Notes and Comments

Books are cited by author's name, title of work, facts of publication, and page number(s) where the information cited appears.

The following abbreviation are used:

Acts = Great Britain, Privy Council, *Acts of the Privy Council of England*

Acts & Ordinances = Great Britain, *Acts and Ordinances of the Interregnum, 1642-1660,* ed. C.H. Firth and Robert S. Rait.

APC = Great Britain, Privy Council, *Acts of the Privy Council of England, Colonial Series*

A.R. George (2003) = A.R. George, *The Babylonian Gilgamesh Epic* (New York: Oxford University Press Inc., 2003).

Atti = Atti e Memorie del 1 Congresso lnternazionale di Micenologia, Prima Parte

BSA = Annual of the British School at Athens

Caesar = Caesar, *Gallic War*

Claudian = Claudian, *The War Against Gildo*

Collection = John Houghton, *A Collection for the Improvement of Husbandry and Trade*

Colonial = Great Britain, Public Records Office, *Calendar of State Papers, Colonial Series, America and West Indies*

Columella = Columella, *De Re Rustica*

CSPD = Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of Elizabeth I*

CSPD Ch I = Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of Charles I*

CSPD Ch II = Great Britain, Public Records Office, *Calendar of State Papers, Domestic, of the Reign of Charles II*

CSPD Ja = Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of James I*

CSPI = Great Britain, Public Records Office, *Calendar of the State Papers, Relating to Ireland*

Early = James Muhly, Robert Maddin, and Vassos Karageorghis, eds., *Early Metallurgy in Cyprus, 4000–500 BC: Acta of the International Archaeological Symposium 1981,* (Nicosia: Pierides Foundation, 1982).

Diodorus = Diodorus Siculus, *Bibliotheca historica*

Dion. = Dionysius of Halicarnassus, *Roman Antiquities*

Epist. = Seneca, *Ad Lucilium Epistulae Morales*

Journals = Great Britain, Parliament, House of Commons, *Journals of the House of Commons*

Herodotus = Herodotus, *The Histories*

HMC = Great Britain, Historical Manuscripts Commission

Interest = The Interest of Great Britain in Supplying Herself with Iron: Impartially Consider'd

Laws = Great Britain, Laws, Statutes, etc., D. Pickering, ed., *The Statutes at Large from Magna Charta to the End of the Eleventh Parliament of Great Britain, anno 1761 [continued to 1806]* (Cambridge: Printed by Joseph Bentham, 1762–1807).

LP = Great Britain, Public Records Office, *Letters and Papers, Foreign and Domestic, Henry VIII*

Lucan = Lucan, *The Civil War*

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Pausanias = Pausanias, *Description of Greece*
Pennsylvania = Pennsylvania Magazine of History and Biography
Pliny = Pliny the Elder, *Natural History*
PM, 1 = Arthur Evans, *The Palace of Minos: A Comparative Account of the Successive Stages of the Early Cretan Civilization as Illustrated by the Discoveries at Knossos*, vol. 1 (London: MacMillan, 1921).
PM, 2 = Arthur Evans, *The Palace of Minos: A Comparative Account of the Successive Stages of the Early Cretan Civilization as Illustrated by the Discoveries at Knossos*, vol. 2 (London: MacMillan, 1928).
Proceedings = Great Britain, Committee for Compounding with Delinquents, *Calendar of the Proceedings of the Committee for Compounding*
S. Clemens = Samuel Clemens, "Frescoes from the Past," in *Life on the Mississippi*.
Strabo = Strabo, *The Geography of Strabo*
Suetonius = Suetonius, *The Lives of the Caesars*
Tenth Census = United States, Department of the Interior, Bureau of the Census, *Tenth Census of the United States (1800)*
Theophrastus = Theophrastus, *Enquiry into Plants*
Thucydides = Thucydides, *The Peloponnesian War*
VCH = The Victoria History of the Counties of England
Vitruvius = Vitruvius, *On Architecture*

Endnotes

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[116] Shalmaneser's boast is recorded by A. Kirk Grayson, *Assyrian Rulers of the Early First Millennium BC*, vol. 2 (Toronto: University of Toronto Press, 1996), 41.

[117] Regarding Shalmaneser killing forty elephants, see Grayson, *Assyrian Rulers of the Early First Millennium BC*, vol. 2, 84.

[118] Regarding the extinction of the Asian Elephant in the Near East and its causes see P.R.S. Moorey, *Ancient Mesopotamian Materials and Industries: The Archaeological Evidence*, 116; and Cornelia Becker, "Small Numbers, Large Potential – New Prehistoric Finds of Elephant and Beaver from the Khabur River/Syria," *Anthropologia-Arkeologia* 57 (2005): 455. For further scientific discussion and evidence of elephants in Mesopotamia and Syria during antiquity, see P.E.P. Deraniyagala, *Some Extinct Elephants, Their Relatives and Two Living Species* (Ceylon: Ceylon National Museum, 1955), 116–117.

[119] R. Schotz, "Die Strukture der Sumerischen Engeren Verbal Präfixe," *Vordera-siatisch-Aegyptische Gesellschaft* 39 (1934): 175, discusses Enigal's role in maintaining Lagash's wood supply.

[120] The discussion of wooden tables, chairs, bowls, and dishes is found in Joint Expedition of the British Museum and of the University Museum, University of Pennsylvania, Philadelphia, to Mesopotamia, L. Legrain, "Business Documents of the Third Dynasty of Ur," *Ur Excavation Texts I* (1947), no. 798, 801, 817, 818, 829, & 845 (D).

[121] On wood from local forests and its uses, see P. Steinkeller, "The Foresters of Umma: Toward a Definition of Ur III Labor," in *Labor in the Ancient Near East*, ed. Marvin A. Powell (University Park, PA: Eisenbrauns, 1987), 92–93.

[122] Concerning imported wood, refer to F. Thureau-Dangin (1907), Gudea B.5.18 (cedars from Ammanus); ibid., Gudea B.5.45; and G. Pettinato "I1 Comercio con l'Estero della Mesopotamia Meridionale nel 3. Millennia av. Cr. alia Luce della Fonti Litterate e Lessicali Sumeriche," *Mesopotamia* 7 (1972): 110 (oaks from the southeastern Arabian penninsula). See also M. Lambert and J. Tourney, "Les Statues D, G, E, et H de Gudea," *Revue d'Assyriologie et d'Archeolgie Orientale* 47 (1953): 78 (wood from northern Arabia and India); and G. Pettinato "I1 Comercio con l'Estero della Mesopotamia Meridionale nel 3. Millennia av. Cr. alia Luce della Fonti Litterate e Lessicali Sumeriche," 141 ("Inscrizioni di Gudea" V.53–VI.2) ("trunks of juniper, large firs, sycamores" and other trees from northern Syria).

[123] H. Guterbach, "Die historische Tradition und ihre literarische Gestaltung bei Babyloniern und Hethitern," *Zeitschrift für Assyrologie*, Neue Folge Band 8 (Band 42) (1934): 34 (pillaging for wood); F. Thureau-Dangin (1907), Gudea, Cylinder A VII, 13ff. (holding wood in the royal treasury); and A. Oppenheim (1954): 268–269 (rulers naming mountains for the dominant species of tree growing on them), demonstrate the high value Mesopotamians placed on wood.

[124] On excessive silt in the Mesopotamian watershed, see T. Jacobsen and R. Adams, "Salt and Silt in Ancient Mesopotamian Agriculture," *Science* 128, no. 3334 (November 1958): 1252, https://doi.org/10.1126/science.128.3334.1251. About Ur-Nammu's dredging of the canals, consult Joint Expedition of the British Museum and of the University Museum, University of Pennsylvania, Philadelphia, to Mesopotamia, C. Gadd and L. Legrain, *Ur Excavation Texts III* (1928), 50.

[125] H. Helbaek, "Ecological Effects of Irrigation in Ancient Mesopotamia," *Iraq* 22 (1960): 194; Jacobsen and Adams, "Salt and Silt in Ancient Mesopotamian Agriculture," 1251–1252; and T. Jacobsen, *Salinity and Irrigation Agriculture in Antiquity* (Undena Publications, 1982), 55, discuss the increased salinization of lower Mesopotamia and its consequences for Mesopotamian agriculture.

[126] Concerning the decline and disappearance of the great cities of Sumeria, see Jacobsen, *Salinity and Irrigation Agriculture in Antiquity*, 55; and Jacobsen and Adams, "Salt and Silt in Ancient Mesopotamian Agriculture," 1252.

[127] J. Cherry, "Evolution, Revolution and the Origins of Complex Society in Crete," in *Minoan Society*, 33; J. Lethwaite, "Why Did Civilization Not Emerge More Often? A Comparative Approach to the Development of

Crete," in *Minoan Society* (1983), 179; and J. Sasson, "A Sketch of North Syrian Relations in the Middle Bronze Age," *Journal of the Economic and Social History of the Orient* 9, no. 3 (December 1966): 178, remark on the sudden emergence of Crete as a major civilization around the beginning of the second millennium BCE.

[128] On the importance of the Near East on the development of Crete, see J. Cherry, "Evolution, Revolution and the Origins of Complex Society in Crete," 41, and Lethwaite, "Why Did Civilization Not Emerge More Often? A Comparative Approach to the Development of Crete," 179.

[129] J. Kupper, *Correspondance de Bahdi-Lim* (Paris, 1954), no. 63; G. Bardet et al., *Archives Administratives de Mari I* (Paris, 1984), no. 514; G. Dossin et al., *Textes Divers* (Paris, 1964), no. 41; J. Kupper, *Correspondance de Kibri Dagan* (Paris, 1950), no. 22–25; and G. Dossin et al., *Textes Divers* (Paris, 1964), no. 17, discuss the importance of wood for Mari armament workers, metallurgists, chariot assemblers, and builders of palaces.

[130] On fuel problems in one part of Mari, see C. Jean, *Lettres Divers* (Paris, 1950), no. 113.

[131] Forests in Mari are mentioned in G. Dossin, *Correspondance de Samsi-Addu* (Paris, 1950), no. 118; and G. Dossin, *Correspondance de lasmah-Addu* (Paris, 1952), no. 86.

[132] G. Dossin, *Correspondance de lasmah-Addu*, tells of the placement of a forest guard in one of the woods.

[133] The king's strict orders can be found in G. Dossin, *Correspondance de Samsi-Addu*, 94.

[134] Mukannisum is quoted in G. Dossin et al., *Textes Divers*, no. 17.

[135] The message of the supervisor of chariot construction appears in G. Dossin et al., *Textes Divers*, no. 41. Timber was so important for the economy and so difficult to obtain that when the palace requested wood, the administrators responsible for supplying the palace placed guards along the route the wood was supposed to take. The guards were to watch for the shipments with instructions to immediately inform the administrators of the timber's progress as it was transported and of its arrival [M. Birot, *Lettres de Yaqqim-Addu* (Paris: Librairie Orientaliste Paul Geuthner, 1974), no. 30 and 32].

[136] The dates of Zimri-Lim's reign are kept purposely vague since according to P. Aström, an authority on the Bronze Age chronology, "the reign of Hammurabi [which was contemporary with Zimri-Lim's reign and by which Zimri-Lim's reign is dated] may thus be dated in 1848–1806, 1792–1750, 1784–1742 BCE Landberger puts the accession of Hammurabi in 1900 BCE and Van de Meer in 1711 + *x*. It is not yet certain which of the dates … is correct." In fact, "the absolute chronology" for the Middle Bronze Age "is a matter of dispute," Aström points out [P. Aström, "Methodological Viewpoints on Middle Minoan Chronology," *Opuscula Atheniensia* 12 (1978): 88 and 90].

[137] The interchange between Zimri-Lim and Kibri-Dagan can be found in P. Aström, "Methodological Viewpoints on Middle Minoan Chronology," no. 22–25.

[138] On the importance of Terqa, see Kupper, *Correspondance de Kibri Dagan*, i.

[139] B. Meissner, *Warenpreise in Babylonien* (Berlin: Verlag der Akademie, 1936), 14, tells of the door problems.

[140] Concerning the differences in price of heated asphalt and dry asphalt, see A. Salonen, *Die Wasserfohrzuege in Babylonien …* (Helsinki, 1939), 147-148.

[141] A Babylonian document in G. Driver, *Letters of the First Babylonian Dynasty* (London; New York: Oxford University Press, H. Milford, 1924), no. 33, tells of the palace's interest in the conservation of wood.

[142] Driver, *Letters of the First Babylonian Dynasty*, no. 33, quotes Hammurabi on the gravity of the wood problem in Babylon.

[143] Hammurabi's orders to Samas-Hazir can be found in F. Thureau-Dangin, "Le Correspondance de Hammurapi avec Samas-Hasir," *Revue d'Assyriologie et d'Archeologie Orientale* 21, no. 1/2 (1924): 20.

[144] Samas-Hazir's threat appears in M. Stol, *Letters from Yale*, (Leiden: Brill, 1981), 20. To be treated "like an enemy of Marduk" meant that Belsunu would be considered an enemy of the Babylonian state, subject to terrible punishment.

[145] On the importation of timber for general construction and shipbuilding from the East, see G. Pettinato, "Il Commercio con l'Estero della Mesopotamia Meridionale nel 3. Millennia av. Cr. alla Luce della Fonti Litterate e Lessicali Sumeriche," *Mesopotamia* 7 (1972): 114–117 and 164.

[146] A. Oppenheim, "The Seafaring Merchants of Ur," *Journal of the American Oriental Society* 74, no. 1 (1954): 14–15, demonstrates that contacts between Magan and Meluhha, and Mesopotamia, peaked near the end of the third millennium BCE.

[147] W.F. Leemans, *Foreign Trade in the Old Babylonian Period* (Leiden: Brill, 1960), 26, discusses the curtailment of wood imports from the East.

[148] L. King, *The Letters and Inscriptions of Hammurabi, King of Babylon*, vol. 3 (London: Luzac and Company, 1900), 22, shows that the demand for wood in Babylon did not slacken.

[149] Cherry, "Evolution, Revolution and the Origins of Complex Society in Crete," 41, tells of Near Easterners trading luxury goods with Crete.

[150] The importance of Crete's timber in attracting interest from the Near East is discussed in R. Hutchinson, *Prehistoric Crete* (London: Pelican, 1962), 105–106; and Sasson, "A Sketch of North Syrian Relations in the Middle Bronze Age," 178.

