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## **Edited by:**

Edward Anson ✦ Michael Fronda ✦ David Hollander  
Timothy Howe ✦ Joseph Roisman ✦ John Vanderspoel  
Pat Wheatley ✦ Sabine Müller



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# Wetlands and Environment in Hellenistic Sicily: Historical and Ecological Remarks\*

*Salvatore Vacante*

The achievement of a comprehensive and satisfying environmental picture of ancient Sicily has so far eluded modern historians. The absence of convincing conclusions on the role effectively played by wetlands in the Greek period is particularly striking. In the early first millennium BCE, Sicily was an ecologically multi-faceted island. However, some relevant ecological modifications rapidly took place in the island. The evidence shows that in most of the Central-Eastern Mediterranean Basin indiscriminate deforestation and agriculture rapidly caused soil erosion, alluvial deposition, and formation of extensive marshes in the late Classical – early Hellenistic period.<sup>1</sup> There is no reason to assume that Sicily made exception to this general process. However, although serious environmental imbalances likely assumed significant proportions here, an overall understanding of local phenomena is far from being achieved. This especially applies to the little explored centuries immediately preceding the Roman conquest. It is therefore necessary to proceed to further investigation, in order to bridge the gap and achieve new insights on the matter. The aim of the present contribution is therefore to provide new information and suggest possible interpretative models for local ecological processes in the proposed historical framework.

(i)

In the Greek period, there were famous wetlands at the mouth of the Hipparis River to the north of Camarina. A passage of the poet Pindar offers a concise but realistic description of the local situation in the middle of the fifth century: ‘the River Oanis, the local lake, and the sacred water channels thanks to which the Hipparis waters its inhabitants.’<sup>2</sup> At that time, the mouth of the Hipparis River formed a huge harbour-lake, which however gradually turned into a marsh. This was likely the object of reclamation between the late fourth and the early third century BCE, because the contemporary Callimachus defines this event as

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<sup>1</sup> E.g. Vita-Finzi 1969; Thirgood 1981; Chew 2001, 69; Collin-Bouffier 2009, 66-68; Walsh 2014, 114; De Angelis 2016, 230 *contra* Grove and Rackham 2003<sup>2</sup> (who instead challenge the idea that deforestation and soil erosion were the primary causes of the progressive drying up of the Mediterranean regions over the centuries). Geo-archaeological stratigraphies from Selinous in Sicily, Sybaris and Elea (Velia) in Southern Italy attest to gradual increase in temperature, diminution of rainfall and accumulation of alluvium from the fifth/fourth century BCE onwards (Ortolani and Pagliuca 2007, 15-17). Apart from timber cutting, deforestation was likely facilitated by climatic change: recent palynological research highlights the fundamental role played by the atmospheric circulation pattern known as North Atlantic Oscillation (NAO) in determining periods of warming/cooling in the Mediterranean Basin during the Late Holocene (Zielhofer et al. 2017, 47-48).

<sup>2</sup> Pind. *Ol.* 5.11-12: ποταμόν τε Ὀανιν, ἐγχωρίαν τε λίμναν, καὶ σεμνοὺς ὀχετοὺς, Ἴππαρις οἷσιν ἄρδει στρατόν; praise of Psaumis of Camarina, winner of the mule chariot-race at Olympia in 456 or 452 BCE (Manganaro 1999, 119).

wicked and the bearer of doom.<sup>3</sup> According to the Latin version, the *palus* of Camarina had become unhealthy: despite the negative opinion of the oracle of Apollo, it was drained, but such reclamation led to the occupation of the city by the enemies.<sup>4</sup> Evidently, the local marshes played a fundamental defensive role for the city.

Which disastrous occupation do the sources refer to? Let us examine the various possibilities. In 405 BCE, Camarina was taken by the Carthaginians;<sup>5</sup> in 399 BCE, by Timoleon;<sup>6</sup> in 309 BCE, by Agathocles;<sup>7</sup> in 279 BCE, by the Mamertines;<sup>8</sup> and in 258 BCE, by the Romans.<sup>9</sup> The Roman conquest was certainly a disaster, because the conquerors took the city and enslaved its inhabitants. At that time, Camarina definitively ended its existence.<sup>10</sup> The insistence of the Latin sources on the unfortunate reclamation suggests its possible dating to the early Hellenistic period. Effectively, archaeological surveys identified a stretch of the Hipparis covered with the remains of demolished buildings transported from Camarina and piles of sand, which seem to indicate possible filling for reclamation.<sup>11</sup> However, these remains consistently date back earlier than the third century BCE. Moreover, some elements point out the fragility of the traditional historical reconstruction on the decline of the city.

In fact, the economic potential of Camarina was remarkable. About 90% of its territory was exploitable for agricultural purposes. This is certainly one of the highest percentages attested in Greek Sicily.<sup>12</sup> The wetlands must be included in the list of local resources. Since the very beginning of the city, the *limnē* played a fundamental socio-economic role, as rightfully highlighted by De Angelis:

one of the main differences between ancient Greek and recent landscapes is the existence of extensive marshlands and watercourses, which have now disappeared through human and natural processes, particularly the eradication of malaria in the later nineteenth and earlier twentieth centuries [...] at Kamarina [...] abundant water resources created both marsh and attractive conditions for fish.<sup>13</sup>

<sup>3</sup> Call. Aet. Frg. 64 Pfeiffer, 1-3; Cordano and Di Stefano 1997, 292.

