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# The Wasting of Wolin: Environmental Factors in the Downfall of a Medieval Baltic Town

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## ABSTRACT

This medieval environmental history examines the tenth-century industrial and trade town of Wolin which grew rapidly on an island immediately off the northwestern coast of Poland. It arose in an environment incapable of supporting its population of 8000 – the largest population in the Baltic during the period. Palaeobotanical evidence records the island's large-scale deforestation and the rapid deterioration of its soils. Having outstripped its local natural assets, Wolin quickly became dependent on imported grain, lumber, and industrial resources. By the mid-eleventh century, Wolin could no longer sustain itself, and became too exhausted to repulse, or recover from, sea-borne raids.

## KEY WORDS

Deforestation, grain, medieval, Poland, soil, Wolin.

## INTRODUCTION

The early medieval port town of Wolin (located on an island directly off the Baltic Sea coast of present-day Poland) was a cosmopolitan and boisterous place. Among its 8000 inhabitants, one might have seen Arab, Byzantine, Jew, Saxon, Pole, Russian, Scandinavian, and Wend meeting at the town's lighthouse, walking down Wolin's oak-paved streets, or standing before its temple to the deity Svantevit. In one of its markets one might rarely glimpse silk from China or jewellery from Syria. An Arabic-speaking traveller described Wolin as a 'city-state' in the mid-tenth century, and indeed, the town was so wealthy and powerful as to exist free of any external overlord for most of its early medieval lifetime.<sup>1</sup>

By the twelfth century, Wolin was a wasted shell of its once-grand self. The town's glory days had lasted only around two centuries and its degeneration was swift. Archaeologists and historians offer different explanations for Wolin's demise: from the speculation that the nearby town of Szczecin undermined its trade, to the theory that eastern silver supplies dwindled, to the popular idea that it was simply destroyed by outright Scandinavian attack. Indeed, many forces probably contributed to Wolin's demise, but its relationship to its environment assured that the bigger the poorly located town grew, the harder it would fall. I claim that the ecological factor was central in the surprisingly rapid decline of Wolin at the end of the eleventh century. Its large population had overtaxed its limited island environment, and, thus perilously reliant on imported resources, Wolin could not survive lost trade security in the face of Danish and Norwegian attacks.

### *The Rise of Wolin*

Tenth century Wolin was exceptional in its size and power. Its population was over 100 times that of the largest villages in its region: a healthy rural settlement in the town's up-river hinterlands would have included eight houses and around seventy inhabitants.<sup>2</sup> Furthermore, at the beginning of the previous century, the largest town in Northern Europe had been the Carolingian emporium town of Dorestad, located on the Lower Rhine, with a population of 3000.<sup>3</sup> Dorestad had benefited from being part of its overlords' wider economic strategy, as had other successful market towns. Wolin, however, existed without external governance for most of its history.<sup>4</sup> Little is known about how Wolin ruled itself in the early Middle Ages, though archaeologist Lech Leciejewicz deduced that nobles and factions wielded power, and that priests of Svantevit (to whom a major temple stood in Wolin) were possible power brokers. The tribal associations and blood ties of the elite also determined their political standing. The luxury goods which flowed into the town served Wolin's elites as visible symbolic capital that purchased and maintained their power.<sup>5</sup>

While exceeding its siblings in size and autonomy, Wolin was a member of a family of international market and industrial towns, all born of Northern Europe's early medieval economic renaissance.<sup>6</sup> These included Dorestad, Hamwic in Wessex, and Birka, Sweden's trading post with the world from England to India, among others. In short, the North saw in this period a proto-urban boom as had not been seen even in Roman times, and these new towns shared one important characteristic in common: they were all geographically poised to take advantage of the newly active trade routes of the period. Wolin was also so poised, standing on an important east-west land and sea route, and at the mouth of the Oder, which stretched deep into the heart of Central Europe.<sup>7</sup>