[151] On the types of trees that grew in Crete, see M. Rossignol and L. Pastouret, "Analyse Pollinique de Niveaux Sapropéliques Post-Glaciaires dans une Carotte en Méditerranée Orientale," *Review of Palaeobotany and Palynology* 11, no. 3–4 (May 1971): 227, https://doi.org/10.1016/0034-6667(71)90004-2.

[152] R. Meiggs, *Trees and Timber in the Ancient Mediterranean World* (Oxford: Clarendon Press, 1982), 99, discusses the use of cedar wood for tool handles in Crete.

[153] Concerning Sir Arthur Evans's interpretation, consult A. Evans, *PM,* 2, 247–248. There is a striking similarity to the Cretan hieroglyphic representation of timber and forest in Chinese. According to Anthony Burgess, *Language Made Plain* (Apollo Editions, 1969), 64, a single Chinese character resembling a tree signifies timber while a set of two such characters signifies a forest.

[154] Cherry, "Evolution, Revolution and the Origins of Complex Society in Crete," 33; J. Lethwait, "Why Did Civilization Not Emerge More Often? A Comparative Approach to the Development of Crete," 179; and Sasson, "A Sketch of North Syrian Relations in the Middle Bronze Age," 178, point to the influence of trade from the Near East on the development of Crete. Although "the idea of [Near Eastern] penetration of the eastern Mediterranean islands … as early as the second millennium still seems strange and hardly acceptable to many scholars," M. Astour of Brandeis University wrote in 1964, "archaeological discoveries of the last decades have revealed prolonged and close relations of the Bronze Age Cyprus and Crete with North Syria" [M. Astour, "Second Millennium B.C. Cypriot and Cretan Onomastica Reconsidered," *Journal of the American Oriental Society* 84, no. 3 (1964): 240–241].

[155] C. Renfrew, "Patterns of Population Growth in the Prehistoric Aegean" in *Man, Settlement and Urbanism,* ed. Peter Ucko et al. (London: Duckworth, 1972), 397; and Malcolm Weiner, "Crete and the Cyclades in LM I: The Tale of Two Conical Cups" in *Minoan Thalassocracy* (1984), 24, tell of Crete reaching its zenith in population and wealth.

[156] The relationship between palatial society in the Near East and Crete is discussed in A. Lawrence, "The Ancestry of the Minoan Palace," *BSA* 46 (1951): 85.

[157] For details on wood use in palatial and domestic architecture at Knossos, see A. Evans, *PM,* 1, 209, 228, 306, 307, and 328.

[158] R. Willetts, *The Civilization of Ancient Crete* (London: B.T. Batsford, 1977), 28, tells of shipwright tools found at Knossos.

[159] On the "black ships of Minos," see "Hymn to Pythian Apollo," *Homeric Hymns,* 393–398.

[160] N. Platon, "L'Exportation du Cuivre de I'lsle de Cypre en Crete et les Installations Metallurgiques de le Crete Minoenne," *Acts of the International Archaeological Symposium "The Relations Between Cyprus and Crete, ca. 2000-500 BCE"* (Nicosia, Cyprus, 1979), 105; C. Davoras, "A Minoan Pottery Kiln at Palaikastro," *BSA* 75 (1980): 117, Fig. 2, and 124; and A. Evans, *PM,* 1, 532, discuss, respectively, bronze founding, pottery kilns, and the calcination of limestone at Knossos.

[161] On the building boom at Knossos, see A. Evans, *PM,* 2, 571, and J.T. Hooker, *Mycenaean Greece* (London: Routledge & Kegan Paul, 1976), 34.

[162] E. Catling & H. Catling, "The Bronze from Tomb 3," in M. Popham, "Sellopoulo Tombs 3 and 4, Two Late Minoan Graves near Knossos," *BSA* 69 (1974): 252, discusses the heyday of bronze production on Crete.

[163] H. Catling, "Copper in Cyprus, Bronze in Crete: Some Economic Problems," *Acts of the International Archaeological Symposium "The Relations Between Cyprus and Crete, ca. 2000-500 BCE"* (Nicosia, Cyprus, 1979), 69, discusses the record amounts of bronze produced.

[164] A. Evans, *PM,* 2, 571, and Weiner, "Crete and the Cyclades in LM I: The Tale of Two Conical Cups," 19, tell of the rich hoards of bronze found on Crete.

[165] On the possibility of exporting large quantities of bronze to the Greek mainland, see E. Catling and H. Catling, "The Bronze from Tomb 3," 252.

[166] H. Georgiou, "Minoan Coarse Wares and Minoan Technology," *Minoan Society,* 88, tells of the increased pottery production.

[167] On the physical growth of Knossos, see A. Evans, *PM,* 2, 463, and P. Warren, "The Place of Crete in the Thalassocracy of Minos," *Minoan Thalassocracy,* 40.

[168] The relationship between population growth and the rise in the standard of living with increased wood consumption is discussed by M. de Montalembert and J. Clement, "Fuelwood Supplies in the Developing Countries," *FAO Forestry Paper* 42 (Food and Agriculture Organization of the United Nations, 1983): 119, and J. Laarman and M. Wohlgenant, "Fuelwood Consumption: A Cross-Country Comparison," *Forest Science* 30, no.2 (June 1984): 24.

[169] The ubiquity of double-axes in Late Bronze Age Crete is from Lena Hakvlin, "Metals in LBA Minoan and Mycenaean Societies on Crete: A Quantitative Approach," (PhD diss., Unigrafia Oy Yliopistopaino, 2013), 42.

[170] Hakvlin, "Metals in LBA Minoan and Mycenaean Societies on Crete: A Quantitative Approach," 42.

[171] Homer, *Odysseu*s 5.234–245.

[172] J. Luce and Kathleen Bolton, "Thera and the Devastation of Minoan Crete: A New Interpretation of the Evidence," *American Journal of Archaeology* 80, no. 1 (Winter 1976): 16, https://doi.org/10.2307/502934, provides his version of the effect of the volcanic eruption at Thera on Crete.

[173] For the scientific evidence for a radical redating of the Thera eruption to the seventeenth century BCE, see M. Baillie and M. Munro, "Irish Tree Rings, Santorini and Volcanic Dust Veils," *Nature* 332 (March 1988): 344, https://doi.org/10.1038/332344a0. Also consult C. Hammer, H. Clausen, W. Friedrich, and H. Tauber (1987), "The Minoan Eruption of Santorini in Greece dated to 1645 BCE?" *Nature* 329 (August 1987): 519, https://doi.org/10.1038/328517a0; and V. LaMarche and K. Hirshboeck, "Frost Rings in Trees as Records of Major Volcanic Eruptions," *Nature* 307 (January 1984): 126, https://doi.org/10.1038/307121a0; and Erkan Aydar et al., "Volcanic Ash and Tsunami Record of the Minoan Late Bronze Age Eruption (Santorini) in a Distal Setting, Southwestern Turkey," Abstract, *Journal of Quaternary Science* 36, no. 4 (April 2021), https://doi.org/10.1002/jqs.3314.

[174] Aydar et al., "Volcanic Ash and Tsunami Record of the Minoan Late Bronze Age Eruption (Santorini) in a Distal Setting, Southwestern Turkey," Abstract.

[175] On changes in wood use at Knossos and its consequences, see A. Evans, *PM*, 2, 565, and J.D.S. Pendlebury, *The Archaeology of Crete* (New York: Biblo and Tannen, 1963), 188.

[176] Pendlebury, *The Archaeology of Crete*, 188.

[177] A. Evans, *PM*, 2, part 2, 565.

[178] Conservation measures adopted are discussed in M. Popham, "The Unexplored Mansion at Knossos," *Archaeological Reports* 19 (November 1973): 58, https://doi.org/10.2307/581091 (recycling bronze), and P. Muhly, "Minoan Hearths," *American Journal of Archaeology* 88, no. 2 (April 1984): 121, https://doi.org/10.2307/504991 (portable braziers).

[179] H. Forbes and H. Koster, "Fire, Axe, and Plow: Human Influence on Local Plant Communities in the Southern Argolid," *Annals of the New York Academy of Science* 268 (1976): 121, tells of producing charcoal from shrubbery; and Pliny 34.96, claims that charcoal was used as a replacement for wood.

[180] Details concerning the landscape of Crete discussed in N. Platon, *Zakros: The Discovery of a Lost Palace of Ancient Crete* (New York: Scribner), 240, and R. Willets (1977), 28, suggest the constraints on intra-island trade.

[181] See H. Wright, "Vegetation History," in *Minnesota,* 193, on pine growing near Messenian Pylos.

[182] O. Rackham, "Charcoal and Plastic Impressions," P. Warren, ed., "Myrtos," *BSA*, Supplement #7 (1972): 303; Theophrastus 5.7.2; and Pliny 33.94, discuss the value of pine for builders, for shipwrights, and as fuel.

[183] O. Dickinson, "The Origins of Mycenaean Civilization," *Studies in Mediterranean Archaeology* 49 (1977): 94, suggests that wood played a role in Knossos's interest in Messenia; and C. Laviosa, "Discussion," *Minoan Thalassocracy,* 185, states that wood played a role in Minoan trade with coastal areas of Asia Minor.

[184] John Chadwick, *The Mycenaean World* (Cambridge: Cambridge University Press, 1976), 35, tells of Pylos's fine harbor.

[185] On the proximity of Pylos to Crete, see O. Dickinson, "The Origins of Mycenaean Civilization," 94.

[186] The Greek legend that talks of Minoans trading with Pylos can be found in the "Hymn to Pythian Apollo," *Homeric Hymns,* 393–398.

[187] On the trade of finished products by Crete for raw materials, see G. Korres, "The Relations between Crete and Messenia in the Late Middle Helladic and Early Late Helladic Period," *Minoan Thalassocracy*, 143.

[188] The quote "of Cretan workmanship" is located in Michael Ventris and John Chadwick, *Documents in Mycenaean Greek,* 2nd ed. (Cambridge: Cambridge University Press, 1973), 336.

[189] Syrian cedars growing near the coast of Asia Minor and their use in shipbuilding are discussed in Theophrastus 3.2.6 and 5.7.1.

[190] See Hakvlin, "Metals in LBA Minoan and Mycenaean Societies on Crete: A Quantitative Approach," regarding

the lack of axes.

[191] Concerning the probable emergence of Egypt as an important naval and maritime power, consult L. Hellbing "Alasia Problems," *Studies in Mediterranean Archaeology* 57 (1979): 52; Hooker, *Mycenaean Greece*, 67–68; and E. Sakellarkis and Y. Sakellarkis, "The Kefitu and Minoan Thalassocracy," *Minoan Thalassocracy*, 201.

[192] R.J. Buck, "The Minoan Thalassocracy Reexamined," *Historia* 11 (1962): 130–131, and C. Starr, "The Myth of the Minoan Thalassocracy," *Historia* 3 (1954–1955): 289, tell of the emergence of Mycenaean Greece as an important maritime power.

[193] For a discussion of the decline in bronze productivity, see E. Catling and H. Catling, "The Bronze from Tomb 3," 252.

[194] Xenophon's quote is in Xenophon, *The Polity of the Athenians* 2.12–13.

[195] H. Haskell, "From Palace to Town Administration: The Evidence of Coarse Ware Stirrup Jars," *Minoan Society*, 121 and 124, discusses the change in the center of pottery production from Knossos to Chania. Pendlebury, *The Archaeology of Crete*, 284, tells of the sparse population of Chania at the height of Minoan power.

[196] Rackham, "Charcoal and Plastic Impressions," 303; Theophrastus 5.7.2; and Pliny 33.94, discuss the value of pine for builders, for shipwrights, and as fuel.

[197] Sterling Dow and John Chadwick, *The Cambridge Ancient History: The Linear Scripts and the Tablets as Historical Documents* (Cambridge: Cambridge University Press, 1971), 42, and J.T. Killen, "The Wool Industry of Crete in the Late Bronze Age," *BSA* 59 (1964): 1–14, http://www.jstor.org/stable/30103132, discuss sheep grazing near Knossos.

[198] M. Zohary and G. Orshan (1965), 41–42, discuss the degradation of the landscape by sheep.

[199] On the forests of Mycenaean Greece, see Willem Van Zeist and S. Bottema, "Vegetational History of the Eastern Mediterranean and Near East during the Last 20,000 Years," in *Palaeoclimates, Palaeoenvironments and Human Communities in the Eastern Mediterranean Region in Later Prehistory*, Part 2, BAR International Series 133, ed. John Bintliff and Willem Van Zeist (Oxford: British Archaeological Reports, 1982), 287 and 319; William McDonald, "Exploration in Messenia," *Atti* (1968): 103; and Alan Wace, *Mycenae: An Archaeological History and Guide* (Princeton: Princeton University Press, 1949), 113.

[200] On the role of the export of resources to Crete and the development of Mycenaean material culture, see Hooker, *Mycenaean Greece*, 55.

[201] On the importance of wood in the construction of houses and palaces, see Hooker, *Mycenaean Greece*, 33, 64, 76, 77, and 105; Carl Blegen and Marion Rawson, *The Palace of Nestor at Pylos in Western Messenia*, vol. 1, part 1 (Cincinnati: University of Cincinnati, 1966), 37; and J. Malcolm Wagstaff and Clive Gamble, "Island Resources and Their Limitations," in *An Island Polity*, ed. Colin Renfrew and J. Malcolm Wagstaff (Cambridge: Cambridge University Press, 1982), 97.

[202] Concerning Mycenaean industries, see Chadwick, *The Mycenaean World*, 141 (bronze founding), and H. Catling and A. Millett, "A Study in the Composition Patterns of Mycenaean Pictorial Pottery from Cyprus," *BSA* 60 (1965): 219, https://doi.org/10.1017/S0068245400013964; Vincent Desborough, *The Last Mycenaeans and Their Successors* (Oxford: Clarendon Press, 1964), 220; Sara Immerwahr, "Mycenaean Trade and Colonization," *Archaeology* 13, no. 1 (1960): 6; and Hooker, *Mycenaean Greece*, 82 (ceramics).

[203] On shipbuilding in Messenia, see Ventris and Chadwick, *Documents in Mycenaean Greek*, 298.

[204] On wood used for the construction of chariot chassis, see Thomas Palaima (1980), "Observations on Pylian Epigraphy," *Studi Micenei ed Egeo-Anatolici* 21 (1980): 201–202.

[205] Ventris and Chadwick, *Documents in Mycenaean Greek*, 370, describe the types of wood used for chariot wheels.

[206] Concerning the use of chariots for hunting and war, refer to Ake Akerström, "Mycenaean Problems," *Opuscula Atheniensia* 12 (1978): 19.