<sup>4</sup> Verg. Aen. 3.700-701 (*et fatis numquam concessa moveri adparet Camarina procul*); Ov. Fast. 4.477 (*hinc Camerinan*); Sil. 14.198 (*et cui non licitum fatis, Camarina, moveri*); Claudian. De rapt. Pros. 2.59 (*Camerina palustri*); Serv. Ad Aen. 3.701 (*CAMERINA PROCUL: palus est iuxta eiusdem nominis oppidum; de qua quodam tempore, cum siccata pestilentiam creasset, consultus Apollo, an eam penitus exhaurire deberent, respondit μή κίνει Καμαρίναν, ἀκίνητος γὰρ ἀμείνων*; *quo contempto exsiccaverunt paludes, et carentes pestilentia per eam partem ingressis hostibus poena dederunt*); Vib. Seq. p. 26 Oberlin ([*palus*] *Camarina nunc, ante Hyperia dicta, Syracusis*); Steph. Byz. s.v. *Kamarina*; Suid. s.v. *Mē kinei Kamarinan*; Cordano and Di Stefano 1997; Borca 2000, 81. However, as pointed out to me by T. Howe, there is no agreement among scholars on the nature of such literary accounts. Some would better fit as literary allegories rather than representations of real historical events (Howe 2008, 16-21).

<sup>5</sup> Diod. 13.108.3.

<sup>6</sup> Diod. 16.82.7.

<sup>7</sup> Diod. 20.32.1-2.

<sup>8</sup> Diod. 23.1.4.

<sup>9</sup> Polyb. 1.24.12; Diod. 23.9.4-5; Zon. 8.12.

<sup>10</sup> Coarelli and Torelli 2000<sup>5</sup>, 206.

<sup>11</sup> Cordano and Di Stefano 1997, 299-300.

<sup>12</sup> De Angelis 2016, 232, Table 7.

<sup>13</sup> De Angelis 2016, 229.

The sudden and complete abandonment of such a prosperous site is inexplicable, especially when we consider its relatively recent foundation.<sup>14</sup>

In the Augustan age, nothing remained of the city. According to Strabo, Camarina had disappeared like most of the Greek cities of the southern coast of Sicily after the conflicts with the Carthaginians. Strabo only mentions Agrigentum and Lilybaeum as still inhabited.<sup>15</sup> Nevertheless, this seems to be a rather quite simplistic view. Apart from military occupation, we must wonder about further negative factors, which would rapidly cause the decline of this city. For example, an interesting possibility is focusing on relevant environmental modifications.

Some data offer interesting insights in this regard. In the Greek period, Camarina's low and calm marshy waters were used to macerate flax, which was certainly cultivated along the river.<sup>16</sup> When the settlement was reoccupied in the Byzantine period, the surrounding fields were cultivated again with hemp and flax, as can be inferred from the name of local districts (Cannavata, from *kannabās*, "hemp") and dialectal terms recalling such crops (*linusa*, *cannavusa*).<sup>17</sup> This means that the marshy environment, which was fundamental for the growing of such crops, was slowly restored. However, these cultivations had suddenly lost importance in the Hellenistic period. In fact, Hiero II imported the flax cables used for the building of his ship *Syrakosia-Alexandris* not from Sicily, but from the Rhone River and Spain.<sup>18</sup> Based on this, we should conclude that the territory of Camarina did not produce flax and hemp—whose existence closely depended on marshes—any more between 269 (or 265) and 215 BCE.<sup>19</sup> There is no reason to assume that the crisis of Camarina was primarily due to political difficulties. On the contrary, the reclamation of local marshes rather damaged the city both from the socio-economic and military point of view, and in turn the disappearance of this habitat indicates the existence of broader environmental changes.

(ii)

A similar case was perhaps that of Selinous. The acropolis (Manuzza Hill) was bordered respectively along the west and the east side by the *Selinos* (Modione) and the Cottone Rivers, whereas some kilometers to the east of the city flowed the *Hypsas* (Belice) River. It is uncertain which of these three courses hosted the pestilential marsh manipulated by Empedocles in the middle of the fifth century BCE. He would divert two freshwater rivers into the saltmarsh, thus extirpating the epidemic causing many deaths among the inhabitants.<sup>20</sup> However, there are many doubts about the reality of this episode. On the one hand, Empedocles was actually interested in hydraulics, as attested by a fragment describing a sort of pump to irrigate fields during the warm season.<sup>21</sup> On the other hand, most of the literary anecdotes depicting the philosopher as hero and savior of the western

<sup>14</sup> Camarina was founded by the Syracusans in 599/8 BCE (Thuc. 6.5.2-3; Ps.-Scymn. 294-296; *Schol. ad Pind. Ol.* 5.16 and 19; Euseb. *Chron. ad Ol.* 45; De Angelis 2016, 169).

<sup>15</sup> 6.2.5.

<sup>16</sup> De Angelis 2016, 255.

<sup>17</sup> Patitucci and Uggeri 2015, 436.

<sup>18</sup> Athen. 5.206f; Michell 2014<sup>2</sup>, 59.

<sup>19</sup> That is, when the ship was built (cf. Mosch. *FGrH* 575 F 1-6 = Ath. 5.206d – 209e), perhaps under Ptolemy II Philadelphus (Rostovtzeff 1953, 1250) or Ptolemy III Euergetes (Hauben 1981, 399).

<sup>20</sup> Diog. Laert. 8.70; Rambaldi 2010, 13.

<sup>21</sup> *Phys.* F 111 D.-K., 7-8; Rambaldi 2010, 14.