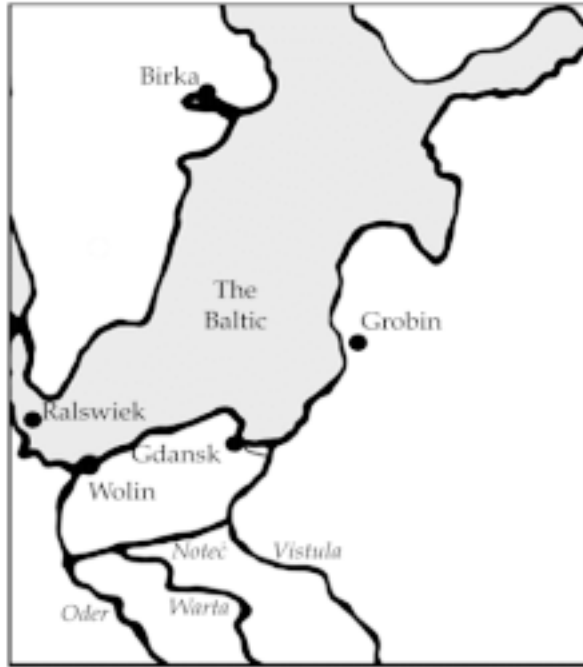


FIGURE 1. Wolin in its Baltic context, c. 900

### *The Environmental Factor*

Everything seems to have been in Wolin's favour. But while it was positioned at the right place at the right time to prosper from a burgeoning Baltic and North Sea economy, one aspect of Wolin's position was anything but favourable: Wolin's local ecosystem could not support such a boom-town. Certainly, the island's environment had maintained a small fishing village on the site of Wolin for centuries before the boom years, but the small settlement's demands had been insignificant compared to those that would be made by the international port town. Wolin quickly met and exceeded its environment's critical mass in the tenth and eleventh centuries, requiring long-range life support in the form of grain imports, wood imports, and a steady supply of other raw materials. As Wolin grew larger, propped up on this long-distance life support, it only grew more dependent on it. At the beginning of the eleventh century Wolin was among the most powerful towns in all of Europe – at the end of the eleventh century Wolin was decaying. Wolin had risked great danger in the form of a disturbance to its delicate system. Indeed, this disturbance came at the hands of an attack by King Magnus the Good of Norway in 1043, which sent the town reeling toward

a miserable decline. Thus, Wolin's extreme ecological disequilibrium should be counted among the chief causes of its downfall, alongside outright Scandinavian attack – or rather, outright attack simply triggered the disaster already made likely by Wolin's local environment.

Wolin's environment, of course, had never known an undisturbed 'golden age' or undisturbed ecosystem, which humans then came along and sullied. This environment had been populated with, or used by, humans for at least 3000 years before the construction of the powerful town.<sup>8</sup> But evidence of a permanent village on the south-eastern side of the island (that would dynamically grow into the powerful town) does not emerge until the seventh century, when a tribal Slavic fishing village appeared. Its inhabitants built their half-sunken houses on the elevated (relatively dry) parts of the Dziwna riverside, and supplemented their fishing with limited farming and livestock breeding. Even then, an important east-west overland route ran past the village.<sup>9</sup>

During the life of this nascent settlement, Wolin Island's soils and vegetation were capable of supporting limited human habitation. However, most of the island's soils were very ill-suited for cultivation, being sandy heath soils, and there is little evidence of the richer meadow soils required for quality pastureland. Regardless of the poor growing conditions, the pre-Wolin villagers still supplemented their diet of fish with rye grown in the best soils available on the island.<sup>10</sup> As for tree cover, there were open-canopied areas of oak woods with lime on the island, and while researchers point out an ancient history of human forest management on the island, the pre-Wolin period shows no deforestation.<sup>11</sup>

In the blink of an eye (relative to the long history of human involvement with the island) a boom-town sprang to life on the south-east edge of island in the eighth and ninth centuries. The small fishing village was supplemented by a craft centre at some point during the seventh century, which came to dominate the settlement by 700. Around this time, an impressive permanent bridge was constructed between the emerging town and the mainland across the Dziwna river. During the course of the eighth century growth continued, and the settlement quickly evolved from a fishing village into a trading and crafting centre. As Wolin began to tap into the stirring Baltic market, even Arabic coins began to surface at the site – among the earliest appearances in Northern Europe.<sup>12</sup> During the course of the ninth century, Wolin became a fully developed town possessing a regular layout, strong fortifications, a large port, and nearly every variety of industrial production and exchange. No longer were there half-sunken houses scattered about the riverside, but sturdy houses and workshops constructed in palisade or post and jamb fashion. These buildings were highly organized into regular blocks possessing four 5 by 6 metre structures each. These blocks were connected by streets paved with split oak trunks. Already by the ninth century, a suburb grew to the south of the town, separated by a wetland area incapable of being built upon. Construction of a northern suburb followed shortly thereafter.<sup>13</sup>