[207] Concerning the expanding population, see Philip Bentancourt, "The End of the Greek Bronze Age," *Antiquity* 50, no. 197 (March 1976): 42, https://doi.org/10.1017/S0003598X00070617; John Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece*, British Archaeological Reports Supplementary Series 28 (Oxford: British Archaeological Reports, 1977), 125; G. Cadogan, "Patterns in the Distribution of Mycenaean Pottery in the East Mediterranean," in *Acts of the International Archaeological Symposium: "The Mycenaeans in the Eastern Mediterranean,"* ed. Vassos Karageorghis (Department of Antiquities, Nocosia, 1973), 168; Vincent Desborough, "The Greek Mainland, c. 1150 BCE – c. 1000 BCE," *Proceedings of the Prehistoric Society* 31 (December 1965): 215; and Emily Vermeule, "The Fall of the Mycenaean Empire," *Archaeology* 13, no. 1 (1960): 66, http://www.jstor.org/stable/41663738.

[208] Jack Balcer, "The Mycenaean Dam at Tiryns," *American Journal of Archaeology* 78, no. 2 (April 1974): 141,

and William McDonald and George Rapp, "Perspectives," in *Minnesota,* 255, discuss the increase in settlements in the Peloponnese during the Late Bronze Age.

[209] The evidence for the increased settlement of hilly areas is found in Herman Van Wersch, "The Agricultural Economy," in *Minnesota,* 180–183.

[210] Tax advantages for settling marginal land are discussed in W. Edward Brown, "Land Tenure in Mycenaean Pylos," *Historia* 5, no. 4 (1956): 393, http://www.jstor.org/stable/4434502.

[211] Concerning the loss of the pine forests near Pylos, see H. Wright, "Vegetation History," in *Minnesota,* 199.

[212] Concerning the number of sheep in Messenia, see Ventris and Chadwick, *Documents in Mycenaean Greek,* 198.

[213] Ibid., 355 and 509, discuss the decentralized setting of many bronze foundries and their need for fuel.

[214] Woodcutters working inland are discussed in John Chadwick, "The Mycenaean Documents," in *Minnesota,* 110.

[215] Concerning the decentralized location of the ceramics industry, see Carl Blegen, *Zygouries: A Prehistoric Settlement in the Valley of Cleonae* (Cambridge: Pub. for the American School of Classical Studies at Athens, Harvard University Press, 1928), 2 and 221–222 (Zygouries); Sara Immerwahr, "Three Mycenaean Vases from Cyprus in the Metropolitan Museum of Art," *American Journal of Archaeology* 49, no. 4 (1945): 555, https://doi.org/10.2307/499870; and Ake Akerström, "A Mycenaean Potter's Factory at Berbati Near Mycenae," *Atti* (1968): 48 (Berbati). According to Ventris and Chadwick, *Documents in Mycenaean Greek,* 134, the kilns at Messenia were also decentralized.

[216] The quote from the study of Melos comes from Wagstaff and Gamble, "Island Resources and Their Limitations," 97.

[217] M. Benchetrit, "L'Erosion Acceleree dans les Chaines d'Oranie," *Revue de Geomorphologie Dynamique* 5 (1954): 150–151, discusses the dynamics of exposed soil carried away by precipitation.

[218] Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece,* 89, speaks about the increase of erosion because of greater slope angle.

[219] Robert Beasley, *Erosion and Sediment Pollution Control* (Ames: Iowa State Universty Press, 1972), 11, discusses the relationship between deforestation and the soil's retention of water after rainstorms.

[220] A. de Vooys and J. Piket, "A Geographical Analysis of Two Villages in the Peloponnese," *Nederlands Aardrijkskundig Genootschap Tijdschrift* 75 (1958): 32, discuss the problems of torrents in the Argive watershed.

[221] On the damage torrents did to human settlement in the Plain of Argos, their threat to the well-being of Tiryns, and their diversion by Bronze Age Mycenaeans, see Balcer "The Mycenaean Dam at Tiryns," 145–147; Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece,* 339; and John Kraft, *A Reconnaissance of the Geology of the Sandy Coastal Areas of Eastern Greece and the Peloponnese* (Newark: College of Marine Studies, University of Delaware, 1972), 113.

[222] J. Kraft, G. Rapp, and S. Aschenbrenner, "Late Holocene Palaeogeomorphic Reconstruction in the Area of the Bay of Navarino: Sandy Pylos," *Journal of Archaeological Science* 7 (1980): 194–195, write about the diversion of the Amoudheri River near Pylos.

[223] The degradation of Melos's landscape as a consequence of deforestation is discussed in Donald Davidson, "Erosion in Greece during the First and Second Millennia BCE," in *Timescales in Geomorphology,* ed. R. Cullingford, D. Davidson, and J. Lewin (Chichester and New York: John Wiley & Sons, 1980), 151; D. Davidson and C. Tasker, "Geomorphological Evolution during the Late Holocene," in *An Island Polity,* ed. Colin Renfrew and J. Malcolm Wagstaff (Cambridge: Cambridge University Press, 1982), 90; and Donald Davidson, Colin Renfrew, and Catriona Tasker, "Erosion and Prehistory in Melos: A Preliminary Note," *Journal of Archaeological Science* 3 (1976): 226.

[224] N. Yassoglou, D. Catacousinos, and A. Kouskolekas, "Land-Use in the Semi-Arid Zone of Greece," Arid Zone Research, *Land Use in Semi-Arid Mediterranean Climates,* vol. 26 (UNESCO, 1964), 63, discusses the transfer of hillside soil to valley bottoms in southern Greece.

[225] Concerning the loss of the original brown forest soil in Messenia see N. Yassoglou and Catherine Nobeli, "Soil Studies," *Minnesota,* 171–172, and Catherine Smith, *Western Mediterranean Europe* (London: Academic Press, 1979), 282–283.

[226] Loss of organic matter and nitrogen in Greek soils is discussed in Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece,* 103–104; N. Yassoglou, D. Catacousinos, and A. Kouskolekas, "Land-Use in the Semi-Arid Zone of Greece," 63–64; and Phoebus Anastassiades, "General Features of the Soils of Greece," *Soil Science* 67, no. 5 (May 1949): 353.

[227] On the growing of flax in Messenia, see J.S. Hutchinson, "Mycenaean Kingdoms and Medieval Estates," *Historia* 26 (1977): 16.

[228] William Albrecht, "Physical, Chemical, and Biochemical Changes in the Soil Community," in *Man's Role in Changing the Face of the Earth*, ed. William Thomas (Chicago: University of Chicago Press, 1956), 657–658, discusses the increased water needs of crops when there are insufficient nutrients in the soil.
[229] On splash erosion see Beasley, *Erosion and Sediment Pollution Control*, 1.
[230] The problems of splash erosion on the Plain of Argos today are discussed by De Vooys and Piket, "A Geographical Analysis of Two Villages in the Peloponnese," 32.
[231] N. West, "Desertification or Xerification?," *Nature* 321 (1986): 562, https://doi.org/10.1038/321562a0, discusses the connection between splash erosion and abnormal runoff.
[232] The effect of excessive runoff in Bronze Age Argos is discussed in Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece*, 89.
[233] The problems of water retention in deforested soils are talked about in Albrecht, "Physical, Chemical, and Biochemical Changes in the Soil Community," 656, and West, "Desertification or Xerification?," 562.
[234] On human-induced drought, see West, "Desertification or Xerification?," 562.
[235] J. Hooker, "The End of Pylos and the Linear B Evidence," *Studi Micenei ed Egeo-Anatolici* 23 (1982): 217, writes about the paucity of arable land in Messenia.
[236] Akerström, "A Mycenaean Potter's Factory at Berbati Near Mycenae," 48, discusses the abandonment of Berbati; Blegen, *Zygouries: A Prehistoric Settlement in the Valley of Cleonae*, 222, covers the abandonment of Zygouries; on the abandonment of Melos, see Davidson, Renfrew, and Tasker, "Erosion and Prehistory in Melos: A Preliminary Note," 226.
[237] Concerning the need of the Mycenaeans to go outside the Peloponnese for wood and food, consult Vermeule, "The Fall of the Mycenaean Empire," 66–67.
[238] On the strategic importance of Troy, see George Rapp and John Gifford, introduction to *Troy: The Archaeological Geology*, ed. George Rapp and John Gifford (Cincinnati: University of Cincinnati, 1982), 4, and J. Kraft, I. Kazan, and O. Erol, "Geology and Paleogeographic Reconstructions of the Vicinity of Troy," in *Troy: The Archaeological Geology*, 40.
[239] Based on personal experience during a week's stay near Troy in August 2013.
[240] On Troy as the emporium for its hinterlands, see John Davies and Lin Foxhall, afterword to *The Trojan War: Its Historicity and Context: Papers of the First Greenbank Colloquium, Liverpool, 1981*, ed. Lin Foxhall and John Davies (London: Bristol Classical Press, 1984), 178.
[241] *Homer's Epigrams,* Epigram X, and Diodorus 5.64 tell of ironmasters smelting iron using pines from Ida as their fuel.
[242] Homer, *The Iliad* 23.147.
[243] C. Mee, "The Mycenaeans and Troy," in *The Trojan War: Its Historicity and Context: Papers of the First Greenbank Colloquium, Liverpool, 1981*, ed. Lin Foxhall and John Davies (London: Bristol Classical Press, 1984), 51, suggests that regular trade occurred between Mycenae and Troy.
[244] Philipp Stockhammer quoted in Ariel David, "Archaeologists Identify Oldest Use of Fossil Fuels in Europe," Haaretz, December 22, 2021, https://www.haaretz.com/archaeology/MAGAZINE-archaeologists-identify-oldest-use-of-fossil-fuels-in-europe-1.10480844.
[245] Concerning the great population losses suffered by Mycenae, Pylos, and Tiryns, see Spyros Iakovidis, *Late Helladic Citadels on Mainland Greece* (Leiden: Brill, 1983), 109.
[246] On the loss of settlements in other Mycenaean regions, refer to P. Bentancourt, "The End of the Greek Bronze Age," 45.
[247] Concerning the decline in population, see Carl Blegen et al., *Lectures in Memory of Louise Taft Semple*, University of Cincinnati Classical Studies, vol. 1 (Princeton: Princeton University Press, 1967), 30; A.M. Snodgrass, *The Dark Age of Greece* (Edinburgh: Edinburgh University Press, 1971), 367; Thomas Kelly, *A History of Argos to 500 B.C.* (Minneapolis: University of Minnesota Press, 1977), 13 (Plain of Argos); and W. McDonald and R. Simpson, "Archaeological Exploration," *Minnesota*, 143 (Messenia).
[248] The migration of Mycenaeans to sparsely populated areas of Greece is discussed in Emily Vermeule, "The Mycenaeans in Achaia," *American Journal of Archaeology* 64, no. 1 (1960): 19–20, https://doi.org/10.2307/502416 (Achaia), and G.S. Kirk, *Homer and the Oral Tradition* (Cambridge: Cambridge University Press, 1976), 65 (interior of Arcadia), 66. The quote "a riddance of grievous famine" appears in Pausanias 8.43.6.
[249] Concerning power intrigues and civil violence, see Vermeule, "The Fall of the Mycenaean Empire," 71, and George Mylonas, *Mycenae's Last Century of Greatness* (Sydney: Sydney University Press, 1968), 29–30.

[250] Philipp Stockhammer quoted in Ariel David, "Archaeologists Identify Oldest Use of Fossil Fuels in Europe."
[251] On the decline in Mycenaean standard of living, see Sterling Dow, "The Greeks in the Bronze Age," *XI Congress International des Sciences Historiques, Rapports* 2 (1960): 25; Iakovidis, *Late Helladic Citadels on Mainland Greece*, 109; and Vermeule, "The Mycenaeans in Achaia," 3.
[252] Ariel David, "Archaeologists Identify Oldest Use of Fossil Fuels in Europe."
[253] The preference for olive culture over cereals at post-Mycenaean Pylos is shown in pollen studies in Wright "Vegetation History," in *Minnesota,* 195 and 199. In contrast, during the Late Bronze Age at Pylos, M. Ventris and J. Chadwick, *XI Congress International des Sciences Historiques, Rapports* 2 (1960), 217, suggest that olives "may have not yet been produced in Messenia."
[254] J. Bintliff, *Natural Environment and Human Settlement in Prehistoric Greece*,125 and 222, discusses the advantage of olives over other crops during droughts.
[255] The ecological protection provided by olives is discussed in Claudio Vita-Finzi, "Roman Dams in Tripolitania," *Antiquity* 35, no. 137 (1961): 20, https://doi.org/10.1017/S0003598X00035754; Pindar, *Olympian Odes* 3.25–27; and Yassoglou and Nobeli, "Soil Studies," 175–176.
[256] Cato the Elder, *On Agriculture* 130; Homer, *Odyssey* 5.236; and Theophrastus 5.9.8, describe how olive wood can substitute for wild sources of wood for fuel and building material.
[257] The limitations of olive wood as a substitute for other woods in building are pointed out by O. Rackham, "Charcoal and Plastic Impressions," 303–304, and Theophrastus 5.6.1.
[258] *The Cypria,* 3, contains the legend linking ecological degradation with the destruction of Mycenaean society.
[259] On the material growth of other states along the Mediterranean in the Late Bronze Age, see R. Faulkner, "From the Inception of the 19th Dynasty to the Death of Ramesses III," in *The Cambridge Ancient History,* ed. I. Edwards et al., 3rd ed., vol. 2 (Cambridge: Cambridge University Press, 1975), 221.
[260] James Muhly, *Copper and Tin: The Distribution of Mineral Resources and the Nature of the Metals Trade in the Bronze Age* (Hamden: Connecticut Academy of Arts and Sciences, 1973), 187 and 214, discusses the lack of copper among major Bronze Age civilizations along the Mediterranean rim.
[261] The major Bronze Age civilizations of the Mediterranean looked to Cyprus for copper according to Muhly, *Copper and Tin,* 192, and H. Catling, *Cyprus and the West, 1600–1050 BC* (UK: University of Sheffield, 1980), 19. Concerning an abundance of wood on Cyprus for smelting copper ore, see G. Constantinou, "Geological Features and Ancient Exploitation of the Cupiferous Sulphide Orebodies of Cyprus," in *Early,* 13, and G. Constantinou, "The Mineral Wealth of Troodos and Its Effect on the Historical Evolution of the Island of Cyprus," *Cyprus Today* 21, no. 3 (1983): 19.
[262] The increase in production of copper at Cyprus for the overseas market is discussed in H. Catling, "The Cypriote Bronze Industry," *Archaeologia Viva* 1, no. 3 (1969): 84, and James Muhly, "The Bronze Age Setting," in *The Coming of the Age of Iron,* ed. Theodore Wertime and James Muhly (New Haven: Yale University Press, 1980), 41 (Cyprus in general). See also P. Dikaios, "Excavations and Historical Background: Enkomi in Cyprus," *Journal of Historical Studies* 1 (1967): 43 (Enkomi); V. Karageorghis, "Kition," *Archaeologia Viva* 1, no. 3 (1969): 113–115; T. Dothan and A. Ben Tor, *Excavations at Athienou, 1971–1972* (Jerusalem: The Israel Museum, 1974) (Athienou); and Joan du Plat Taylor, "A Late Bronze Age Settlement at Apliki, Cyprus," *The Antiquaries Journal* 32, no. 3-4 (1952): 164, https:// 10.1017/S0003581500076800 (extreme northwest of Cyprus).
[263] On the thirteenth century BCE shipwreck, see Cemal Pulak, "The Ulburum Shipwreck: An Overview," *The International Journal of Nautical Archaeology* 27, no. 3 (1998): 193; George Bass, "Splendors of the Bronze Age," *National Geographic* 172, no. 6 (1987): 709, tells of 200 ingots found on the Bronze Age shipwreck; James D. Muhly and Vasiliki Kassianidou, "Parallels and Diversities in the Production and Trade of Copper and Iron in Crete and Cyprus from the Bronze Age to the Iron Age," *British School at Athens Studies* 20 (2012): 129, http://www.jstor.org/stable/23541205.
[264] Constantinou, "Geological Features and Ancient Exploitation of Cupriferous Sulphide Ore Bodies of Cyprus," in *Early,* 22.
[265] T. Wertime, "Mediterranean Pyrotechnology," in *Early,* 355.
[266] Burning cuiferous sulphide ores would produce great amounts of sulfur dioxide according to Richard Beatty, *Copper (Elements)* (Singapore: Marshall Cavendish, 2001), 13.
[267] H. Catling, *Cypriote Bronzework in the Mycenaean World* (Oxford: Clarendon Press, 1964), 77, tells of axes found and their relation to logging.
[268] Regarding the removal of the hardwoods and the use of Calbria pine see Michael Rice Jones, "Oxhide Ingots,