Greeks are certainly unreliable,<sup>22</sup> as is the belief that Selinous honoured him for his service with a *herōon* and commemorative coinage.<sup>23</sup> We should highlight that at the beginning of the 20th century much of the territory of Selinous was still marshy.<sup>24</sup> Towards the end of the previous century, Schubring identified the river restored by Empedocles with the Cottone River, whose mouth formed the main harbour of Selinous. He based his conclusions on the following evidence: firstly, the excessive distance of the Belice River from Selinous; secondly, the existence of marshes formed by the Cottone River; thirdly, the presence of two little freshwater tributaries of the Cottone River springing from the Marinella Hill, which he identified with those diverted by Empedocles.<sup>25</sup>

Whatever the original situation, there is complete uncertainty on the nature of the disease mentioned by the ancient sources. It may have been malaria, which infested the territories of Camarina and Selinous until some decades ago,<sup>26</sup> or typhus.<sup>27</sup> Such diseases can effectively cause very serious epidemics, so their possible effects on ancient populations must not be underestimated. According to De Angelis, human losses likely caused a dramatic demographic crisis in Selinous.<sup>28</sup> Given the unreliability of Empedocles' intervention, neither the exact dating nor the duration of this epidemic is correctly evaluable. Did part of the population move from Selinous to the *chōra* after the outbreak of such an environmental crisis? In 409 BCE, when the Carthaginians destroyed the city and massacred its inhabitants, the population amounted to 23,600 individuals.<sup>29</sup> If they were male citizens, then this is a high figure, when compared to the average.<sup>30</sup> After the massacre, the Syracusan Hermocrates founded a new city on the acropolis.<sup>31</sup> Where did he find the colonists? Did he resort perhaps to exiled people, or rather to citizens living in the surroundings of the city? The latter possibility can maybe fit our case. What is certain, Selinous never recovered from this crisis, and in the middle of the third century BCE the city was finally abandoned. Only a few traces of following occupation are attested.<sup>32</sup> To explain the sudden decline of one of the most important cities of the entire Greek World, some hypotheses have been formulated. According to Crouch, '[...] early trade and settlement do not seem to have been hampered by malaria, which may, however, have contributed to the abandonment of the site in the late third century B.C.E.,'<sup>33</sup> and 'perhaps the scourge of malaria contributed to the ruin as the mix of fresh and salt water became the right environment for malaria-bearing mosquitoes'.<sup>34</sup> Crouch follows Thirgood's hypothesis

<sup>22</sup> Traina 1988, 109-110.

<sup>23</sup> On the alleged *herōon* (temple B of the acropolis) see Coarelli and Torelli 2000<sup>5</sup>, 79, 91, 93; Marconi 2008, 78 (sanctuary of Asclepius-Eshmun); on the coinage, see Rambaldi 2010, 17 (coins bearing personifications of the river-gods *Selinus* and *Hypsas*).

<sup>24</sup> Hulot and Fougères 1910, 19-24.

<sup>25</sup> Schubring 1865, 415-418.

<sup>26</sup> Sallares 2002, 38 and n. 33.

<sup>27</sup> De Angelis 2016, 198.

<sup>28</sup> De Angelis 2016, 199.

<sup>29</sup> Diod. 13.57-58.

<sup>30</sup> The population of a large *polis* or *polis myriandros* amounted to about 10,000 male citizens (Hansen 2006, 84).

<sup>31</sup> Diod. 13.63.2-6.

<sup>32</sup> In 250 BCE, the residual inhabitants were transferred to Lylibaeum by the Carthaginians (Diod. 24.1.1); Coarelli and Torelli 2000<sup>5</sup>, 79; Crouch 2003, 80.

<sup>33</sup> Crouch 2003, 75.

<sup>34</sup> Crouch 2003, 80.



that the abandonment of prosperous sites like Selinous was due to the spread of a deadly variety of malaria introduced into Sicily by the Carthaginians in the fourth century BCE.<sup>35</sup> Confirmation in this regard comes from Strabo, who claims that malignant malaria appeared in Sicily and Southern Italy in the late third century BCE.<sup>36</sup> Unfortunately, it is uncertain to what extent such a ‘Strabonian’ model might be justified. In fact, we can only ascertain that Selinous suddenly ceased its life in the course of the Hellenistic period. Yet, the colonists sent from Megara Hyblaea in the middle of the seventh century BCE found excellent environmental conditions, and the city flourished over the early periods thanks to a vast and fertile territory. We can therefore wonder about the most plausible explanation for such irreversible decline.

A possible hint comes from palynological research. Pollen analyses point out that, just before the foundation of Selinous, its territory ‘consisted of undisturbed Mediterranean evergreen forest, which [...] declined abruptly and reduced the arboreal pollen sums from 80 percent to 20 percent’; the same can be said for Gela, just a few kilometers to the west of Camarina, whose foundation ‘caused an abrupt decline in the forests and a strong increase of agricultural activity and the first indications of local sweet chest-nut and olive trees’.<sup>37</sup> Such data are enormously useful to our purposes. In fact, they lead us to suspect that in Selinous and Camarina the salinization of the local rivers, the depletion of the water table and the diffusion of extensive marshes likely depended on the heavy deforestation and the consequent hydrogeological alterations. If so, the hypothesis that a general ecological crisis hit both sites in the ancient Greek period should lead us to deeper investigations.

(iii)

Extensive marshes also studded the Plain of Catania in Antiquity. Here the local rivers usually overflowed in winter, and if original oak, willow, and tamarisk plain forests still existed, then there is good reason to believe that the Greek colonists met with a Pontine Marshes-like territory.<sup>38</sup> Even in the middle of the 20th century, overflows were typical in this area.<sup>39</sup> The overflow of the Simeto River and its tributaries created persistent quagmires, where tamarisks, willows, and reeds of the genre *Phragmites* and *Arundo* proliferated.<sup>40</sup>

Before the modern reclamations, a huge marshy lake called Biviere extended to the north of ancient Leontini (Lentini). This lake originated from the pouring of the rivers flowing from the Hyblaeen Mountains into a preexisting geological depression.<sup>41</sup> Diodorus reports the legend according to which Heracles gave eternal *mnēmeia* (‘signs’, ‘memories’)

<sup>35</sup> Thirgood 1981, 64.