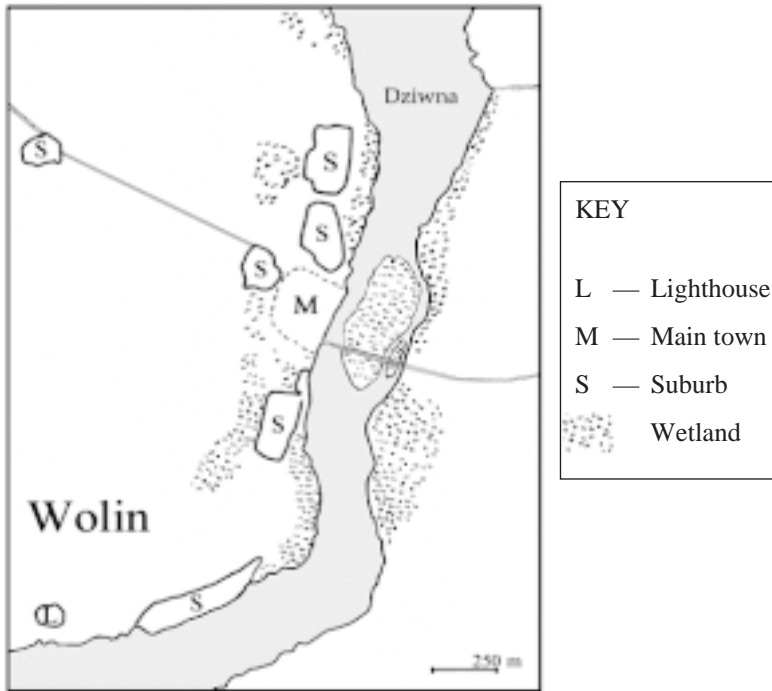


FIGURE 2. Wolin and its immediate surroundings, c. 900

### LONG-DISTANCE TRADE

By the tenth century the clamour of every kind of early medieval industry made likely a din of Wolin. Archaeology shows craftspeople clustered in neighbourhoods, from the textile-workers to comb-makers, soapstone-workers to glass-makers. Almost 9000 half-worked pieces and shards of amber have been found from the first half of the tenth century alone. Bronze- and iron-workers crafted buckles, tools, and jewellery. Archaeologists have also found the tools of smiths and leather-makers – less popular neighbours than the other craftspeople. A large area devoted to shipbuilding and repair featured a crane and a store of spare parts.<sup>14</sup>

These craft specialists, free to move wherever there was a preferable mix of supply of raw materials and buyers, huddled in Wolin to cash in on its booming economy. Trade was free and lucrative. Archaeologists have deduced from the

presence of merchants' goods found in the workshops of craftspeople that Wolin's crafters made a practice of sidestepping middlemen, and dealing directly with craftspeople and traders from every region on the Baltic route, including Denmark, Germany, Norway, Rus, and also from much further abroad. While most trade was of the regional sort between Wolin and the Oder hinterlands and between Wolin and other Baltic coastal towns, merchant-adventurers who plied the rivers of Rus also brought extravagant luxury items to Wolin, such as cowry shells from the Indian ocean, and jewellery from Egypt.<sup>15</sup>