Copper Production, and the Mediterranean Trade in Copper and Other Metals in the Bronze Age" (masters thesis, Texas A&M University, May 2007), https://oaktrust.library.tamu.edu/handle/1969.1/5957; and Vasiliki Kassianidou, Maria Socratous, and Gaetano Di Pasquale, "Ancient Slag Heaps in Cyprus: The Contribution of Charcoal Analysis to the Study of the Ancient Copper Industry" in "Archaeometallurgy in Europe III, Proceedings of the 3rd International Conference, June 29–July 1, 2011," ed. Andreas Hauptman and Diana Modarressi-Tehrani, *Der Anschnitt* 26 (2015): 381.

[269] J. Ekman, "Animal Bones from a Late Bronze Age Settlement at Hala Sultan Tekke, Cyprus," in "Hala Sultan Tekke, Cyprus," ed. P. Astrom et al., *Studies in Mediterranean Archaeology* 45, no. 3 (1976): 169, discusses the change from pig raising to goat and sheep herding.

[270] The movement of alluvium by currents toward Hala Sultan Tekke is discussed in J. Gifford, "Paleography of Ancient Harbour Sites of the Larnaca Lowlands, Southwestern Cyprus," in *Harbour Archaeology: Proceedings of the First International Workshop on Mediterranean Harbours*, ed. Avner Raban (British Archaeological Reports Oxford Ltd, 1985), 45 and 47–48. The resulting sealing off of the city from the sea is covered in V. Karageorghis, "Notes on a Late Cypriote Settlement and Necropolis Site Near the Larnaca Salt Lake," *Report of the Department of Antiquities, Cyprus* (1968): 10–11, and M. Nikolaou and H. Catling, "Composite Anchors in Late Bronze Age Cyprus," *Antiquity* 42, no. 167 (1968): 229, https://doi.org/10.1017/S0003598X00118691. A study discussed in D. Christodoulou, *The Evolution of the Rural Land Use Pattern in Cyprus* (London: University of London, London School of Economics, 1959), 42, demonstrates that deforestation would significantly increase siltation, showing that six times as much soil is lost by erosion from bare lands as from heavily forested areas.

[271] Philip Boyes, "Social Change in 'Phoenicia' in the Late Bronze/Early Iron Age Transition," (PhD diss., Queens College, University of Cambridge, December 2012), 185.

[272] Enkomi's loss of access to the sea is discussed in Catling, *Cypriote Bronzework in the Mycenaean World*, 136, and C. Schaeffer, "Les Peuples de la Mer et Leurs Sanctuaries a Enkomi-Alasia aux XIIe-XIe S. Av. N. E.," *Alasia* 4 (1971), 546.

[273] On the periodic flooding of Enkomi, see Schaeffer, "Les Peuples de la Mer et Leurs Sanctuaries a Enkomi-Alasia aux XIIe-XIe S. Av. N. E.," 530.

[274] David Kaniewski et al., "Environmental Roots of the Late Bronze Age Crisis," *PLoS ONE* 8 (August 14, 2013), https://doi.org/10.1371/journal.pone.0071004.

[275] The adoption of hydro-metallurgy is covered in F. Koucky and A. Steinberg, "Ancient Mining and Mineral Dressing on Cyprus," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 164–176; P. Raber, "The Organization and Development of Early Copper Metallurgy in the Polis Region, Western Cyprus," (PhD diss., Pennsylvania State University, 1984), 222 and 224; and Theodore Wertime and S. Wertime, "Metallurgy," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 135.

[276] On the recycling of bronze, refer to George Bass et al., "Cape Gelidonya: A Bronze Age Shipwreck," *Transactions of the American Philosophical Society* 57, no. 8 (1967): 120, https://doi.org/10.2307/1005978; Porphyrios Dikaios, *Enkomi: Excavations 1948–1958*, vol. 2 (Mainz: Verlag Philipp von Sabern, 1971), 535; J. Lagrace, "La Cachette de Fondeur Aux Epees (Enkomi, 1967) et l'Atelier Vosin," *Alasia* 4 (1971), 415, 465, and 427; and T. Stech-Wheeler, J. Muhly, K. Maxwell-Hyslop, and R. Maddin, "Iron at Taanach and Early Metallurgy in the Eastern Mediterranean," *American Journal of Archaeology* 85, no. 3 (July 1981): 265, https://doi.org/10.2307/504169. Arthur Knapp, *Copper Production and Divine Protection* (Paul Astroms Forlag, 1986), 86–87, suggests that the recycling of bronze "represented an important facet of metal working in the coastal centers of Late Bronze Age Cyprus."

[277] Vasso Karageorghis and Vasiliki Kassianidou, "Metalworking and Recycling in Late Bronze Age Cyprus," *Oxford Journal of Archaeology* 18 (1999): 181.

[278] The date of the closing of the last copper furnace is found in V. Karageorghis (1976), 94.

[279] Concerning the decline in copper production, see G. Bass "Cape Gelidonya: A Bronze Age Shipwreck," 120; Hellbing, "Alasia Problems," 80; and H. Matthaus, "Discussion Following Matthaus," *Early*, 200. Some attribute the decline in copper production on Cyprus to a shortage of tin [J. Walbaum, "From Bronze to Iron," *Studies in Mediterranean Archaeology* 54 (1978): 72] rather than to difficulties in procuring fuel. If tin shortages were the problem, however, copper production would most likely have risen instead of falling. Lacking bronze, states in the eastern Mediterranean would have reverted to copper as their chief metal. Such was the case during the Sargonid Era at Ur when hammered axes of unalloyed copper replaced earlier bronze ones when tin was not available [R. Forbes, *Metallurgy in Antiquity* (Leiden: Brill, 1959), 251]. Perhaps the decrease in copper production could be

attributed to the scarcity of accessible ore. The resumption of full-scale copper mining and smelting in later times [Koucky and Steinberg, "Ancient Mining and Mineral Dressing on Cyprus," 154–155] belies this hypothesis. Disruption of trade routes by pirates, such as raiders from the Near East, has also been blamed for the decline of the Cypriot copper industry. According to this hypothesis, sea lanes were no longer safe for the Cypriots to export copper. Nevertheless, the search for so many ways to save fuel before these raiders ever appeared points to an energy crisis as the main culprit. The ascendancy of iron as civilization's primary metal has also been suggested as the cause for the decline of the copper industry in Cyprus [Taylor, "A Late Bronze Age Settlement at Apliki, Cyprus," 164]. As shall be shown at the end of the chapter, most likely the reverse occurred: fuel problems faced by copper smelters on Cyprus led to experimenting with iron and its subsequent replacement of bronze.

[280] John Rolfe, "Discoveries at Anthedon in 1889," *American Journal of Archaeology* 6, no. 1–2 (1980): 107, https://doi.org/10.2307/496154, and F. Stubbings (1954), "Mycenae 1939–1953: Part VII, A Bronze Founder's Hoard," *BSA* 49 (1954): 296, http://www.jstor.org/stable/30096997, discuss the use of scrap bronze in Mycenaean Greece.

[281] Michael Ventris and John Chadwick, *Documents in Mycenaean Greek* (Cambridge: Cambridge University Press, 1959), 355–356; John Chadwick, "Life in Mycenaean Greece," *Scientific American* 227, no. 4 (1972): 44, http://www.jstor.org/stable/24922889; and Chadwick, *The Mycenaean World*, 140, cover the problem of bronze supply for Messenian smiths.

[282] On the decline in population and settlements, see Catling, *Cypriote Bronzework in the Mycenaean World*, 301, and H. Catling, "The Achaean Settlement of Cyprus," in *Acts of the International Archaeological Symposium: "The Mycenaeans in the Eastern Mediterranean,"* ed. Vassos Karageorghis (Department of Antiquities, Nocosia, 1973), 37.

[283] Kaniewski et al., "Environmental Roots of the Late Bronze Age Crisis," discuss the environmental causes of the decline of Bronze Age Cyprus as well as the rest of the Near East in the 1100s BCE.

[284] The disappearance of Messenia's advanced material culture is discussed in Desborough, "The Greek Mainland, c. 1150 BCE – c. 1000 BCE," 227. William McDonald and Richard Simpson, "Further Exploration in Southwestern Peloponnese," *American Journal of Archaeology* 73, no. 1 (1969): 143, https://doi.org/10.2307/502778, discuss the decline in Messenia's population. The destruction of the palace at Pylos could have occurred at the hands of the local population, who were discontented over their rulers' inability to provide them with basic necessities because of the ecological problems discussed in Chapter 4.

[285] Wertime, "Mediterranean Pyrotechnology," in *Early*, 358–359, argues the case for the energy crisis on Cyprus as the initial stimulus to working in iron.

[286] It takes twice as much charcoal to make an equivalent amount of copper than iron according to Lee Horne "Fuel for the Metal Worker: The Role of Charcoal and Charcoal Production in Ancient Metallurgy," *Expedition* 25 (1982): 12.

[287] C. Schaeffer, "Discussion Following Dr. Desborough's Paper," *Acts of the International Archaeological Symposium: "The Mycenaeans in the Eastern Mediterranean,"* ed. Vassos Karageorghis (Department of Antiquities, Nocosia, 1973), 337, discusses the high iron content in the slag heaps. T. Wertime, "The Pyrotechnologic Background," in *The Coming of the Age of Iron*, ed. T. Wertime and J. Muhly (New Haven: Yale University Press, 1980), 15, describes the manual extraction of iron from the copper slag. A. Snodgrass, "Iron and Early Metallurgy in the Mediterranean," in *The Coming of the Age of Iron*, ed. T. Wertime and J. Muhly (New Haven: Yale University Press, 1980), 344–345, confirms that the production of iron materials began in Cyprus at the end of the Late Bronze Age.

[288] Odysseus's boast about working with his hands appears in Homer, *Odyssey* 15.320; his skill in splitting kindling can be found in ibid., 321–323; and his ability as a shipwright appears in ibid., 5.234–237.

[289] Homer, *Iliad* 16.634, portrays the crashing of felled timber; the cicadas are mentioned in ibid., 3.152–153; and mention of mules dragging timber can be found in ibid., 17.742–744.

[290] On the rapid expansion of Greek society in Asia Minor and the corresponding development of industries, see David Magie, *Roman Rule in Asia Minor* (Princeton: Princeton University Press, 1950), 54.

[291] Xenophon, *Hellenica* 3.2.17; Herodotus 6.28, and Strabo 13.4.5, discuss the cultivation of wheat in these three river basins of southwest Anatolia.

[292] Strabo 12.8.7, describes the crumbly earth along the riverbanks.

[293] Concerning plowing and erosion, see Pausanias 8.24.11.

[294] The Strabo quote appears in Strabo 12.8.19.

[295] On the port of Myus and its subsequent transformation into a landlocked town, see Peter Levi, *Pausanias' Guide*

to Greece (1971), 232, no. 10; George Bean, *Aegean Turkey* (London: Ernest Benn Ltd, 1966), 245; Pausanias 7.2.11; and Strabo 14.1.10.

[296] The change of Priene from a coastal town to an inland city is discussed in Levi, *Pausanias' Guide to Greece*, 232, no. 11, and Pausanias 8.24.11. To point out to his readers the role humans played in changing the topography of their world, Pausanias presented a converse situation to the development of the Maeander basin. He used Aetolia, a region in western Greece just north of the Peloponnese, as his example. Aetolia had been deserted for a number of years. The Aetolians, Pausanias explained, "have been driven out" of their territory by Roman policy and "the whole country has been turned into a wilderness. Hence, Aetolia remaining untilled, the Achelous [the river which flows through Aetolia] does not wash down so much mud on the Echinadian islands [directly opposite the Achelous's mouth]." For this reason, Pausanias concluded, "The Echinadian islands have not yet been joined to the mainland" [Pausanias 8.24.11].

[297] On the acceleration of the silting of the lower Cayster River basin after 700 BCE, see S. Erinc, "Changes in the Physical Environment of Turkey since the End of the Last Glacial," in *The Environmental History of the Near and Middle East Since the Last Ice Age*, ed. William Brice (Academic Press, 1978), 102.

[298] Magie, *Roman Rule in Asia Minor*, 75, discusses the exploitation of the Cayster River basin by the Ephesians.