<sup>36</sup> 3.5.12; according to Collin-Bouffier 1994, the spread of malaria would cause the sudden end of prosperous cities, such as Poseidonia/Paestum and Selinous.

<sup>37</sup> So De Angelis 2016, 230, who comments palynological data respectively from Tinner et al. 2009 (Selinous), and Noti et al. 2009, 384 (Gela).

<sup>38</sup> That is, swamp-forests, perhaps a common habitat in the ancient Mediterranean Basin (Vacante 2018).

<sup>39</sup> Vitaliano Brancati’s masterpiece *Il bell’Antonio* (1949) describes the Plain of Catania with meaningful words: ‘Un acquazzone che si prolunghi per dodici ore basta a sommergerla completamente mescolando le acque del Simeto con quelle del lago di Lentini [...]’.

<sup>40</sup> *Arundo donax* was native of the Southern Caspian Sea, from where it spread to the Mediterranean in uncertain times (Hardion et al. 2004).

<sup>41</sup> This depression is part of the rift valley (*Graben*) known as ‘Scordia-Lentini’ (Torelli et al. 1998; Frasca 2009, 22).



to the locals.<sup>42</sup> The scholarly tradition readily identified one of these signs with the Biviere, which was therefore called *Herculeus Lacus*.<sup>43</sup> However, the first attestation of the lake and its name date back to the Middle Ages. The possible etymology of the term ‘Biviere’ is from the French *vivier* (Latin *vivarium*), that is ‘fishery’, or ‘fish-pond’. In fact, we know that under Frederick II a large dam diverted the waters of the Trigona River into the natural depression, thus creating a huge fishery-lake.<sup>44</sup> In the absence of human intervention, the Biviere Lake would certainly regain its original marshy aspect, which was perhaps prevalent in ancient times.<sup>45</sup>

According to Aristotle, the nutritional capacity of Leontini’s pastures was outstanding.<sup>46</sup> In the Greek period, the surroundings of the Biviere Lake were likely devoted to animal husbandry.<sup>47</sup> In fact, the *hippobotai*, the Chalcidian élite responsible for the foundation of Leontini and Catane,<sup>48</sup> possibly exploited the green pastures on the banks of local marshes to feed their horse herds.<sup>49</sup> Cicero’s anecdote on Dionysius’ horse, which sank into one of the local (marshy?) rivers, is indicative in this regard.<sup>50</sup>

The vineyards were particularly suited for this marshy territory;<sup>51</sup> however, the bulk of agricultural production likely came from cereals. After Marcellus’ conquest in 214 BCE,<sup>52</sup> the territory of Leontini became *ager publicus*, that is, property of the Roman people. Cicero lists Leontini among the *civitates decumanae*, that is those whose citizens were obliged to pay a tax consisting of the tenth part (*dekate*, or *decuma*) of the yield (*lex frumentaria*).<sup>53</sup> Such a fiscal system would replicate that already imposed by Hiero II on his territories (*lex Hieronica*), perhaps in imitation of the Ptolemaic model.<sup>54</sup> Strabo says that Leontini suffered much for its subjection to Syracuse,<sup>55</sup> and Cicero highlights the desolation of this city under the Romans with quite clear words (*civitas misera atque inanis*).<sup>56</sup>

However, such judgements seem to be overly negative. On the one hand, the Romans found Leontini included in the territory of Hiero II.<sup>57</sup> This means that the citizens already paid a *decuma* to Syracuse at that time. Therefore, the fiscal conditions of this city did not change very much under the new rulers. On the other hand, some scholars suspect a

<sup>42</sup> Diod. 4.24.1.

<sup>43</sup> Casagrandi-Orsini 1898 *contra* Columba 1891, 102; cf. Frasca 2009, 1 and n. 2.

<sup>44</sup> *Vivarium Lentini, flumen et piverium* are mentioned in 1240 (Huillard-Bréholles 1859, 868); on the dam’s rests, see Agnello 1935, 297; on the Biviere Lake, see Valenti 1998.

<sup>45</sup> In the 20th century, the water depth in the middle of the lake was usually no more than two meters in winter and about 30 cm in summer (De Pietro 2011, 218).

<sup>46</sup> HA 520b 1-3.

<sup>47</sup> Frasca 2009, 45-46.

<sup>48</sup> Arist. Pol. 1289b 36-40; Strabo 10.1.8.

<sup>49</sup> De Angelis 2003, 82.

<sup>50</sup> *De div.* 1.73.

<sup>51</sup> Frasca 2009, 45.

<sup>52</sup> Liv. 26.40.14.

<sup>53</sup> Verr. 2.3.44, 47, 104, 113.

<sup>54</sup> Cic. Verr. 2.3.13-14, 151; Rostovtzeff 1910, 233-235; Bell 2007, 194 *contra* De Sensi Sestito 1977, 156-158.

<sup>55</sup> 6.2.7.

<sup>56</sup> Verr. 2.2.160.