All of this trade, industry, and overall wealth combined to make Wolin exceptional. At the beginning of the eleventh century, Wolin was among the greatest towns in Northern Europe. Seemingly destined to be the London of the Baltic, its population was among the very largest yet seen in Middle Ages, and in terms of area, Wolin had no equals, in the Baltic at least.<sup>16</sup> But Wolin's high-powered economic machine did not run without fuel. The first and most critical resource upon which the town depended was, of course, grain. Wolin's soils, as palaeobotanists have established, were poor even before intensive settlement began – now they were being asked to supply 8000 people with sustenance through both cultivation and livestock grazing. The island's grasses were unable to sustain animal husbandry, and grazing quickly caused the spread of poor pastureland. The poor, sandy habitats quickly turned into non-arable heathland.<sup>17</sup> With so many people concentrated in one small section of the island (a section, which palaeobotany indicates, was the most ecologically delicate on the island – even before intensive settlement) every available piece of land was brought under cultivation. With even the poorest, sandy heath soils turned into arable, leaching proceeded quickly.<sup>18</sup> Within only a few generations, farmers had to apply substantial amounts of manure to the barren soils in order to produce anything at all.<sup>19</sup> With the island's land producing grain only with difficulty, and with yields no doubt diminishing yearly, grain soon had to be imported.

Małgorzata Latałowa's recent pollen studies revealed the major influence of Wolin's humans on their local ecosystem, and provides evidence of such grain importation. In a study published in 1997, Latałowa examined the organic deposits that accumulated at the base of Wolin's port structures over the town's Early Medieval lifetime. The port itself had been discovered only since 1980. Latałowa took samples from archaeological trench walls and recorded the types and volume of pollen and plant macrofossils, and used carbon 14 testing to date when the vegetation lived. By painstakingly cataloguing the evidence for the variety of plants, she was able to observe foreign plants in the samples. Latałowa's research is valuable to this study because it reveals the origins of imported grains.<sup>20</sup> Her evidence suggests these grain supplies originated in the Oder hinterlands to the south.<sup>21</sup>

The town also depended on a supply of raw materials to fuel the industries that kept Wolin wealthy. When a small fishing settlement had stood on the site

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of the town, almost all of the resources necessary to its survival were located on the island (and most of them swam at the bottom of the river only steps away). By the late tenth century, Wolin's critical lines of supply stretched from Denmark to Hungary. The town's amber-crafters depended on large supplies of the golden fossil shipped from the northern shores of Germany and Denmark. Shipbuilders and bone- and antler-workers depended on resources like deer and perfectly shaped boughs (for ships' ribbing) delivered from inland forests.<sup>22</sup> Wolin's bronze-crafters waited for shipments of copper from Saxony to the west or Hungary to the south, while the town's iron-workers received their highest quality iron from Sweden.<sup>23</sup> Both Wolin's smiths (upon whom nearly all the other craftspeople depended for their tools), and those who worked at the smelter located on the edge of town, counted on a regular supply of charcoal to keep their industries running – a supply the deforested island itself was unlikely to maintain.

Trees also provided part of the fuel that kept Wolin running. The wharf that welcomed all those traders from Wolin's hinterlands and far-flung ports was constructed of huge halves of oak trunks. The sturdy streets of the town were likewise made of split tree trunk planking.<sup>24</sup> Furthermore, Wolin constructed great wooden palisades around its central town and northern suburb after a costly Viking raid in the ninth century, and its 8000 townspeople also consumed large amounts of wood and underbrush in their hearths during cold Baltic winters. Not surprisingly, palaeobotanists have discovered that Wolin's wood consumption resulted in the elimination of forests on the entire island before the turn of the millennium. This deforestation persisted for all of Wolin's life span, and was not limited to oaks, the most valuable wood for the town's constructions, but also alder and every other tree type represented in the palaeobotanical evidence.<sup>25</sup> But not even the entire island possessed enough trees to supply Wolin's demands for its physical expansion, for the construction of defences, port facilities, and streets, and for the constant repairs to all of its infrastructure. The town soon became dependent on the importation of timber from its Polish hinterlands, from where it was most likely floated down the Oder and Dziwna, requiring security, manpower, and other valuable assets.<sup>26</sup>

#### THE DISTURBANCE TO WOLIN'S DELICATE SYSTEM: WAR AGAINST ECOLOGY

At the turn of the eleventh century Wolin was among the most powerful towns in all of Europe; at the end of the eleventh century Wolin had decayed. In its early life, everything seemed to have been in Wolin's favour. While it was positioned at the right place at the right time to prosper from a booming Baltic and North Sea economy, however, Wolin's local ecosystem could not support it when it grew into a boom-town. A disturbance had sent Wolin's delicate system