[299] The silting of Ephesus and attempts at remedial action appear in Strabo 12.8.15, and Bean, *Aegean Turkey*, 164.

[300] Concerning the dates for the development of Ephesus, see P. Ure, "The Outer Greek World in the Sixth Century," in *The Cambridge Ancient* History, vol. 4, ed. J. Bury et al. (Cambridge: Cambridge University Press, 1977), 93–94.

[301] G. Griffith, "Pergamon," in *The Oxford Classical Dictionary*, ed. N. Hammond and H. Scullard (Oxford: Clarendon Press, 1970), 799–800, writes on the development of Pergamon.

[302] Esther Hansen, *The Attalids of Pergamon* (Ithaca: Cornell University Press, 1971), 215, describes the pottery works on the slopes through which the Cetius River flowed.

[303] Pausanias 7.2.1, describes the transformation of Atarneus into swampland.

[304] The two quotes honoring work come from Hesiod, *Works and Days*, 312 and 412–413.

[305] Hesiod's advice to his brother appears in ibid., 406 and 407–408.

[306] On building a wagon, and barn and house, see ibid., 455–456 and 807, respectively; the making of iron in mountain glens is described in Hesiod, *Theogony*, 865–866. Hesiod, *Works and Days*, 423–434, lists what his brother should make from the timber he cut.

[307] Pausanias 5.20.3, quotes the inscription on the bronze tablet in front of the pillar.

[308] Concerning the terra-cotta model, see D. Robertson, *Greek and Roman Architecture* (Cambridge: Cambridge University Press, 1969), 54.

[309] On Plato's remark about local wood providing beams for huge buildings, see Plato, *Critias* 111.

[310] U. von Wilamowitz-Moellendorff and B. Niese, *Staat und Gesellschaft der Griechen und Römer* (B.G. Teubner, 1910), 118, discuss Solon issuing bounties on wolf kills.

[311] On Persian control of the major timber areas of Greece and Asia Minor, see Herodotus 5.2, 13, and 17. Evidence of the loyalty of northern Greece to Persia is also found in Herodotus 7.185, which states that the Greeks of Thrace contributed 120 ships to Xerxes's forces, and that both Thrace and Macedonia supplied the Persian monarch with soldiers.

[312] Ibid., 5.18–19 and 22, demonstrates Macedonian subservience to Persia.

[313] Ibid., 5.23, reports on Darius's gift to Histiaeus of a portion of the Strymon valley and the retraction of the gift.

[314] On Gelon's equivocal stance, see ibid., 7.168.84. Thucydides 2.62.2 preserves Pericles's boast.

[315] The wood-built wall quote is found in Herodotus 7.141.

[316] Themistocles's interpretation can be found in Herodotus 7.142.

[317] Plutarch's quote can be found in Plutarch, *Themistocles* 4.1–3. And Aeschylus's description of the silver mines comes from Aeschylus, *The Persians*, 238.

[318] The quote about the one hundred ships is from Plutarch, *Themistocles* 4.4–5.

[319] Regarding the flight of Xerxes, see Plutarch, *Themistocles* 4.4.

[320] Peter Green's conclusion is from Peter Green, *Xerxes at Salamis* (New York: Praeger, 1970), 198.

[321] The quote about turning Athenians into seafarers is in Plutarch, *Themistocles* 4.4.

[322] Xenophon, *The Polity of the Athenians* 2.11 discusses the advantage of controlling the sea.

[323] Herodotus 9.13, provides the description of the burning of Athens.

[324] Vitruvius, *On Architecture* 4.2 argues that stone columns are copies of their wooden predecessors.

[325] Aristotle, *Athenian Constitution* 22.7 gives the date the Laurion miners struck the rich vein of silver.

[326] The "Pluto" quote comes from Strabo 3.2.9.
[327] Aristotle, *Athenian Constitution* 22.7 confirms that the silver extracted at Laurion paid for the Athenian fleet.
[328] Aristophanes's description of the Acharnians is found in Aristophanes, *Acharnians,* 180–181.
[329] Thucydides 2.14 tells of the rural refugees taking all the woodwork of their houses to Athens.
[330] Rodney Young, "An Industrial District of Ancient Athens," *Hesperia: The Journal of the American School of Classical Studies at Athens* 20, no. 3 (1951): 227, https://doi.org/10.2307/146745, describes two middle-fifth century BCE Athenian houses designed to capture solar heat.
[331] Xenophon, *Memorabilia* 3.8.8–10 quotes Socrates on the advantages of designing a house to use solar energy.
[332] On the colonization of Amphipolis, see Thucydides 1.100.
[333] Diodorus 12.32 reports on the Corinthians and Corcyrans procuring timber to build their fleets.
[334] Thucydides 1.23 tells of the bloodshed and destruction brought on by the Peloponnesian War.
[335] The boast of Pericles is quoted in Diodorus 12.40.
[336] The Theban quip can be found in Plutarch, *Moralia* 193e.
[337] Diodorus 12.45, reports that the Spartans cut down all the trees in Attica. Lysias, *On the Olive Stump* 7.6–7 confirms this.
[338] On Attica's lower-lying lands turning into swamps, see Diodorus 12.58.
[339] Thucydides 2.54 tells of the dual catastrophes brought about by the Spartan invasion of Attica.
[340] Ibid., 3.98 tells of the Aetolians setting fire to a forest in which retreating Athenians hid.
[341] The building of stockades around Megara is reported in ibid., 4.69.
[342] Ibid., 2.75 describes the siege of Plataea, and ibid., 2.77, tells of the Spartans' attempt to burn it.
[343] Ibid., 4.108 tells of the loss of Amphipolis and the Athenian reaction to the loss.
[344] Perdiccas's collusion with the Spartans is described in ibid., 4.82.
[345] On Brasidias's actions at Amphipolis, see ibid., 4.108.
[346] The quotes on peace and reconciliation appear in Aristophanes, *Peace,* 600–601, 867, and 999.
[347] On the solar design of the Dema house, see J. Jones, L. Sackett, and A. Graham, "The Dema House in Attica," *BSA* 57 (1962): 103–104, http://www.jstor.org/stable/30104501.
[348] J. Jones, A. Graham, L. Sackett, and M. Ioannes Geroulanos, "An Attic Country House Below the Cave of Pan at Vari," *BSA* 68 (1973): 418–420, http://www.jstor.org/stable/30103283, discuss the solar house built transversely on the spine of a mountain.
[349] Alcibiades's "Empire" quote is found in Thucydides 6.18; his quote on procuring timber from Italy is found in ibid., 6.90.
[350] On the Athenians' commitment to finding new sources of timber, see ibid., 8.1.
[351] Perdiccas's agreement with the Athenians is found in N. Hammond and G. Griffith, *A History of Macedonia, II* (Oxford: Clarendon Press, 1979), 139. Archelaus's relations with the Athenians is discussed in ibid., 138–139.
[352] Pharnabazus is quoted in Xenophon, *Hellenica* 1.1.25.
[353] The quote "without ships … " is found in ibid., 2.2.10.
[354] von Wiamowitz-Moellendorff and Niese, *Staat und Gesellschaft der Griechen und Römer,* 118, quote Menander on the rarity of rabbits.
[355] The son of Tesias is quoted in Demosthenes, *Against Callicles,* 10–11.
[356] The quote about crops only returning the sown seed is from Menander, *Farmer,* Fragment 96.
[357] Archilochos's description of Thasos is found in Archilochus, *Fragments* 21.
[358] On the role of timber in Aristotle's ideal state, see Aristotle, *Politics* 7.1327a.
[359] Plato's idealistic representation of Attica comes from Plato, *Critias* 111. Like Aristotle, Plato, too, recognized the importance for a state to be well stocked with timber. His Utopian country of Atlantis had "in abundance all the timber that forest provides for the labors of carpenters" (ibid., 114e). Timber was so crucial to the well-being of Atlantis that the rulers built canals "to convey to the city the timber from the mountains" (ibid., 118d–e).
[360] Plato's observation about the wooded land can be found in *Critias*, III c–d, in John Pairman Brown, *The Lebanon and Phoenicia,* 141.
[361] Regarding the water table in Athens dropping, see Patrik Klingborg, *Greek Cisterns: Water and Risk in Ancient Greece, 600–50 BC* (Uppsala: Uppsala Universitet, 2017), 130–131.
[362] On the building of reservoirs in Athens, see Aristotle, *Politics* 7.11.
[363] The capacity of reservoirs, or cisterns, is discussed in David M. Robinson and J. Walter Graham, *Excavations at Olynthus, Part VIII* (Baltimore: Johns Hopkins Press, 1938), 308; and Theodore Wertime, "Cypriote Metallurgy against the Backdrop of the Mediterranean Pyrotechnology: Energy Reconsidered," in *Early*, 356.

[364] On lime-derived plaster being used to line reservoirs, see David Robinson (1930), *Excavations at Olynthus: Part II, Architecture and Sculpture* (Baltimore: Johns Hopkins Press, 1930), 102; and Theodore Wertime, "Cypriote Metallurgy against the Backdrop of the Mediterranean Pyrotechnology: Energy Reconsidered," 356.
[365] Marcus Cato's advice regarding the operation of his lime kiln is found in Cato the Elder, *On Agriculture* 38.
[366] The amount of wood required to fire one kiln is discussed in Theodore Wertime, "Cypriote Metallurgy against the Backdrop of the Mediterranean Pyrotechnology: Energy Reconsidered," 355.
[367] Xenophon's recommendations to farmers are discussed in Xenophon, *Economics* 17.10.
[368] Demosthenes, *Against Callicles* 11 quotes the son of Tesias on his father's retaining wall.
[369] Aristotle's quote on solar energy is from Aristotle, *Economics* 1.6.7.
[370] On the solar design of Priene and its houses see Theodor Wiegand and Hans Schrader, "Die Privathäuser," in *Priene* (Berlin: Reimer, 1904); Joseph Chamonard, "Le Quartier du Theatre: Etude sur l'Habitation Delienne a l'Epoque Hellenistique," 8.1, in *Exploration Archéologique de Délos*, École Française d'Athènes (1922–1924), discusses the use of passive solar design in the architecture of fourth-century BCE Delos.
[371] On the movement of furnaces to coastal locations and the probable reason for the move, see C. Conophagos, "Une Methode Ignoree de Coupellation du Plomb Argentifere Utilisee par les Grecs Anciens," *Annales Geologiques des Pays Helleniques* 11 (1960): 144, and C. Conophagos, "Smelting Practices at Ancient Laurion," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 183.
[372] Concerning the change in smelting techniques at Laurion, see Conophagos, "Smelting Practices at Ancient Laurion," 188.
[373] Regarding metallurgists making the change from charcoal to coal, see Theophrastus, *On Stones* 16.
[374] Theophrastus, *On Stones* 16.
[375] The quote from Aristotle comes from Aristotle, *Politics* 6.8.6.
[376] Lysias's case is reported in Lysias 7.
[377] On the decrees passed in Chios, see B. Haussoullier, "Inscriptions de Chios," *Bulletin de Correspondance Hellenique* 3 (1879): 253; André Plassart and Charles Picard (1913), "Inscriptions d'Eolide et d'Ionie," *Bulletin de Correspondance Hellenique* 37 (1913): 210, https://doi.org/10.3406/bch.1913.3133; and A. Wilhelm, "Die Pacturkunden der Klytiden," *Jahreshefte des Österreichischen Archäolgischen lnstituts in Wien* 28 (1933–1935): 207–210.
[378] E. Schulhof and P. Huvelin, "Loi Reglant la Vente du Bois et du Charbon a Delos," *Bulletin de Correspondance Hellenique* 31 (1907): 50, 60, and 64, reproduce the regulation of the sale of wood and charcoal at Delos.
[379] The decree from Kos can be found in Borimir Jordan and John Perlin, "On the Protection of Sacred Groves," *Greek, Roman, and Byzantine Monographs*, no. 10, ed. Kent Rigsby (Durham: Duke University, 1984), 155.
[380] Concerning the average wage of an Athenian working man in Classical Greece, see D. Young, *The Olympic Myth of Greek Amateur Athletics* (Chicago: Ares, 1984), 117.
[381] Jordan and Perlin, "On the Protection of Sacred Groves," 156, quote Philstos.
[382] Concerning regulations of the sacred groves at Sounion, see D. Birge, "Sacred Groves in the Ancient Greek World" (PhD diss., University of California, Berkeley, 1982), 573–574.
[383] On restrictions at the sacred grove by the port of Athens, consult Jordan and Perlin, "On the Protection of Sacred Groves," 157.
[384] Birge, "Sacred Groves in the Ancient Greek World," 341, discusses the dual protection by both religious and secular groups of another sacred grove in Attica.
[385] To arrive at the figure of more than 24 million pines or over 52 million oaks consumed in producing silver at Laurion, the following assumptions have been made: (1) 2,700,000 tons of slag were produced by silver miners at Laurion from 650 BCE to 100 BCE [C. Patterson, "Silver Stocks and Losses in Ancient and Medieval Times," *Economic History Review* 25, no. 2 (1972): 223 and 231]; (2) To produce 1 ton of silver slag, 450 kilograms of charcoal are required [L. Salkield, "The Roman and Pre-Roman Slags at Rio Tinto, Spain," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 145]; (3) Ancient charcoal kilns required 16 tons of wood to produce 1 ton of charcoal [Constantinou, "Geological Features and Ancient Exploitation of the Cupiferous Sulphide Orebodies of Cyprus," in *Early*, 22]; (4) One pine tree yields 800 kilograms of wood [ibid., 22]; (5) One oak tree yields 375 kilograms of wood [L. Salkield, "Ancient Slag in the South West of the Iberian Peninsula," *La Minería Hispana e Ibero-Americana* 1 (1970): 94]. Theodore Wertime and S. Wertime, "Metallurgy," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 135, estimate that possibly more than 2,000 square

miles of forest were consumed to produce silver at Laurion. Two thousand square miles translates into almost twice the area of Attica!

[386] On the time periods of greatest activity at Laurion, see M. Crosby, "The Leases of the Laureion Mines," *Hesperia: The Journal of the American School of Classical Studies at Athens* 19 (1950): 190.

[387] The "timber yard" quote appears in Xenophon, *Hellenica* 6.1.11.

[388] The agreement between Amyntas and the Chalcidian League is in *Supplementum Epigraphicum Graecum,* 135.

[389] Diodorus, 1492, tells of Amyntas fleeing from Macedonia.

[390] The warning to the Spartans appears in Xenophon, *Hellenica* 5.2.16–22.

