgubini Moretti 1998, 29; Carbonara and Messineo 1994, 38–40; didactic panels in Lucus Feroniae Antiquarium.
  12. Casali di Mentana – oil – surface remains of a villa, including the circular base (*ara*) of an oil press; no dates. References: Pala 1976; Rossiter 1981.
  13. Nomentana/Saleria – wine – villa with construction/habitation phases between 1st–4th centuries AD; contains the remains of a wine press, a rectangular basin with associated channels and at least 6 *dolia in situ*. References: Messineo and Perego 1987–88, 456–459.
  14. Nomentana/Salaria – oil? – rectangular room of a villa containing a central row of pillars; six *dolia* found *in situ* in association with a basin lined in *cocciopesto* and bearing a drainage aperture; presumed for oil production; dated to the 4th or 5th centuries AD. References: Di Manzano 1984, 131–132.
  15. Via Nomentana – wine – remains of a villa located 14 km outside of Rome near S. Alessandro; chronology spans the late Republican to late Imperial periods; area for wine pressing contained the base of the *arbores*, a circular *ara* with two channels leading into a series of decanting basins lined with *cocciopesto*, three of which were excavated; the wine pressing facilities may have been abandoned shortly prior to the complete abandonment of the villa in the 4<sup>th</sup> century. References: Staffa 1989–90, 189–212.
  16. Ager Tibertinus (Granaraccio) – wine and oil – *pars rustica* of a partially excavated villa complex; a series of rooms contained a *calcatorium* or *forum*, the base of an olive mill and two *torcularia* in association with channels and basins; the excavators suggest that the *torcularia* were used contemporaneously; no dates are indicated. References: Faccenna 1957, 148–153; Rossiter 1981.
  17. Ager Tibertinus (Guidonia) – wine and oil – portion of a *villa rustica* constructed in the 1st or 2nd century AD; large *atrium* with a black and white mosaic floor; suite of chambers used for wine and oil production abuts the north side of the *atrium*, but does not communicate with it directly; entrance to this suite from a courtyard to the west of the *atrium*; well preserved *calcatorium* or *forum* with a drainage channel leading into a basin set outside of the suite; circular base of the *trapetum* in association with two basins fed by channels. References: Caprino 1944–45, 39–51; Rossiter 1981.
  18. Ager Tibertinus (Valle Pitella) – wine and oil – the *pars urbana* and *pars rustica* of a villa were excavated at the 24.8 km mark of the via Tiburtina; furnishings included mosaic and marble revetment; area G contained a paved *opus spiccatum* floor and the base of a press presumed to have been used for both wine and oil; channels lead from the *ara* to a large basin. References: Reggiani 1978, 219–225; Rossiter 1981.