tumbling. It came in the form of an attack by King Magnus the Good of Norway in 1046, which sent the town reeling toward a miserable decline. In 1043, Magnus, the son of Saint Olaf, undertook a campaign against Baltic piracy. Unfortunately for Wolin, many of those pirates headquartered in the wealthy, cosmopolitan town. Encircled by strong ramparts since the mid-900s, Wolin had been too powerful to suffer Viking raids since that century. At this time, however, the powerful king led a united force of Danes and Norwegians against the town.<sup>27</sup> The invaders burnt Wolin's suburbs to the ground, and archaeologists have uncovered many skeletons in the burned layer.<sup>28</sup> While the king did not completely overtake the town centre or destroy its pagan temple, Magnus very much succeeded at hampering Wolin's ability to harbour pirates.

Magnus also hampered Wolin in more enduring and disastrous ways. For the first time, Wolin proved incapable of finding its feet again after the attack. A Viking attack of the ninth century could not have been much more mild than that of Magnus; indeed archaeology indicates the ninth century Vikings had burned Wolin's suburbs to the ground and had left the northern suburb's craftspeople temporarily devoid of workshops and resources. But the same archaeology indicates the earlier attack had amounted to only a brief skip in the churning of Wolin's well-fuelled economic machine.<sup>29</sup> On the other hand, the evidence from the eleventh century reveals a drastic slip in Wolin's economy. By mid-century the town ceased to grow.

Archaeology provides hints that Wolin could no longer count on the importation of natural resources around this time. The town's inhabitants made many new buildings or repairs with wicker construction rather than with heavy timber. The townspeople ceased to expand Wolin's once-grand system of wooden streets, and began repairing the existing streets with poor quality planks and reused old material. There was also a decrease from mid-century onwards in imported finished wares, in the town's industrial production, and in those wares being exported.<sup>30</sup>

By 1043, Wolin had a delicate situation on its hands: one it could not maintain after Magnus's assault. Magnus's attack had lasted only days, at the most; there was no long-lasting blockade of Wolin or any effort to disrupt its trade routes. Thus, on the face of things, his campaign, as destructive as it was, should not have crippled the town as it seems to have done. However, even a minor disruption to the town's resource flow and shipping security, laid bare Wolin's great weaknesses. As explained above, the palaeobotanical evidence shows that the island had been deforested since the town's early dynamic expansion, and that its soils could not sustain intensive agriculture and were worsening with every generation. Historian Georges Comet believes one grain planted yielded four grains produced under average medieval conditions. Once divided between its human and animal producers, such a yield left little surplus, if any.<sup>31</sup> Wolin, with its sapped soils, had thus counted on external life support for generations by the time

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Magnus arrived. His attack interfered with the secure delivery of Wolin's critical resources, the most critical to Wolin's great population being foodstuffs.<sup>32</sup>

By the eleventh century's close, Wolin's economy had collapsed.<sup>33</sup> Wolin devolved into the plaything of Vikings interested in plundering the faded power. In 1098, the Viking Erik sent the people of the once-fearless town scurrying in panic. Erik victimised the hapless town, leaving behind dead citizens and taking a hefty tribute.<sup>34</sup> Wolin's final obliteration came when another Scandinavian force came through looking for pirates in the twelfth century, but by then there was only an empty husk to be burned. As Saxo Grammaticus reports in the *Gesta Danorum*, the houses were 'devoid of any defence'.<sup>35</sup>

## WOLIN AND GDANSK: ACCESS TO NATURAL RESOURCES

A comparison between Wolin and a neighbouring trade and industrial centre illustrates the role of environmental factors in the survival of medieval towns. About 250 km to the east of Wolin, Gdansk (see Figure 1) watched its contemporary wither as it successfully endured the years of turmoil. Like Wolin, Gdansk was a protected seaport and inland port (on the Vistula River). Archaeological evidence in the forms of pot shards and early defences suggest the town began to thrive in the ninth century (nearly contemporaneous with Wolin) and became the centre of its region's economic life from that century onwards. Its craftspeople worked leather and horn and likely included shipbuilders. Standing 4 km inland from the mouth of the Vistula, its craftspeople and traders relied on its wooden palisade and fort for security from raiders. Shortly after 1000, a large part of Gdansk was razed. Archaeology shows that the fort (and most likely parts of the craftworking and fishing neighbourhood) burned, but it cannot explain whether the fort was ordered to be burned as a political manoeuvre by Duke Wladyslaw Herman, who had burned other strongholds, or whether part of the town suffered an attack.<sup>36</sup>