[391] The description of Jason by himself and by a contemporary can be found in ibid., 6.1.7 and 6.1.4.

[392] Aeschines, *On the Embassy* 27–28, discusses the choosing of Iphicrates.

[393] Demosthenes is quoted in Demosthenes, *On the Treaty with Alexander* 28.

[394] Concerning the price of a single log, see W. Dittenberger, ed., *Sylloge Inscriptionum Graecaium,* vol. 1 (Leipzig: Apud S. Hirzelium, 1915), footnote no. 2 to 248 K2. On the wage of a master mason at the beginning of the fourth century BCE, consult Young, *The Olympic Myth of Greek Amateur Athletics*, 118, no. 14.

[395] On Phaenippus's wealth from wood sales see Demosthenes, *Against Phaenippus* 7.

[396] The charge that Phaenippus sold cut timber for over 3,000 drachmas appears in ibid., 30.

[397] The charge against Medias is found in Demosthenes, *Against Medias,* 167–168.

[398] Demosthenes's charges of timber bribes to Lasthenes and to Athenian envoys appear in Demosthenes, *On the False Embassy,* 114 and 145.

[399] On timber from Macedonia becoming the most notorious bribe, see Theophrastus, *Characters,* no. 23.

[400] The Roman proscriptions on the Macedonians are found in Titus Livius (Livy), *The History of Rome* 45.29.14.

[401] On Italy being one of the few spots in southern Europe that still had accessible timber for shipbuilding, see Theophrastus 4.5.5.

[402] Ibid., 5.8.1, reports fir and silver fir growing near Rome.

[403] Dion. 3.43.1, and Pliny 16.37, give the names of various precincts in Rome that denote former stands of timber.

[404] Livy 1.33.9, reports that forests once grew on the hills and mountains above Rome.

[405] Theophrastus's report is found in Theophrastus 5.8.3.

[406] On the forests near Antium, see Livy 3.22.9.

[407] Zonaras 8.1, in Dio Cassius, *Roman History* 8, explains why the Greeks named the forest the "Avernian" woods.

[408] The account of the Ciminian forest is from Livy 9.36.1, 14, and 5–7.

[409] Virgil's quote is found in Virgil, *Aeneid* 6.763–765.

[410] Concerning the mother of Rome's legendary founder, see Livy 1, 3, and 4.

[411] Juvenal's quote appears in Juvenal, *Satires* 15.152.

[412] Camillus is quoted in Livy 5.53.9.

[413] Ovid writes about oaks providing both food and shelter in Ovid, *The Art of Love* 2.621–623.

[414] Ibid., 3.117–119 describes the first Senate house.

[415] On shingles, see Pliny 16.36.

[416] Juvenal, *Satires* 11.117 tells of locally built furniture.

[417] Theophrastus 5.8.1 and 3 tells of beech and fir exported for shipbuilding.

[418] Livy 5.55.3 reports on the rebuilding of Rome after its sack by the Gauls.

[419] Dion. 3.43.1 recounts that houses and buildings covered the hills where trees had stood.

[420] The settlement of the well-forested seacoast of Rome is reported by Livy 1339.

[421] M. Cary and H. Scullard, *A History of Rome* (London: Palgrave Macmillan, 1979), 187, discuss extensive ranching. Arnold Toynbee, *Hannibal's Legacy* (Oxford: Oxford University Press, 1965), 309, writes about the practice of intensive agriculture.

[422] Pliny is quoted in Pliny 17.40.

[423] Horace, *Epistles* 2.2.183–186, and Virgil, *Georgics* 2.207–211, record the taming of the woodland.

[424] The Lucretius quote is found in Lucretius, *De Rerum Natura* 1367–1370.

[425] Virgil's comment on the fate of local birds comes from Virgil, *Georgics* 2.209–210.

[426] The complaint of a lady of ill repute is in Plautus, *Truculentus* 904–905.

[427] Cato the Elder's recommendations to farmers near Rome appear in Cato the Elder, *On Agriculture* 7.

[428] Cicero's "rake" quote is in Cicero, *The Three Speeches on the Agrarian Law Against Rullus* 2.48.

[429] Cicero's feelings about the loss of forests appear in ibid., 1.3.

[430] On the Romans obtaining timber from Liguria for shipbuilding, see Strabo, 4.6.2.

[431] Livy, 10. 24. 5, writes of the opening of the Ciminian forest to Roman exploitation.
[432] On the exploitation of the forests of Umbria, see Strabo 5. 3. 7.
[433] Ibid., 5.2.5, writes about the conquest of Etruria and the exploitation of its forests.
[434] On the forests of the Po valley providing feed for pigs and much pitch, see ibid., 5.1.12.
[435] Plutarch, *Moralia,* p. 676, discusses the use of pitch in shipbuilding.
[436] Dioscorides, *Physicus* 1.94, tells of using pitch for medicinal purposes.
[437] On the Po valley developing into the most affluent province in Italy, see Strabo 5.1.12.
[438] On the danger presented by the Gauls in the Po valley, see Livy 21.25.
[439] Concerning forests outside of Italy, see Caesar 5.12 (Gaul and England); Strabo 4.5.2 (England); Dio Cassius 37.47.4 (south of France); Tacitus, *Germania* 5 (Germany); and Lucan 9.426 (North Africa).
[440] Descriptions of the Hercynian Forest appear in Pliny 16.6, and Caesar 6.25.
[441] Concerning unicorns inhabiting the Hercynia forest, see Caesar 6.26.
[442] Pliny 5.6–7 writes about the mystery and wonderment of North African forests.
[443] Roman attitudes toward the people in the wilderness are found in *Epist.* 90.9, and Tacitus, *Germania* 16 (Germans). See also Dio Cassius 39.44.2 (Morini and Menapi), and Lucan 9.427–428 (North Africans).
[444] Cassivelíanus's tactics are discussed in Caesar 5.19.
[445] Ibid., 3.28, describes Caesar's destruction of the woods to evict the enemy.
[446] On the life-style of Caligula, see Suetonius 4.36–37.
[447] Seneca's auditory description of the baths is in *Epist.* 56.1–2.
[448] Seneca's comments on the heat of bathwater is in ibid., 86.10.
[449] R. Forbes, *Studies in Ancient Technology,* vol. 6 (Leiden: Brill, 1958), 50, tells of the Romans using whole trunks of trees to fuel the baths.
[450] Bathing in early times is described in *Epist.* 86.9–10.112. Pliny 36.122 provides the data on the increase of baths over time.
[451] On the number of baths at Laurentum, see Elmer Merrill, *Selected Letters of the Younger Pliny* (London: Macmillan, 1914), 260.
[452] The experiment appears in T. Rook, "The Development and Operation of Roman Hypocausted Baths," *Journal of Archaeological Science* 5, no. 3 (September 1978): 281.
[453] Frontino, *De Controversis Agrorum* 2.55, reports on the reservation of forests so as to guarantee fuel for bathing establishments.
[454] On the newness of window glass, see *Epist.* 90.25.
[455] Seneca's jest appears in Seneca, *On Providence* 4.9–10.
[456] Martial's complaint to his patron is found in Martial 8.14.
[457] On the discovery of glassblowing, see J. Morin-Jean, *La Verre en Gaule Sous L'Empire Roman* (Paris, 1977), 13.
[458] Strabo's quote on Roman manufacturing appears in Strabo 16.2.25.
[459] The mass appeal of glass vessels is reported in Pliny 36.199.
[460] Ibid., 36.194, pinpoints the location of glassworks.
[461] Pliny's description of glass manufacturing is in ibid., 36.68.
[462] Strabo's discussion of wealthy Romans' lavish building practices is found in Strabo 5.2.5.
[463] Ibid., 5.3.7, talks about the fickleness of Roman building tastes.
[464] M. Ruggiero, *Studi sopra gli edifizi e le arte meccaniche dei pompeiani* (Naples, 1872), 9–11, shows the large amounts of wood used by Roman house builders.
[465] *Epist.* 90 9, and Juvenal 3.255–257, write about the nuisance and the danger caused by log haulers.
[466] Tacitus, *Annals* 4.62, and Pliny 16.86, no. 91 (Loeb Classical Library), tell of amphitheaters built of wood.
[467] The quote describing Caligula's villa is from Suetonius 4.37.
[468] Ibid., 6.21, also describes Nero's spherical ceiling.
[469] *Epist.* 90.9 writes about the use of large timbers for the roofs of banquet halls such as Nero's.
[470] F. Kretschmer, "Der Betriebsversuch an einem Hypokaustum der Saaburg," *Germania* 31 (1953): 15, notes that the furnaces of Roman central heating systems consume large pieces of wood.
[471] Calculations on the amount of wood consumed to heat a Roman villa are presented by Forbes, *Studies in Ancient Technology,* vol. 6, 56.
[472] On the size of trees burned by lime kilns, see Brian Dix, "The Manufacture of Lime and Its Uses in the Western Roman Provinces," *Oxford Journal of Archaeology* 1, no. 3 (November 1982): 337.
[473] Walter Solter, *Römische Kalkbrenner im Rheinland* (Düsseldorf: Rheinland Verlag, 1970), 20, reports on the

quantity of wood consumed in one day by a lime kiln.
[474] Seneca's observation appears in Seneca, *To Helvia* 10.1 and 5.
[475] Strabo 537 writes about woodsmen floating logs down the various tributaries of the Tiber.
[476] Diodorus 5.39 comments on how busy Ligurian lumberjacks were.
[477] The reason for the vicinity of Pisa losing most of its timbers is found in Strabo 5.2.5.
[478] Pliny 36.121 gives the number of water storage basins and reservoirs built by Augustus.
[479] Ibid., 35.52–53 and 173–174, and 35.159, lists the materials used to construct Rome's water system.
[480] On the bronze foundries at Capua, see Pliny 34.95.
[481] Ibid., 34.138, writes on the many uses of iron.
[482] Ibid., 33.94, tells that pine was the favorite fuel of the ironmasters.
[483] The description of melting the ore on Elba can be found in Diodorus V.13.
[484] Elba's Greek name appears in Diodorus 5.13.
[485] Strabo's account of iron being brought to Populonia is found in Strabo 5.2.6.
[486] To arrive at the figure of about 45 million pine trees consumed by producing iron at Populonia, the following assumptions have been made: (1) 500,000 tons of iron were produced at Populonia [Theodore Wertime and S. Wertime, "Metallurgy," in *Early Pyrotechnology*, ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 135]; (2) 4100 kilograms of charcoal are needed to produce 907 kilograms of iron [R. Forbes, *Studies in Ancient Technology* 9 (Leiden: Brill, 1972), 202]; (3) Ancient charcoal kilns required 16 tons of wood to produce 1 ton of charcoal [Constantinou, "Geological Features and Ancient Exploitation of the Cupiferous Sulphide Orebodies of Cyprus," in *Early*, 22]; (4) One pine tree yields 800 kilograms of wood [ibid., 22]. Wertime and Wertime, "Metallurgy," 135, estimate that about 1 million acres of forest were consumed by the iron furnaces at Populonia.
[487] Helen Loane, *Industry and Commerce in the City of Rome* (Baltimore: Johns Hopkins Press, 1938) 24, estimates the amount of olive oil consumed.
[488] Pliny 15.10–11 discusses the use of fire by olive oil producers.
[489] On the building boom in Rome, see H. Bloch, *I Bolli Laterizi e la Storia Edilizia Romana* (Rome: L'Erma di Bretschneider, 1947), 12.
[490] Eugene Ayres and Charles Scarlott, *Energy Sources* (New York: McGraw Hill, 1952), 9, estimate the quantity of wood required to produce brick.
[491] On "lowland fir," see Vitruvius 2.10.1–2; compare it to the quote by Pliny in Pliny 16.41–42.
[492] On the Etruscans building ships from timber growing near Pisa, see Strabo 5.2.5; its replacement by vines and wheatfields is reported in Pliny 14.39, 18.86, and 18.109.
[493] Livy's allusion to the thinning of the Ciminian forest is found in Livy 9.36.1.
[494] Livy's quote on a giant forest near Modena is from ibid., 33.24.7.
[495] Strabo 5.4.5 tells of Agrippa's destruction of the Avernian woods.
[496] On wood shortages in Italy, see Pliny 34.96.
[497] Ibid., tells of the substitution of charcoal for wood by bronze founders.
[498] Martial 1.41 and Statius, *Silvae* 1.6.65–75, tell of glass recycling; Pliny 36.199 tells how glass recycling saves fuel.
[499] Saving fuel in cooking by adding wild fig stalks is discussed in Pliny 23.12.
[500] Ruggiero, *Studi sopra gli edifizi e le arte meccaniche dei pompeiani*, 28, describes the change from unitary beam supports to the use of sections of wood joined together by cement at Pompeii.
[501] Pliny 17.28 tells of the substitution of wood by wheat stalks in the Campania region.
[502] Hadrian's protection of the cedars of Lebanon is told by John Pairman Brown, *The Lebanon and Phoenicia*, 152–154.
[503] Varro's quote comes from Varro, *On Agriculture* 1.13.
[504] Vitruvius is quoted in Vitruvius 6.1.1.
[505] On the proper siting of baths, see ibid., 5.10.1 and 6.4.1.
[506] Columella 1.6.18 recommends a southern exposure for the location of oil presses and storage areas. Pliny the Younger writes about the orientation of his summer house in Pliny the Younger, *Letters* 5.6; ibid., 2.17, describes his winter villa's ability to take advantage of solar heat. The percentage of bathhouses in England oriented to the south or west is found in Rook, "The Development and Operation of Roman Hypocausted Baths," 272.
[507] On the central baths at Pompeii, see August Mau, *Pompeii: Its Life and Art* (New York, London: Macmillan, 1902), 208–211.