<sup>57</sup> As a consequence of the treaty concluded between the king and Rome in 263 BCE (Diod. 23.4.1).

massacre of the local population by Marcellus.<sup>58</sup> The event is uncertain, but, if proved, the likely reason behind it would be the easier confiscation of this very fertile land. In fact, according to Cicero, the yield of local wheat was well above the normal average,<sup>59</sup> and Strabo emphasizes the exceptional fertility of local soils in the Augustan age.<sup>60</sup>

However, we lack precise information on where Greeks and Romans effectively grew cereals in the Plain of Catania. How could such vast plains be cultivated, if they were usually inaccessible by seasonal overflows? A possible solution may be to theorize the cultivation of the banks of river and wetlands after water withdrawal in spring. These soils were of course very rich in silt, and therefore exceptionally fertile.

We do not know if Cicero visited the Biviere Lake. At least in theory, this is likely, because the large *Via Pompeia* connecting Catane to Syracuse ran along the east side of this area.<sup>61</sup> It is also unknown if reclamations were attempted in the early centuries of the Roman Empire. Despite the general decline of Leontini in this period, the agricultural capacity of its territory remained relevant,<sup>62</sup> and several farmsteads dotted the plains to the north of the city.<sup>63</sup>

It is unknown if malaria was present here in the ancient times. Of course, this disease infested the territory of Leontini until the middle of the 20th century.<sup>64</sup> Giovanni Verga's novel *La malaria* (1882) attests the exploitation of the fertile soils surrounding the unhealthy Biviere Lake:

[...] e in fondo il lago di Lentini, come uno stagno, colle sponde piatte [...] sul greto pascolano svogliatamente i buoi [...] la malaria acchiappa gli abitanti [...]. Però dov'è la malaria è terra benedetta da Dio. In giugno le spighe si coricano dal peso, e i solchi fumano quasi avessero sangue nelle vene appena c'entra il vomero in novembre.

In fact, apart from fishing, other economic activities were profitable here, such as cereal agriculture and animal husbandry, which drew great benefit from the deep alluvial soils.

Until the 20th century reclamation, a large marshy area known as Pantano of Lentini or Gelsari lay about 7 km to the east of the Biviere Lake.<sup>65</sup> It is uncertain if we should identify this area with the *Leontinensis palus*, which some modern sources distinguished from the *Leontinus lacus* (perhaps the Biviere Lake).<sup>66</sup> Many literary descriptions stress the wild character of the Pantano. This marsh, whose waters usually mingled with those of the Gornalunga and the Simeto Rivers in winter, was formed by the alluvium deposited by the

<sup>58</sup> Coarelli and Torelli 2000<sup>5</sup>, 324; cf. Frasca 2009, 123 n. 21. According to Livy the massacre was false information spread by the Romans (24.30.3-7). However, a certain number of executions is mentioned by Plutarch (*Marc.* 14.1-5).

<sup>59</sup> *Verr.* 2.3.109-113; Sallares 1991, 377 n. 243.

<sup>60</sup> 5.4.8.

<sup>61</sup> Frasca 2009, 52 and 148 *contra* Uggeri 2004, 202.

<sup>62</sup> Cf. Plin. *NH* 3.8.88 (*oppidum*); Wilson 1990, 23; Frasca 2009, 148.

<sup>63</sup> Fasicaro 1996; Valenti 1997-1998, 244; Bejor 2007, 16-17; Frasca 2009, 152.

<sup>64</sup> E.g. Fazello 1573, 3.3; Franklin 1842, 297: 'Within a short distance of Lentini is an expanse of water, called the Lake of Biviere, which, though nineteen miles in circumference during the winter months, often dwindles during the heats of summer to a circumference of eight or nine; leaving an extensive swamp exposed to the action of a vertical sun, and, as usual in this warm climate, engendering malaria with all its evil consequences.'

<sup>65</sup> Fazello 1573, 3.2.

<sup>66</sup> Amico 1757, 361-362.

seasonal overflow of the S. Leonardo (ancient *Terias*) River, and was covered by dense vegetation.<sup>67</sup> According to the geologist Vita-Finzi, the origin the Mediterranean historical alluvium, the so-called Younger Fill, was due to the gradual erosion of deforested and cultivated soils during the late first millennium BCE.<sup>68</sup> There are of course good reasons to believe that the Pantano Marshes began their existence in the Hellenistic period.<sup>69</sup> In my opinion, every doubt could be dispelled by identifying the location of the ancient harbour of Leontini, which was situated at an unknown point of the S. Leonardo (*Terias*) River. Pseudo-Skylax informs us that in the late fourth century BCE the river was navigable for 20 stades (a little less than 4 km) from the mouth.<sup>70</sup> In addition, the Arab geographer Al-Idrisi attests that in the middle of the 12th century Lentini was 6 miles, that is about 10 km, from the sea, and that the river was navigable right up to the city.<sup>71</sup>

The measurement provided by Pseudo-Skylax likely refers to the effective distance between the sea and the *polis*. If so, the ancient harbour would be far from the urban settlement of Leontini discovered by modern excavations. It would lie at the foot of the hilly spurs surrounding the S. Leonardo River just before the Pantano Plain. Here the river flows through a roughly semicircular valley, which was well suited to ancient harbour structures.<sup>72</sup> We can conclude that, at the time of Al-Idrisi, silting had already produced impressive coastline advancement in this area. Effectively, geo-archaeological stratigraphy from various coastal settlements of the Mediterranean shows vast alluvium accumulations in the fourth century BCE and in the seventh century CE.<sup>73</sup>

Based on Pseudo-Skylax, we should wonder if the late Classical-early Hellenistic age represented a turning point in the ecological balance of this territory. Possible clues of environmental changes in this period come from Morgantina. This ancient and prosperous city was founded near the springs of the Gornalunga River on a strong hill position, but by the time of Strabo, was completely abandoned.<sup>74</sup> Geological studies point out the rapid depletion of local water resources immediately after the Roman conquest of 211 BCE.<sup>75</sup> Deforestation,<sup>76</sup> climatic change,<sup>77</sup> or bad water management<sup>78</sup> are just some of the explanations scholars have offered for this phenomenon. Unfortunately, we lack an effective solution to this problem, but it can be reasonably supposed that ecological

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<sup>67</sup> De Burigny 1790, 228: 'Le acque del F. Reina, o di S. Leonardo, che gli antichi chiamarono Teria impaludano sin presso la spiaggia, formano il Pantano di Lentini, coverto lunghesso le ripe dalle canne, e da altri palustri arboscelli'; Lopriore 1901; De Pietro 2011, 222-224.