Whatever the source of the conflagration, Gdansk survived while Wolin could not endure similar fires in 1043. Gdansk's region was a land of plenty in terms of ecological resources. Surrounded by oak, poplar, ash, elm, and hornbeam, wood was Gdansk's most plentiful natural asset. Nearby dryer, upland soil featured pine, spruce, and abundant hazel, the fruits of which local inhabitants enjoyed: archaeologists found the husks of hazel nuts scattered all about the town. Gdansk's inhabitants also kept many pigs in its immediate area, suggesting abundant local woods in which swine would have fed.

While the palaeobotanical record shows Wolin's adverse effects on its local forests, Gdansk's situation allowed it to enjoy more resources without endangering itself. Despite the industries that relied upon the products of the area's forests, including dying, shipbuilding, smithing, tanning, and tar-making, the expanding

town only managed to clear around 25% of its woodland. Its environmental resources allowed the town to rebuild itself after the fires of the eleventh century, while Wolin had no such fortune.<sup>37</sup>

## CONCLUSION

In the tenth century, Wolin had grown to become the most populous, most wealthy town the Baltic had ever known due to its location at the nexus of the Baltic Sea trade. A market for any and all goods available in Northern Europe (and occasionally offering items from distant Asia) Wolin attracted an unprecedented population, densely situated on an island with sandy soils and oak copses. The palaeobotanical record shows that this population, as many as 8000 inhabitants, taxed the island's already poor soils to the point where they could no longer produce grain. The record also shows the island was deforested by the beginning of the eleventh century. Wolin grew to rely on the importation of natural resources. Palaeobotanists have traced the origins of Wolin's grain and wood imports to the Polish hinterlands to the south. In the ninth century, Wolin had survived a Viking raid which had left the town's industrial section burnt to the ground. Still supported by a yet-undissipated environment, Wolin's inhabitants had quickly rebuilt its workshops and continued its steady growth. In the eleventh century, however, Wolin could not so easily recover from a fire suffered at the hands of Danish and Norwegian invaders. The town had spent its local wood resources. Archaeology shows that eleventh century repairs were made with re-used material and wicker. When sea borne violence threatened the resource supply of the import-reliant town Wolin's large population could not return to farming on soils long ago wasted.

The evidence from pre-capitalist, pagan Wolin refutes one of the basic premises of environmental history – that holds the western capitalist-Christian worldview responsible for inspiring Europeans' (and neo-Europeans') non-sustainable habits.<sup>38</sup> The palaeobotanical record shows that the townspeople of Wolin were perfectly capable of overstepping their environmental limits with guidance from neither of these economic structures nor cultural superstructures. The evidence from Wolin also adds significantly to our appreciation of pre-industrial humans' ability to alter their local environments. While medieval colonisation and land reclamation has been a fertile area for environmental historical research, the case of Wolin suggests that historians should look more closely at the effects of early medieval towns on their environments, and those environments' effects on towns.

## NOTES

The author wishes to thank the Department of History, University of Maine, William H. TeBrake, and the Ursu Foundation for research support.

<sup>1</sup>Władysław Filipowiak, 'Die Entwicklung der Stadt Wolin vom 9. bis zum 12. Jahrhundert', in *Vor- und Frühformen der europäischen Stadt im Mittelalter*, eds. Herbert Jankuhn, Walter Schlesinger, and Heiko Steuer (Göttingen: Vandenhoeck & Ruprecht, 1975), 126. Władysław Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', in *Society and Trade in the Baltic during the Viking Age*, ed. Sven-Olof Lindquist (Visby: Gotlands Fornsal), 124, 135. Małgorzata Latałowa, 'Man and Vegetation in the Pollen Diagrams from Wolin Island (NW Poland)', *Acta Palaeobotanica* 32: 132. Ibrahim ibn Jakub quoted in Władysław Filipowiak, *Wolin-Vineta – Die tatsächliche Legende vom Untergang Aufstieg der Stadt* (Rostock: Hinstorff Verlag, 1992), 122.