[508] Dr. James Ring's discussion of the effectiveness of Roman solar endeavors is found in James W. Ring, "Windows, Baths, and Solar Energy in the Roman Empire," *American Journal of Archaeology* 100, no. 4 (October 1996): 722.
[509] Concerning the willow's many uses, see Pliny, 17.143 and 16.174.
[510] Pliny's suggestion for cultivating a grove of cypresses appears in ibid., 16.141.
[511] Vitruvius's observation on forests and snow is found in Vitruvius 8.1.6–7.
[512] Regarding the relationship of deforested hills and torrents, see Pliny 31.53.
[513] Strabo 5.3.5 tells of the silting of the mouth of the Tiber and the problems it created.
[514] Cary and Scullard, *A History of Rome*, 364–365, discuss Claudius's attempt to provide Rome with a deep-water port.
[515] The silting of the deep-water port is reported by N. Flemming, *Archaeological Evidence for Eustatic Change of Sea Level and Earth Movements in the Western Mediterranean During the Last 2,000 Years*, Geological Society of America, Special Paper 109 (Boulder, 1969): 33.
[516] John Bradford, *Ancient Landscapes* (London: George Bell & Sons, 1957), 255–256, discusses moving Rome's port to Civitavecchia.
[517] The quote about woods providing inspiration comes from Quintilian 10.3.32.
[518] Seneca's quote on ancient forests as proof of the presence of God is found in *Epist.* 41.3.
[519] Martial's threat to Priapus is from Martial 8.40.
[520] On the prosperity of Etrurian potters, see David Reece, "The Technological Weakness of the Ancient World," *Greece and Rome* 16, no. 1 (1969): 45, https://doi.org/10.1017/S0017383500016314.
[521] Ibid., 46, and Gilbert Charles-Pickard, *La Civilisation de L'Afriaue Romaine* (Paris: Plon, 1959) 78, discuss the decline of the Etrurian ceramics industry while workshops in southern France flourished.
[522] Morin-Jean, *La Verre en Gaule Sous L'Empire Roman*, 13, writes about the decline of Italian glassworks and the simultaneous rise of the industry in southern France.
[523] On the Roman takeover of Gallic iron mining and smelting, see J. Monot, "Quelques Gisements des Scories Antiques des Environs d'Avallon," *Revue Archéologique de l'Est et du Centre-Est* 15 (1963): 265.
[524] Concerning the obsession for tables made from sandarac wood, see Pliny 13.92 and 100, and Dio Cassius 61.10.3 (Seneca's proclivity for such tables).
[525] Diodorus 5.35–38 gives detailed coverage on silver mining in Iberia.
[526] On the importance of the Iberian silver mines and the Roman treasury, see G. Jones, "The Roman Mines at Riotinto," *Journal of Roman Studies* 70 (1980): 161, https://doi.org/10.2307/299560.
[527] On the treatment of slaves by the silver miners, see Diodorus 5.35–38.
[528] Strabo 3.2.8 describes the tall chimneys used in silver smelting.
[529] Salkield, "Ancient Slag in the South West of the Iberian Peninsula," 94, identifies the type of tree burned in the Spanish silver smelting furnaces.
[530] Theophrastus 5.8.1 discusses the conservation policies of Cypriot rulers.
[531] The regeneration of large stands of pine on Cyprus because of such conservation policies is told by ibid., 5.7.3.
[532] J. Bruce, "Antiquities in the Mines of Cyprus," in *The Swedish Cyprus Expedition*, ed. E. Gjerstad et al. (Stockholm: V. Peterson, 1973), vol. 3, appendix 5, 650, tells of Roman mine props made of pine.
[533] Pliny 33.94 asserts that pine was the preferred fuel in copper smelting.
[534] The amount of slag found on Cyprus is given by Hans-Gert Bachmann, "Reviews of Papers on Archaeo-metallurgical Topics," in *Early*, 378.
[535] Ibid., 378.
[536] The changes in the landscape of the Roman world are noted in Tertullian, *De Anima* 30.3.
[537] On the French metallurgists cutting back on their fuel use, see Pliny 34.96.
[538] The move of glassworkers to Belgium and Germany is discussed in Reece, "The Technological Weakness of the Ancient World," 46, and Clasina Isings, *Roman Glass from Dated Finds* (Groningen: J.B. Wolters, 1957), 11–12.
[539] Morin-Jean, *La Verre en Gaule Sous L'Empire Roman*, 27, tells of the abandonment of southern France by glass makers.
[540] Monot, "Quelques Gisements des Scories Antiques des Environs d'Avallon," 265, writes about the decline in iron production in southern France.
[541] The move northward by ironmasters to the Jura Mountains is told in P. Pelet, "Une industrie du fer primitive au pied du Jura vaudois: la ferreière de Prins-Bois et ses voisines," *Revue Historique Vaudoise* (1960): 100.
[542] On later fuel problems of ironmasters in the Jura Mountains, see P. Pelet, *Fer, Charbon, Acier dans le Pays de*

Vaud (1973), 185.

[543] Henry Cleere, "Ironmaking in a Roman Furnace," *Britannia* 2 (1971): 206, https://doi.org/10.2307/525810, discusses the migration of the Anglo-Roman iron industry and its eventual demise.

[544] Henry Cleere, "Ironmaking," in *Roman Crafts*, ed. Donald Strong and David Brown (New York: New York University Press, 1976), 245, estimates the amount of forest destroyed by the Anglo-Roman iron industry.

[545] The conversion of smelting operations to the production of salts of copper is discussed in F. Koucky and A. Steinberg, "Ancient Mining and Mineral Dressing in Cyprus," in *Early Pyrotechnology,* ed. Theodore Wertime and S. Wertime (Washington, D.C.: Smithsonian Institution, 1982), 154.

[546] The use of copper vitrol as a broad-spectrum medicine is discussed in Pliny 34.113–115.

[547] Lucan 9.429 and Pliny 5.12 write about the Roman destruction of North African forests.

[548] Pliny 13.95 testifies to the extinction of the most valued type of sandarac tree.

[549] J. Tixeront, "Conditions Historiques de l'Erosion en Tunisie," *International Association of Scientific Hydrology: Assemble Generate, Proces Verbaux* 2 (1951), 78, describes the earthen levees and dams.

[550] Patterson, "Silver Stocks and Losses in Ancient and Medieval Times," 225, credits the silver from Spain with financing Rome's growth.

[551] The figure of more than 500 million trees supplying fuel for the Spanish silver mines is based on the following assumptions: (1) about 30 million tons of slag were produced by silver miners [Wertime, "Mediterranean Pyrotechnology," in *Early,* 135]; (2) to produce 1 ton of silver slag requires 450 kilograms of charcoal [Salkield, "The Roman and Pre-Roman Slags at Rio Tinto, Spain," in *Early Pyrotechnology,* 145]; (3) Ancient charcoal kilns required 16 tons of wood to produce 1 ton of charcoal [Constantinou, "Geological Features and Ancient Exploitation of the Cupiferous Sulphide Orebodies of Cyprus," in *Early*, 22]; (4) One oak tree produces 375 kilograms of wood [Salkield, "Ancient Slag in the South West of the Iberian Peninsula," 94].

[552] The figure of more than 7,000 square miles deforested to fuel the silver furnaces is based on the assumption that 121 trees grew on 1 acre [Salkield, "Ancient Slag in the South West of the Iberian Peninsula," 94].

[553] Emperor Vespasian's conservation measure for the mining areas in Iberia is reproduced in J. van Nostrand, "Roman Spain," in *An Economic Survey of Ancient Rome,* vol. 3, ed. T. Frank (Baltimore: John Hopkins Press, 1937), 169.

[554] The conclusion that output was limited not by the supply of ore comes from the fact that 1 million tons of ore remained [Salkield, "Ancient Slag in the South West of the Iberian Peninsula," 90] and that over 64,000 tons of silver were extracted from the Spanish silver ore in the early part of the twentieth century [Salkield "The Roman and Pre-Roman Slags at Rio Tinto, Spain," in *Early Pyrotechnology,* 139].

[555] The addition of base metal to silver coinage by Commodus is discussed in N. Baynes, "Constantine," in *The Cambridge Ancient History,* vol. 12, ed. S. Cook et al. (Cambridge: Cambridge University Press, 1971), 725.

[556] Scriptores Historiae Augustae, *Commodus Antoninus* 7.8 and 14.8 tell of his killing spree and his methods of raising money.

[557] On the debasement of currency by Severus, see Baynes, "Constantine," in *The Cambridge Ancient History,* vol. 12, 725.

[558] The requisitioning of commodities by the government is discussed in A. Alfoldi, "The Crisis of the Empire," in *The Cambridge Ancient History,* vol. 12, ed. S. Cook et al. (Cambridge: Cambridge University Press, 1971), 221.

[559] On compulsory provisioning of the government by its citizens, see *Codex Theodosianis* 11.16.15.

[560] Patterson "Silver Stocks and Losses in Ancient and Medieval Times," 227, discusses the institutionalization of barter and payment with goods.

[561] Claudian 1.17, 36, and 62–71; Ammianus Marcellinus 10.1–2; and Symmachus, *Letters* 2.6, vividly describe Rome's dependence on North Africa for its supply of grain and the consequences of Rome's dependent position.

[562] Claudian's desire to return to the good old days is in Claudian 1.110–112.

[563] The quotes of the landowner on the poor condition of the land are in Symmachus 1.5 and 2.52.

[564] Centuries before Symmachus, Columella had complained about soil exhaustion in Columella, "Praefatio," 1.

[565] Ibid., 2.1.5, observed the high yields to quickly decline.

[566] St. Ambrose, *De Officiis* 3.7.45–51 presents the early Christian view on soil exhaustion.

[567] On the pagan interpretation of soil exhaustion, see Columella, "Praefatio," 2–3.

[568] The "nourish their mother" quote is from ibid., 2.1.6.

[569] Columella's remedy for soil exhaustion is found in ibid., 1.7.

[570] Columella's critique of the Roman system of agriculture is found in ibid., "Praefatio," 3.

[571] The types of materials the Romans resorted to for fuel are listed in Ulpian, *Digesta* 32.3.55.

[572] Concerning Probus's wild beast hunt, see Scriptores Historiae Augustae, *Probus* 19.3–5.
[573] The number of bathing establishments can be found in J. Waltzing, *Etude Historique sur les Corporations Professionnelles chez les Romains Depuis les Origins Jusqu'a la Chute de L'Empire D'Occident,* vol. 2 (Leuven, 1896–1900), 125.
[574] Scriptores Historiae Augustae, *Severus Alexander* 24.5–6, tells of Severus Alexander cutting down entire forests for fuel to heat the baths.
[575] *Codex Theodianis* 13.5.13 tells of the provisioning of the guild with sixty ships to carry fuel to the bathing establishments.
[576] Ibid., 13.5.10, speaks of the wood runs from North Africa to Rome.
[577] The changes in brick and masonry work over time as described by George Perkins Marsh is found in George Marsh, *The Earth as Modified by Human Action* (New York: Scribner, Armstrong, and Company, 1874), 320.
[578] On the consumption of forest land by the smelting of copper and iron, see Theodore Wertime, "The Furnace versus the Goat: The Pyrotechnologic Industries and Mediterranean Deforestation in Antiquity," *Journal of Field Archaeology* 10, no. 4 (Winter 1983): 452, https://doi.org/10.2307/529467.
[579] Regarding carbon dioxide added to the atmosphere due to the smelting of iron ore, see Cleere, "Ironmaking," in *Roman Crafts*, 129; and Robbie M. Andrew, "Global CO2 Emissions from Cement Production," *Earth Systems Science Data* 10, no. 1 (2018): 195, https://www.earth-syst-sci-data.net/10/195/2018/essd-10-195-2018.pdf.
[580] William Ruddiman's calculation regarding the rise in carbon dioxide is covered in William F. Ruddiman, "The Anthropogenic Greenhouse Era Began Thousands of Years Ago," *Climatic Change* 61, no. 3 (2003): 275, https://doi.org/10.1023/B:CLIM.0000004577.17928.fa.
[581] "Africa's Ancient Steelmakers The Haya Were Centuries Ahead of European Metallurgists," *Time* 112, no. 13 (September 25, 1978): 80, and Peter Schmidt and Donald Avery, "Complex Iron Smelting and Prehistoric Culture in Tanzania," Abstract, *Science* 201, no. 4361 (September 22, 1978), https://doi.org/10.1126/science.201.4361.1085.
[582] The "lost…inquiry" comes from personal correspondence with Dr. Peter Schmidt.
[583] The elders quoted in P. O'Neil, et al., *The Tree of Iron* (Foundation for African Prehistory and Archaeology [production company], Documentary Educational Resources [distributor], 1988) [documentary].
[584] From personal correspondence with Dr. Peter Schmidt.
[585] High-grade steel remark from " O'Neil, et al., *The Tree of Iron*.
[586] "Of course …" quote from O'Neil, et al., *The Tree of Iron*.
[587] "Flabbergasted" quote from O'Neil, et al., *The Tree of Iron*.
[588] Reenactment shown in O'Neil, et al., *The Tree of Iron*.
[589] "Indistinguishable…" remark can be found in P. Schmidt and D. Avery, "More Evidence for an Advanced Prehistoric Iron Technology in Africa," *Journal of Field Archaeology* 10, no. 4 (1983): 428, https://doi.org/10.1179/009346983791504228.
[590] One ton of wood per smelt remark can be found at O'Neil, et al., *The Tree of Iron*.
[591]Concerning access to forest trees for fuel by early iron workers, see Peter Schmidt, "Historical Ecology and Landscape Transformations in Eastern Equatorial Africa," in *Historical Ecology: Cultural Knowledge and Changing Landscapes*, ed. Carole Crumley (Santa Fe: School for Andvanced Research Press, 1994), 108
[592] Peter Schmidt, "Why Deep Time Landscape Histories are Needed to Improve Environmental Management in Africa," in *Aquatic Resources in Africa*, ed. T. Chrisman and L. Chapman (Gainesville: University Press of Florida), 20–37.
[593] The best accounts of deforestation and technological change in iron working in pre-colonial northwestern Tanzania can be found in Peter Scmidt, "Archaeological Views on a History of Landscape Changes in East Africa," Journal of African History, Volume 38, Number 3, pp. 393-421.
[594] This figure is based on the use of *Burkea africana* as the fuel – A. Maroyi, "*Burkea africana* Hook." [Internet] Record from PROTA4U, ed. R.H.M.J. Lemmens, D. Louppe, and A.A. Oteng-Amoako (Wageningen, Netherlands: PROTA [Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale], 2010), updated April, 1, 2017, https://uses.plantnet-project.org/en/Burkea_africana_(PROTA). *Brukea africanus* has a mean wood volume of 16.5 m^3/ha.
The assumption that a meter cubed of slag equals 2 meters cubed of charcoal – Randi Holland, 1980, "Man's Role in the Changing Habitat of Mema During the Old Kingdom of Ghana," *Norwegian Archaeological Review* 13, no. 1 (1980): 42–43.