19. Ager Tibertinus – wine or oil – Roman villa with stone base of an *arbor*. References: Mari 1991, n. 14.
20. Ager Tibertinus (Colle Lecinone) – oil – Roman villa dated 1st BC to 1st AD; surface finds included the *ara* of an oil press. References: Mari 1991, n. 18.
21. Ager Tibertinus (Colle Lecinone) – oil – surface remains of a Roman villa with a phase dated to the 2<sup>nd</sup> century AD; *ara* of an oil press. References: Mari 1991, n. 19.
22. Ager Tibertinus (ex Convento S. Angelo in Plaiule) – oil – so-called ‘Villa of Catullus’ with components of the structure ranging in date from the Republican to the Medieval periods; among the surface finds was the *ara* of an oil press. References: Mari 1991, n. 27.
23. Ager Tibertinus (Casale Imperi) – oil – remains of a villa with stone fragments of an oil press. References: Mari 1991, n. 45.
24. Ager Tibertinus (Quarto Pomata) – oil – remains of a Roman villa; one area contained stone fragments of an oil press as well as associated channels and a tank lined with *cocciopesto*. References: Mari 1991, n. 120.
25. Ager Tibertinus (casale S. Angelo) – wine or oil – among the remains of a Roman villa were two *arae* of wine and/or oil presses. References: Mari 1991, n. 127.
26. Ager Tibertinus (Colle della Foce) – oil – Roman villa with late Republican and early Imperial period phases; intact *ara* of a wine press. References: Mari 1991, n. 149.
27. Ager Tibertinus (Colle Bulgarini) – wine or oil – Roman villa dating between the 2<sup>nd</sup> century BC and the early Imperial period; fragments of a travertine *ara*. References: Mari 1991, n. 167.
28. Ager Tibertinus (Casalone) – wine or oil – Roman villa with an intact travertine *ara*. References: Mari 1991, n. 199.
29. Ager Tibertinus (Colle Merulino) – wine? – Roman villa with initial phase dated to the 2<sup>nd</sup> century BC; a basin is presumed to have served for wine production. References: Mari 1991, n. 202.
30. Ager Tibertinus (Lunghezzina) – oil – remains of a Roman villa; stone components of an oil press with associated channels and basins. References: Mari 1991, n. 215.
31. Via Gabina – oil – villa 11, one of several villas surveyed along this road, was originally constructed in the later 3<sup>rd</sup> century BC with a ‘U’ shaped plan and an external *hortus*; major rebuilding in the early Imperial period (2<sup>nd</sup> c. AD) following the same general plan; oil pressing facilities dated to ca. AD 150-220/30, including the foundation of a press, floor paved in *opus spiccatum*, 6 sunken tanks and basins used to separate oil from *amurca* and to allow sediment to settle; abandoned sometime after AD 220/30. References: Widrig 1980; Oliver-Smith and Widrig 1981; Widrig *et al.* 1983; Rossiter 1981.
32. Via Prenestina – wine or oil – poorly preserved villa located just a few kilometers outside the Aurelian wall in Casal Bertone possibly dated to the Republican period; two basins lined with *cocciopesto* with a channel defined as a ‘decanting channel’. References: Calci and Messineo 1989-90, 133-134.
33. Collatia – oil? – surface remains of a large villa, including the base of an oil press. References: Quilici 1974, n. 87.
34. Collatia (castello di Lunghezza) – wine and oil? – architectural remains and surface finds of a large Roman villa; rectangular block of granite served as the base of an *arbor*. References: Quilici 1974, n. 100.
35. Collatia (casale Benzone) – oil – surface remains of a Roman villa; *ara* of an oil press and two elongated basins. References: Quilici 1974, n. 106.
36. Collatia (13 km via Prenestina) – wine and oil – architectural remains and surface finds of a villa; two stone blocks served as the base of *arbores* associated with a pair of basins. References, Quilici 1974: n. 201.
37. Collatia – wine or oil – a basin within the confines of a Roman villa is presumed to have been used for either wine or oil production. References: Quilici 1974, n. 221.
38. Collatia (16 km via Prenestina) – wine or oil – surface finds of a Roman villa, including the peperino components of an wine or oil press. References: Quilici 1974, n. 229.
39. Collatia (fosso di Montegiardino) – wine or oil – remains of a Roman villa contained a basin presumed to have been used in the production of wine or oil. References: Quilici 1974, n. 241.
40. Collatia (collina di Riserva Nuova) – wine or oil – remains of a Roman villa contained a basin presumed to have been used in the production of wine or oil. References: Quilici 1974, n. 245.
41. Collatia (casale S. Ambrogio) – oil – imperial period villa containing the stone base (peperino) of an oil press. References: Quilici 1974, n. 248.
42. Collatia (16.5 km via Prenestina) – oil – surface remains of a Roman villa; stone base of an oil press in association with mill stones. References: Quilici 1974, n. 258.
43. Collatia (Castelaccio dell’Osa) – oil? – architectural remains of a Roman villa, including a basin assumed to have been used for the production of olive oil. References: Quilici 1974, n. 317.
44. Collatia (Castelaccio dell’Osa) – oil? – a basin and a millstone noted among the architectural remains of a Roman villa are presumed to have been used for the production of olive oil. References: Quilici 1974, n. 319.
45. Collatia (strada della Borghesiana) – wine? – Roman villa; among the surface remains was a basin presumed to have been used for wine production. References: Quilici 1974, n. 362.
46. Collatia (Tor Angela) – oil – elongated stone basin presumed to have been used for the production of olive oil discovered within a Roman villa. References: Quilici 1974, n. 482.
47. Collatia – wine or oil – among the remains of a villa was a stone basin presumed to have been used for either wine or oil production. References: Quilici 1974, n. 444.
48. Collatia (fattoria delle Due Torri) – oil – among the architectural remains of a Roman villa was the stone *ara* of an oil press. References: Quilici 1974, n. 456.

49. Collatia (Tor Carbone) – wine or oil – remains of a Roman villa; among the surface remains was the *ara* of a wine or oil press. References: Quilici 1974, n. 517.
50. Collatia (Torre Nova) – oil – remains of a Roman villa; *ara* of an oil press. References: Quilici 1974, n. 616.
51. Collatia (via di Tor Vergata) – oil – remains of a Roman villa; surface finds included the stone components of an oil press and basins. References: Quilici 1974, n. 618.
52. Collatia (casale La Barcaccia) – wine or oil – Roman villa containing a basin presumed to have been used for wine or oil production. References: Quilici 1974, n. 756.
53. Collatia (vigne Passo Lombardo) – oil – remains of a Roman villa containing a basin presumed to have been used for oil production. References: Quilici 1974, n. 761.
54. Collatia (casale Passo Lombardo) – oil – remains of a Roman villa containing the stone base of *arbores*. References: Quilici 1974, n. 779.
55. Casilina/Tuscolana – wine and oil – large villa complex with origins in the early 1st century AD; excavators reveals features related to both wine and oil pressing; a pair of sunken decanting *dolia* with related channels found in association with two large cisterns with total capacity of ca. 102,000 liters (197 *cullei*), assumed to be for wine storage; the *ara* of an oil press were also noted. References: Rea 1985, 102–111.
56. Nemi – wine – recent excavations of a villa by Scandinavian archaeologists revealed the foundation of a wine press and a *calcatorium*; the chronology of the villa is late Republican to middle Imperial. References: unpublished; personal communication with Dr. Eeva-Maria Viitanen (University of Helsinki).
57. Via Latina – wine and oil – salvage excavations of a villa located near the 7th mile of the via Latina at Casale di Leucite revealed a *torcularium vinarium* with 2 related basins and associated drainage channels; the villa dates to the late Republican and early Imperial periods; a large grinding stone of leucite lava is presumed to be part of an oil mill. References: Corrente 1987-88, 398–401.
58. Via Ardeatina – wine or oil – large villa located about 25 km outside of Rome that was occupied until at least the 4th century AD; *pars rustica* contained three *cocciopesto*-lined basins connected by channels; three *dolia in situ*. References: Scarnicchia 1987-88, 553–559.

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*An assessment of wine and oil production in Rome's hinterland*

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