<sup>2</sup>Klaus Randsborg, *The First Millennium AD in Europe and the Mediterranean: An Archaeological Essay* (Cambridge: Cambridge University Press, 1991), 80. Richard Hodges, *Dark Age Economics: The Origins of Towns and Trade AD 600–1000* 2nd edn (London: Duckworth, 1989), 134–5.

<sup>3</sup>Richard Hodges, 'Frisians and Franks: Argonauts of the Dark Ages', *Archaeology* 37: 30. van Es, W.A. 'Dorestad Centered', in *Medieval Archaeology in the Netherlands*, eds. J.C. Bestemann, J.M. Bos, and H.A. Heidinga (Assen: Van Gorcum, 1990), 154, 176.

<sup>4</sup>Wolin allied itself with the Poles from the mid-tenth to early eleventh century in the face of Saxon aggression. Filipowiak, *Wolin-Vineta*, 122.

<sup>5</sup>Lech Leciejewicz, 'Polish Archaeology and the Medieval History of Polish Towns', in *The Comparative History of Urban Origins in Non-Roman Europe: Ireland, Wales, Denmark, Germany, Poland, and Russia from the Ninth to the Thirteenth Century*, eds. H.B. Clarke and Anngret Simms (London: British Archaeological Reports, 1985), 335.

<sup>6</sup>See Hodges, *Dark Age Economics*.

<sup>7</sup>Filipowiak, *Wolin-Vineta*, 33.

<sup>8</sup>Latałowa, 'Man and Vegetation in the Pollen Diagrams', 123.

<sup>9</sup>Leciejewicz, 'Polish Archaeology', 341. J.M. Steane and M. Foreman, 'The archaeology of medieval fishing tackle', in *Waterfront Archaeology: Proceedings of the third international conference on waterfront archaeology*, eds. G.L. Good, R.H. Jones, and M.W. Ponsford (London: Council for British Archaeology, 1991), 92, 94. Helen Clarke and Björn Ambrosiani, *Towns in the Viking Age* (New York: St. Martin's Press, 1991), 114. Filipowiak, *Wolin-Vineta*, 35.

<sup>10</sup>Małgorzata Latałowa, 'The last 1500 years on Wolin Island (NW Poland) in the light of palaeobotanical studies', *Review of Palaeobotany and Palynology* 73: 217, 224. Małgorzata Latałowa, 'Man and Vegetation in the Pollen Diagrams from Wolin Island (NW Poland)', *Acta Palaeobotanica* 32: 214.

<sup>11</sup>Latałowa, 'The last 1500 years on Wolin Island', 216–7. Latałowa, 'Man and Vegetation in the Pollen Diagrams', 206.

<sup>12</sup>Clarke and Ambrosiani, *Towns in the Viking Age*, 114. Filipowiak, 'Die Entwicklung der Stadt Wolin', 190, 207. Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 121.

<sup>13</sup>Filipowiak, 'Die Entwicklung der Stadt Wolin', 197, 203. Clarke and Ambrosiani, *Towns in the Viking Age*, 115.