<sup>68</sup> Vita-Finzi 1969, 91-92.

<sup>69</sup> Frasca 2009, 22: '[...] acquitrini scandivano ad Est il litorale tra le foci dei fiumi S. Leonardo e Gornalunga'; and 53: 'l'ampia zona paludosa dei Pantani costieri.'

<sup>70</sup> *Per.* 13; Frasca 2009, 61 n. 118. Pseudo-Skylax's *Periplus* likely dates back to the years 340-330 BCE (perhaps before 338/7 BCE [Shipley 2011]).

<sup>71</sup> 29 (Amari and Schiaparelli 1883, 33).

<sup>72</sup> From here, the ships could go up to Leontini by river, and small boats likely passed the final stretch of water in channels (at least, in the Roman period: Basile 1996, 397; Frasca 2009, 150).

<sup>73</sup> Ortolani and Pagliuca 2007, 15.

<sup>74</sup> 6.2.4: 'it was a city, but now it does not exist'; Morgantina shows almost continuous occupation from the early second millennium BCE onwards; the settlement was razed between 40 and 30 BCE, and totally ceased to exist towards the middle of the first century CE (Bruno, Bobbo and Bruno 2015, 8).

<sup>75</sup> Crouch 2003, 51.

<sup>76</sup> Wilson 1990.

<sup>77</sup> Bruno and Nicosia 1998.

<sup>78</sup> Crouch 2003, 51, 70; Bruno, Bobbo and Bruno 2015.

modifications had likely caused irreparable damage to the local water table. Soil erosion would also have produced huge quantities of silt, which was transported to the sea by winter overflowing. This means that the most likely origin of both the Gornalunga and the S. Leonardo (Pantano) coastal wetlands can directly be linked to the deep hydrogeological instability of internal areas of Eastern Sicily in the early Hellenistic period.

(iv)

Some interesting aspects can be highlighted in Syracuse. Well before the modern reclamations, large wetlands formed by the overflows of the Anapus River extended to the south-west of the city.<sup>79</sup> Some sources report on the presence in this area of a marsh called *Lysimeleia*,<sup>80</sup> whereas others mention a marsh called *Syraka* or *Syrakō* from which the city would take its name.<sup>81</sup> It is difficult to distinguish both on a simple topographical basis. According to a recent theory, the *Syrakō* marsh extended in the surroundings of the Porto Piccolo (*Lakkios*) just in front of the island of Ortigia.<sup>82</sup> However, there are many uncertainties in this regard. It is perhaps better to follow Letronne and Serradifalco, who argued that *Lysimeleia* and *Syraka* were different denominations indicating the same marsh.<sup>83</sup>

The ancient aspect of the Syracusan wetlands and their socio-economic role are mostly unknown. A very interesting aspect is the possible presence and use of papyrus (*Cyperus papyrus*). Was this plant perhaps a gift from the Ptolemies to Hiero II? On the one hand, the possible assonance between the late-Egyptian words *pa-en-peraa* and *pa-per-aa*, ‘material of the Pharaoh’, perhaps alluding to the royal monopoly of papyrus,<sup>84</sup> and the Sicilian terms *pappèra* and *pampèra* indicating the plants in the Modern age,<sup>85</sup> is certainly suggestive. On the other hand, we must notice that the usual Egyptian terms to indicate the papyrus plant are *djet*, or *tjufi*; whereas a more supported etymology for the Greek *papyros* (and the Latin *papyrus*), a name attested by Theophrastus in the late fourth-early third century BCE, is from *pa-p-ior*, ‘that which is coming from the river’.<sup>86</sup> Theophrastus says that, excepting Egypt, papyrus also grew in Syria at the time of Antigonos the One-Eyed, but does not mention its presence in Sicily.<sup>87</sup> However, Byzantine and Arab sources seem to support the view that the plant was indigenous to the island.<sup>88</sup> According to some botanists, two different varieties of papyrus currently grow in Egypt (*subsp. hadidii*) and Sicily (*subsp.*

<sup>79</sup> Cf. e.g. Thuc. 6.101.3 (*helos*); Diod. 14.70-71 (*helē*).

<sup>80</sup> Thuc. 7.53.2 (Athenian siege); Theoc. *Id.* 16.84 (kingdom of Hiero II).

<sup>81</sup> Scymn. 281; Strabo 8.5.3 (*Syrakō* was the abbreviation of the name of the city in Epicharmus); Vib. Seq. p. 27 Oberlin (*palus* called *Tyraca*, to be emended); Steph. Byz. s.v. *Syrakousai* (marsh called *Syrakō*); Borca 2000, 80; Evans 2016, 1 n. 2.

<sup>82</sup> Mirisola 2015.

<sup>83</sup> Letronne 1812, 58; Lo Faso Pietrasanta Duca di Serradifalco 1840, 177-178.

<sup>84</sup> Robinson 2009, 131.

<sup>85</sup> Denon 1788, 221; Macri 1829, 33.