- <sup>14</sup>Władysław Filipowiak, 'Wyspa Wolin w prahistorii i we wczesnym sredniowieczu', in *Z Dziejów Ziemi WoliŃskiej*, ed. Tadeusza Bialeckiego (Szczecin: Instytut Zachodniopomorski w Szczecinie, 1973), 90. Filipowiak, 'Die Entwicklung der Stadt Wolin', 197–199. Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 126–128, 130–132. Clarke and Ambrosiani, *Towns in the Viking Age*, 115.
- <sup>15</sup>Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 121, 135–6. Filipowiak, 'Die Entwicklung der Stadt Wolin', 199, 203.
- <sup>16</sup>Filipowiak, *Wolin–Vineta*, 14–15.
- <sup>17</sup>Latałowa, 'The last 1500 years on Wolin Island', 215, 225.
- <sup>18</sup>Latałowa, 'Man and Vegetation in the Pollen Diagrams', 193. Latałowa, 'The last 1500 years on Wolin Island', 225.
- <sup>19</sup>Latałowa, 'Man and Vegetation in the Pollen Diagrams', 215.
- <sup>20</sup>Małgorzata Latałowa, 'Some Problems in the Palaeoecological Interpretation of Archaeological Layers in the Early Medieval Port of Wolin, Northwest Poland', in *Environment and Vikings: Scientific Methods and Techniques Birka Studies 4*, eds. Urve Miller and Helen Clarke (Stockholm and Rixensart: PACT Belgium, 1997), 91–104. See also Latałowa, 'Man and Vegetation in the Pollen Diagrams'.
- <sup>21</sup>Latałowa, 'The last 1500 years on Wolin Island', 215.
- <sup>22</sup>van Es, 'Dorestad Centered', 44. Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 130.
- <sup>23</sup>M.M. Postan, 'The Trade of Medieval Europe: the North', in *The Cambridge Economic History of Europe 2*, 2nd ed., ed. M.M. Postan and Edward Miller (Cambridge: Cambridge University Press, 1987), 252.
- <sup>24</sup>Małgorzata Latałowa, 'Paleoecological evidences of the hydrological changes in the early medieval port of Wolin (NW Poland)', *Acta Paleobotanica* 35: 48. Filipowiak, 'Die Entwicklung der Stadt Wolin', 197.
- <sup>25</sup>Latałowa, 'The last 1500 years on Wolin Island', 217. Latałowa, 'Man and Vegetation in the Pollen Diagrams', 155.
- <sup>26</sup>Latałowa, 'The last 1500 years on Wolin Island', 217.
- <sup>27</sup>The *Saga of Magnus the Good* reports, 'never did a king before/So many ships to any shore.../The robbers, hemmed 'twixt death and fire,/Knew not how to escape thy ire;.../The heathen on his false gods calls,/and trembles even in their halls;/And by the light from its own flame/The king this viking-hold o'ercame.' Snorri Sturleson, *The Heimskringla II*, Samuel Laing trans. and ed. (London: Longman, Brown, Green, and Longmans, 1844), 382.
- <sup>28</sup>Filipowiak, *Wolin–Vineta*, 123.
- <sup>29</sup>Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 123.
- <sup>30</sup>Filipowiak, *Wolin–Vineta*, 123. Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 123. Filipowiak, 'Die Entwicklung der Stadt Wolin', 206.
- <sup>31</sup>Georges Comet, 'Technology and Agricultural Expansion in the Middle Ages: The Example of France North of the Loire', in *Medieval Farming and Technology* eds. Grenville Astill and John Langdon (New York: Brill Publishers, 1997), 18.
- <sup>32</sup>On the decrease in raw material imports see Filipowiak, *Wolin–Vineta*, 123.
- <sup>33</sup>Filipowiak, 'Die Bedeutung Wolins im Ostseehandel', 137.
- <sup>34</sup>Saxo Grammaticus quoted in Filipowiak, *Wolin–Vineta*, 124.
- <sup>35</sup>'*vacuas defensoribus*' Saxo Grammaticus, *Danorum Regum Heroumque Historia*, ed. Eric Christiansen (London: British Archaeological Reports, 1980), 547.

## THE WASTING OF WOLIN

<sup>36</sup> On the dating of early Gdansk see Andrzej Zbierski, trans. Mairin Cassidy, 'The Development of the Gdansk Area from the Ninth to the Thirteenth Century', in *The Comparative History of Urban Origins in Non-Roman Europe*, eds. Clarke and Simms, 309. On Gdansk as a regional centre see Zbierski, 'The Development of the Gdansk Area', 309. See also Leciejewicz, 'Polish Archaeology', 346–7.

<sup>37</sup> For Gdansk's relationship with its forests, see Zbierski, 'The Development of the Gdansk Area', 296–7. A new town named Wolin was founded on the island near the site of the collapsed centre in the later Middle Ages, but bore no common lineage with the original town.

<sup>38</sup> For the traditional view which sees the development of capitalism as among the roots of environmental destruction in Europe, see Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (New York: Harper-Collins, 1980), 42–68. For thoughts on Christianity's role in western environmental degradation see Lynn White, Jr. 'The Historical Roots of Our Ecologic Crisis', *Science* 155 (March 1967): 1203–7. Even at over thirty years old, the idea is far from antiquated; see Donald Worster, *The Wealth of Nature: Environmental History and the Ecological Imagination* (Oxford: Oxford University Press, 1993), 185–188.