<sup>86</sup> HP 4.8.2-3; Bunson 2002<sup>2</sup>, s.v. *papyrus*, 295. Not only the term *papyros* is used by Theophrastus, who was in close relations with Ptolemy I (Diog. Laert. 5.2.37) but also appears in Greek inscriptions from Egypt dating to the third century BCE (e.g. OGIS 56A, l. 63: *papyroïdes* [238 BCE]). I thank Professor D. Hollander for having drawn my attention to the terminology of plant cultivated in the time of the Ptolemies.

<sup>87</sup> HP 4.8.3.

<sup>88</sup> Chiovenda 1931, 532 *contra* Pampanini 1933. According to Wilson 2013, 82 n. 7, the *massa papirianensis* near Palermo attested in the sixth century CE by Gregory the Great (*Ep.* 9.170) were living plants and not paper; cf. Lewis 1974, 19.

*siculus*), but others deny such a taxonomic distinction.<sup>89</sup> We must notice that the plant is today almost extinct in Egypt,<sup>90</sup> whereas it still survives well in the low and quiet waters of Sicily, alongside the Cyane and Fiumefreddo Rivers. Is this perhaps a clue that Sicily—and not Egypt—was its original habitat? Whatever the solution to this puzzle may be, the possible presence of papyrus at the mouth of the Anapo River in Antiquity suggests the existence of a well-balanced river ecosystem and the absence of malignant malaria.

The banks of the Syracusan marshes were likely devoted to cereal agriculture. According to the myth, Hades would carry Demeter's daughter Kore to the underworld in the surroundings of the Cyane River.<sup>91</sup> Diodorus attributed to Heracles, who reached this place with his herds, the foundation of the local cult of Demeter.<sup>92</sup> Some centuries later, Al-Idrisi describes the Syracusan territory as fertile and exceptionally suitable to the cultivation of wheat, but does not mention harmful or unhealthy wetlands.<sup>93</sup> In fact, during the Middle Ages there was a close connection between marshes and cultivated fields. A possible turning point in this apparently well balanced ecological condition was perhaps in 1558. In this year, an unexpected overflow of the Anapo River damaged most of the local fields of wheat and Syracuse suffered a terrible famine followed by a deadly epidemic.<sup>94</sup> This means that the banks of the river were generally not subject to flooding, and were traditionally cultivated without fear of any kind. The outbreak of the epidemic was also an unexpected event. Nonetheless, this was not due to malaria, but to plague carried by a ship bearing cereals from Egypt to Sicily.<sup>95</sup> However, from this period onwards, several water locks were built alongside the Anapo River in order to prevent harmful floods.<sup>96</sup>

Apart from this, in modern times both the river and the marshlands behind Syracuse certainly offered fundamental livelihoods to the locals. Not only were hunting and fishing practiced, but vegetables and other materials were extracted for various uses. For example, a special custom of the Syracusan peasants was the use of resistant papyrus ropes to tie harvested wheat bundles.<sup>97</sup> Besides, between the 16th and the 19th centuries, the lower course of the Anapo River was the seat of extensive flax and hemp maceration, which provided high revenues for the city.<sup>98</sup> Such installations produced bad vapours groundlessly reputed to be the origin of malaria, whose spread was however quite limited in this territory.

To what extent do such modern images correspond to the ancient situation? The sources attest that serious epidemics afflicted the Athenians (413 BCE),<sup>99</sup> and the Carthaginians (396 BCE),<sup>100</sup> when they were encamped in the Lysimeleian Marshes during their sieges of Syracuse. The nature of such diseases is unknown. In the case of the

<sup>89</sup> On the various classifications of *Cyperus papyrus*, see Lim 2016, 172.

<sup>90</sup> Burn 2014, 40.

<sup>91</sup> *Ov. Met.* 5.409.

<sup>92</sup> 4.23.4; 14.72; Coarelli and Torelli 2000<sup>5</sup>, 276, 281; Rawles 2015 (who suggests that the *Lysimeleia* marshes would host a lake sacred to the goddess).

<sup>93</sup> 29 (Amari and Schiaparelli 1883, 33-34).

<sup>94</sup> Privitera 1878, II, 164; Polto 2004, 167.

<sup>95</sup> Privitera 1878, II, 174.

<sup>96</sup> Polto 2004, 166-169.

<sup>97</sup> Denon 1788, 221.

<sup>98</sup> Polto 2004, 170-172.

<sup>99</sup> *Thuc.* 7.47.2 (*nosos*); *Diod.* 13.12.1 (*loimos*).

<sup>100</sup> *Diod.* 14.70-71.



Athenians, malaria has been suggested,<sup>101</sup> or a mixture of various diseases.<sup>102</sup> By contrast, the decimation of the Carthaginians was almost certainly due to smallpox.<sup>103</sup> Consequently, malaria was not the cause of such epidemics. In addition, we must stress that, despite the presence of extensive marshes, the Syracusans never abandoned their city, unlike the inhabitants of Camarina and Selinous. What is the likely reason behind such macroscopic difference? When we look at the Syracusan territory, we find that the Anapo River originates from the steep eastern valleys of the Hyblaeon Mountains. These inaccessible areas likely escaped intense deforestation and agriculture in the Greek period. In fact, as highlighted by De Angelis,

at Megara Hyblaea the water table rose high enough to force the subterranean grain silos to be abandoned by the mid-seventh century. In turn, this indirectly suggests that the virgin site given to the settlers by the native leader Hyblon was forested and had to be cleared.<sup>104</sup>

Without a doubt, the upper course of the Anapo River just behind Megara Hyblaea was richly forested. Over the centuries, the tall trees represented an important obstacle to soil erosion and silt accumulation. The limited spread of malaria in the Syracusan territory was likely due to this balanced ecological situation.

We must therefore underscore the profound ecological impact of deforestation and agriculture on Sicily. When the Greek colonists arrived, most of the island was thickly forested, but the situation rapidly changed. In fact, to build their fleets, Dionysius I, and later Hiero II, were compelled to draw timber from the top of Mount Etna or even to import it from Calabria.<sup>105</sup> Based on such data, Harris rightfully argues that Sicily had lost most of its tall trees ‘by about 310 BC’.<sup>106</sup> This conclusion is full of important historical consequences. In fact, the indiscriminate deforestation continued throughout all Archaic and Classical Greek periods and likely altered the water table in most of Sicily. This situation caused deep and rapid ecological transformations. In the deforested territories, the rains washed away the superficial part of the soils, and enormous quantities of sediments rapidly poured into river basins. The accumulation of alluvium caused advancement of the coastline and formation of extensive coastal wetlands.

The low hills to the south of Syracuse were intensively cultivated. Here, the marshy lower course of the Helorus (modern Tellaro) River flowed immediately to the south of the homonymous subcolony of Syracuse. According to Servius, the late fourth century CE commentator on Virgil, the denomination of the city would come from the Greek *helē*, that is ‘ponds’, ‘marshes’, which were created by periodical overflows of the river. In fact, Servius explains the expression *stagnantis Helori* in the Aeneid<sup>107</sup> as follows: ‘*fluvii qui ad imitationem Nili superfunditur campis, et Graeci stagna ἑλῆ dicunt, unde ait stagnantis Helori*’.<sup>108</sup> De Angelis describes this peculiar environmental situation with extremely efficient words: ‘At

<sup>101</sup> Grmek 1979, 150-161; Sallares 2002, 36.

<sup>102</sup> Malaria, typhoid, cholera, dysentery (Evans 2016, 141 n. 73).

<sup>103</sup> Littman 1984.

<sup>104</sup> De Angelis 2016, 230.

<sup>105</sup> Diod. 14.42.4-5 (Dionysius I); Athen. 5.206f, 208e-f (Hiero II’s *Syrakosia-Alexandris* ship built with timber from the Mount Etna); Thommen 2012, 40; Michell 2014<sup>2</sup>, 280.

<sup>106</sup> Harris 2013, 180.

<sup>107</sup> Verg. *Aen.* 3.698: *praepingue solum stagnantis Helori*.

<sup>108</sup> Serv. *Ad Aen.* 3.698; Copani 2005, 247.



Heloros, the river by the same name was Nile-like, in that it overflowed its banks, and the wetlands that resulted attracted fish which the inhabitants readily exploited'.<sup>109</sup> Servius' commentary lets us suppose that the overflows rendered soils rich in silt and therefore exceptionally fertile. Even the ancient myth about Demeter's vain search of Kore throughout the valleys of the Helorus River reported by Ovid,<sup>110</sup> likely alluded to the fertility and wildness (presence of dense marsh vegetation, perhaps) of this territory.

Not surprisingly, at the beginning of the Hellenistic age this rich city was included in the Syracusan territory, along with the other famous granary of Eastern Sicily, Leontini.<sup>111</sup> After the Roman conquest, Helorus continued its life. The huge sanctuary of Demeter attests the great importance and wealth of this city in the early second century BCE. On the contrary, only a few remains date back to the late Republican and Augustan ages.<sup>112</sup> However, in the late fourth century CE—that is, more or less at the time of Servius—estates of some importance flourished in the immediate inland, as attested by the famous villa discovered on the right bank of the river. One of the mosaics found here shows an ox cart crossing through wide marshes, which unfortunately can hardly be identifiable with the local ones.<sup>113</sup> Even in the case of Helorus, therefore, we must emphasize the close relations occurring between human settlements and wetlands. In fact, since the very beginning of the city, the lower marshy course of the river was an important factor of social and economic development. The surrounding banks, periodically flooded and covered with fertile silt, were an irresistible temptation for agriculture, whereas a dense riparian vegetation likely rendered large stretches of the river inaccessible still in the late Antiquity.

### Conclusions

The evidence allows us to shed light on some aspects of the wetlands of Sicily in the Hellenistic period. The available data suggest that indiscriminate deforestation and large-scale agriculture produced the spread of extensive coastal marshlands. This situation caused various socio-economic consequences from place to place. In some cases, the birth of coastal marshes was just the ultimate effect of a general decrease in the water table, as we can observe very well in Selinous, Camarina and Morgantina. This trend represented a capital problem for the surviving of local communities, and even the spread of malignant malaria was a consequence of such environmental changes. In other cases, as in Syracuse or Leontini, old and new marshy areas continued to be exploited by local populations, perhaps without relevant consequences.

In conclusion, serious hydrogeological modifications in the Hellenistic period certainly caused a vast array of effects on Sicilian settlements. This assumption encourages us to reconsider the classical approach of historians, who usually emphasize the primary role of politics or warfare in determining the fate of ancient communities. On the contrary, the example of the wetlands is very useful to show the potential impact of events once considered of limited importance, such as deforestation and soil erosion, on human settlements. The analysis of the sources suggests that decline and even abandonment of otherwise prosperous and wealthy cities in consequence of serious hydrogeological

<sup>109</sup> De Angelis 2016, 229.

<sup>110</sup> *Fast.* 4.483-484.

<sup>111</sup> Diod. 23.4.1.

<sup>112</sup> Coarelli and Torelli 2000<sup>5</sup>, 287.

<sup>113</sup> Coarelli and Torelli 2000<sup>5</sup>, 288-290.

imbalance was more than a mere theoretical possibility in the Sicily of the late first millennium BCE.

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