Wood to charcoal ratio: every unit of charcoal requires 7 units of wood – Food and Agriculture Organization of the United Nations, "Logistics of Charcoal Production" in *Simple Technologies for Charcoal Making* (Food and Agriculture Organization, 1981), http://www.fao.org/3/X5328E/x5328e02.htm#chapter%201%20%20%20logistics%20of%20charcoal%20production Amount of slag measured from Bassar region: about 83,000 meters cubed – Philip de Barros, "Bassar: A Quantified, Chronologically Controlled, Regional Approach to a Traditional Iron Production Centre in West Africa," *Africa: Journal of the International African Institute* 56, no. 2 (1986): 163.

[595] De Barros, "Bassar: A Quantified, Chronologically Controlled, Regional Approach to a Traditional Iron Production Centre in West Africa," 168.

[596] One of the first Europeans to visit the Bassar region of Togo is quoted in Candice L. Goucher, *The Iron Industry of Bassar, Togo: An Interdisciplinary Investigation of African Technological History* (PhD diss., University of California, Los Angeles, 1984), 64.

[597] One of the first Europeans quoted in Goucher, "The Changing Ecology of the Bassar Region," in *The Iron Industry of Bassar, Togo: An Interdisciplinary Investigation of African Technological History* (PhD diss., University of California, Los Angeles, 1984).

[598] Ibid..

[599] Regarding the decline in production of iron, see Frederick Hupfeld, "Mitthellungen aus de deutschen Schutzgebieten, Part IV," *Stahl und Eisen*, vol. 20 (1899), 347–352.

[600] V.F. Hupfeld, "Die Eisenindustrie in Togo," *Mitteilungen aus den deutsche Schutzgebieten* 11 (1899), 175–94, and Candice Goucher, "Iron is Iron 'Til it is Rust: Trade and Ecology in the Decline of West African Iron-Smelting," *Journal of African History* 22, no. 2 (1981): 183.

[601] Barbara Eichhorn and Caroline Robion-Brunner, "Wood Exploitation in a Major Pre-Colonial West African Iron Production Centre (Bassar, Togo)," *Quanternary International* 458 (2017): 171, https://doi.org/10.1016/j.quaint.2017.08.073.

[602] Archibald Sayce quotes can be found in Archibald Sayce, "Part 2 – The Historical Results," in *Annals of Archaeology and Anthropology*, vol. 4, University of Liverpool, Institute of Archaeology, ed. P.E. Newberry (Liverpool: University Press of Liverpool, 1912): 55.

[603] Great City quote can be found in Herodotus 2.29; a few trees description appear in John Garstang, "Preliminary Notes on an Expedition to Meroe in Ethiopia," in *Annals of Archaeology and Anthropology*, vol. 3, University of Liverpool, Institute of Archaeology, ed. P.E. Newberry (Liverpool: University Press of Liverpool, 1910): 58.

[604] Description of Mema's earlier iron production appears in Tereba Togola, "Archaeological Investigations of Iron Age Sites in the Mema Region, Mali (West Africa)," (PhD diss., Rice University, 1993), 80.

[605] A. Maroyi "*Burkea africana* Hook," https://uses.plantnet-project.org/en/Burkea_africana_(PROTA).

[606] Goucher, "Iron is Iron 'Til it is Rust: Trade and Ecology in the Decline of West African Iron-Smelting," 192.

[607] Kokou Kouami, Nuto Yaovi, and Atsri Honan, "Impact of Charcoal Production on Woody Plant Species in West Africa: A Case Study in Togo," *Scientific Research and Essay* 4, no. 9 (2009): 893, https://academicjournals.org/journal/SRE/article-full-text-pdf/C31F6B716278.

[608] Goucher, "Iron is Iron 'Til it is Rust: Trade and Ecology in the Decline of West African Iron-Smelting," 181.

[609] Slide presented at a lecture by Dr. Candice Goucher, "Forging Iron in the Atlantic World," An Interdisciplinary Symposium, Fowler Museum, University of California, Los Angeles, November 10, 2018.

[610] The artisan's message to Zeno regarding the repairing of his ship is in Società Italiana per la Ricerca dei Papiri Greci e Latini in Egitto, *Papiri Greci e Latini*, vol. 4 (Firenze), 382.

[611] The foreman's report to Apollonius is in Michael Rostovtzeff, *A Large Estate in Egypt in the 3rd Century B.C.: A Study in Economic History* (Madison: University of Wisconsin, 1922), 70.

[612] Apollonius's order to Zeno is found in C. Edgar (1925-), *Zenon Papyri*, 2.59159 (this is the papyrus number in the text).

[613] The central government's promotion of arboriculture is described in A. Hung and J. Smyly, eds., *Tebtunis Papyri*, vol. 3, part 1 (London: Oxford University Press, 1933), 98–99.

[614] Concerning the pharoah's use of cedar logs, see J. Wilson, "Egyptian Historical Texts," in *Ancient Near Eastern Texts Relating to the Old Testament*, ed. J. Pritchard (Princeton: Princeton University Press, 1969), 254.

[615] A The pharoah's boast is in ibid., 241.

[616] Zakar-Baal's boast can be found in John Pairman Brown, *The Lebanon and Phoenicia*, 180.

[617] Regarding Egyptian and Phoenician shipbuilding, I appreciate a lengthy conversation with Dr. Pearce Paul Creasman, Associate Professor and Curator in the Laboratory of Tree-Ring Research (with joint/affiliate

appointments in the School of Anthropology, Department of Classics, Department of Religious Studies) at the University of Arizona.

[618] Regarding Phoenicians as sailors and traders throughout the Mediterranean, see Thucydides, 1.4; and Diodorus Siculus V.20.

[619] Concerning the transport of tin to Cyprus, consult Strabo III.5.

[620] About the importation of the alphabet, see Herodotus V.58.

[621] Amru Ibn Ass is quoted in Ibn Khaldun, "Kiyadatu-l-Astil," in *The History of the Mohammedan Dynasties in Spain*, vol. 1, by Ahmed Ibn Mohammed Al-Makkari, trans. Pascual de Gayangos (The Royal Asiatic Society of Great Britain and Ireland, 1840), appendix B, xxxiv.

[622] On the inhabitants of the northern shore of the Mediterranean sending fleets against those living on the southern coast, see ibid., xxxiv.

[623] Ammianus Marcellinus is quoted in Ammianus Marcellinus, 14.8.14.

[624] Theophanes, *The Chronicles of Theophanes,* 385, reports Artemios's command.

[625] On the Ifriqiyans' building their fleet, see Khaldun, "Kiyadatu-l-Astil," xxxv, and Abu Ubayd Abd Allah ibn Abd al-Aziz Bakri, "Description de l'Afrique Septentrionale," trans. M. de Slane, *Journal Asiatique* (1858): 509–510.

[626] Ibid,, and A. Bakri, "Description de l'Afrique Septentrionale," trans. M. de Slane, *Journal Asiatique,* (1859): 149, tell about the Berbers obtaining wood for the Iriqiyans.

[627] The Arabs' expectation for the fleet is found in A. Bakri, "Description de l'Afrique Septentrionale" (1858), 509–510.

[628] Ibn Khaldun's quote on the conquest of Sicily with vessels built in North Africa can be found in Ibn Khaldun, "Kiyadatu-l-Astil," xxxv.

[629] Yaqut's quote on timber in the mountains above Cefulu can be found in M. Amari, *Biblioteca Arabo-Sicula*, vol. 1 (1880), 191 (paragraph 111).

[630] Ibid., 68 (paragraph 33), quotes Idrisi on supplies of wood to Messina.

[631] Idrisi is quoted on the supply of timber to Taormina (ibid., 68, paragraph 33) and San Marco (ibid., paragraph 32). al-Makkari discusses the rebelliousness of the Berbers in Ahmed Ibn Mohammed al-Makkari, *The History of the Mohammedan Dynasties in Spain*, trans. P. de Gayangos (London, 1840), 136.

[632] al-Makkari's quote on Spain is found in ibid., 1.1.

[633] The praise for Spain comes from Ibn Hawqal, *Configuracion del Mundo*, trans. M. Romani Suay (Valencia, 1971), 60.

[634] The verses of Ibn Hafaga are found in Muhammad Ibn Abd Allah al-Himyari, *Kitab Ar-Rawd Al-Mitar*, trans. P. Maestro Gonzales (1963), 213.

[635] Idrisi's quotes on Tortosa are in P. Jaubert, *Geographie D'Edrisi,* vol. 2 (Paris, 1836–1840), 235, and Edrîsî, *Description de L'Afrique et L'Espagne*, trans. R. Dozy and M. de Goeje (Leiden: Brill, 1866), 251 / 191.

[636] al-Himyari's quote concerning Denia is found in E. Levi-Provencal, *La Péninsule ibérique au moyen-âge,* (Leiden: Brill, 1938), 76 / 95, no. 2

[637] Ibn Khaldun's belligerent words are found in Khaldun, "Kiyadatu-l-Astil," xxxiv.

[638] The quote telling of the Christians' retreat is found in ibid., xxxvi.

[639] Maqdisi's comparison of Cairo and Baghdad is in Desmond Stewart, *Great Cairo: Mother of the World* (Cairo: American University in Cairo Press, 1981), 70.

[640] Nasir-i Khusrau's description of the shops in Cairo is in Nasir-i Khusrau, *Nāṣer-e Khosraw's Book of Travels,* trans. W.M. Thackston (Albany: Bibliotheca Persica,1986), 53–54.

[641] The description of the sultan's gardens comes from ibid., 47.

[642] Nasir-i Khusrau points out the greater efficiency of ship transport in ibid., 40.

[643] M. Lombard, "Les Arsenaux en Mediterranee," *Le Navire et L'Economie Maritime du Moyen Age au XVIIIe Siecle Principalement en Mediterranee,* Colloque International d'Histoire Maritime (Paris: S.E.V.P.E.N., 1958), 71, no. 81, tells of cedar wood from the western North African mountains used in Egypt.

[644] Idrisi in Jaubert, *Geographie D'Edrisi,* vol. 2, 235, discusses the Egyptians' working with wood from Tortosa.

[645] Ibn Hawqal's report on pine from northern Syria appears in Abū al-Qāsim Muhammad Ibn Hawqal, *Configuration de la Terre*, trans. J. Kramers and G. Wiet (Paris : Maisonneuve and Larose, 1965), 180.

[646] M. de Goeje, ed., *Bibliotheca Geographorum Arabicorum,* vol. 2 (Leiden: Brill, 1967), 197, quotes Maqdisi on Cairo's firewood supply.

[647] Nasir-i Khusrau's quote on the ships he saw is in Khusrau, *Nāṣer-e Khosraw's Book of Travels*, 40.

[648] al-Makkari's quote on the vulnerability of the Arab world comes from al-Makkari, *The History of the*

Mohammedan Dynasties in Spain, vol. 2, 245.

649 Ibn Khaldun's account of Christian victories is Khaldun, "Kiyadatu-l-Astil," xxxvi.

650 The Ifriqiyan leader's reply to his Egyptian overlords is found in De Lacy O'Leary, *A Short History of the Fatmid Khalifate* (London: Kegan Paul, Trench, Trubner & Co., 1923), 200.

651 Ibn Mamati's accounts of the Egyptian government's conservation efforts appears in A. Bahgat, "Les forêts en Egypte et leur administration au moyen âge," *l'institut d'Égypte, Cairo, Bulletin* 4, no. 1 (1901), 143–144.

652 On the governor of Faiyum's complaints, see ibid., 148–150.

653 M. Lombard, "Arsenaux et Bois de Musulame VII-XI Siecles," *Le Navire et L'Economie Maritime du Moyen Age au XVIIIe Siecle Principalement en Mediterranee,* Colloque International d'Histoire Maritime (Paris: S.E.V.P.E.N., 1958), 102, no. 5, discusses the price of teak wood.

654 The Arab commentator's quote on forests in Venetian territory appears in M. Lombard, *Espaces et réseaux du haut Moyen Âge* (De Gruyter Mouton, 1972), 149, no. 174.

655 On the Christians becoming the "masters of the sea" once again, see Khaldun, "Kiyadatu-l-Astil," xxxviii.

656 The Byzantine emperor's terrible threat to the doge is in G. Tafel and G. Thomas, "Urkunden zur älteren Handels und Staatsgeschichte der Republik Venedig … ," *Fontes Rerum Austriacarum,* vol. 12 (Vienna, 1856), 26.

657 The agreement by the doge, clergy, and nobility to prohibit the trading of wood to the Muslims appears in ibid., 25–26.

658 Pope Gregory is quoted in A. Germain, *Histoire du Commerce de Montpellier*, vol. 1 (Montpellier, 1861) no. 46.

659 *Liber Communis Detto Anche del R. Archivio Generale di Venezia* (Venice, 1872), no. 294 and no. 297, tells of the fate of those caught running the Venetian wood blockade. 143. al-Maqrizi is quoted in A. Bahgat (1901), p. 156.

660 Theodoric's reference to Italy with respect to wood is in T. Hodgkin, trans., *Cassiodori Variae,* vol. 5 (1886), 16.

661 Theodoric's reasons for wanting a fleet appear in ibid., 145. Theodoric's ordering an underling is in ibid., 5.20.

662 Ibid., 517, contains Theodoric's praise for Abundantius.

663 Ibid. tells of the king's new confidence because of his fleet.

664 Ibid. contains Theodoric's announcement order to the fishermen.

665 The eleventh-century observer is quoted in J. Norwich, *A History of Venice* (New York: Alfred A. Knopf, 1981), 65.

666 Dante's description of the Arsenal appears in Dante, *Inferno* 21.

667 On the regulation of the transport of pitch and timber on the Adige, see A. Schaube, *Handelsgeschichte der Romanischen Völker des Mittelmeergebiets …* (Munich and Berline: R. Oldenbourg, 1906), 698, and *Liber Juris Civilis Urbis Veronae, Caput 275* (*Book of Civil Law of the City of Verona*, Chapter 275).

668 B. Cechetti and V. Zanetti, *Monograßa della Vetraria e Muranese* (1874), 9, discuss early laws limiting the amount of and types of wood burned by glassworkers.

669 Ibn Khaldun's discussion of the prophecy appears in Khaldun, "Kiyadatu-l-Asatil," appendix B, xxxix.

670 The Venetian commander's view of the Turkish fleet is presented in D. Malipiero, "Annali Veneti," *Archivio Storico ltaliano,* Series 1, 7 (1843): 49–52.

671 A high-ranking Turkish minister is quoted in J. Norwich, *A History of Venice*, 127.

672 The quote on the quality of trees used by the Turks for shipbuilding appears in P. Pantera, *L'Armata Navale* (Rome: Edigio Spada, 1614), 4.

673 The secret document to the general-captain regarding Turkish prisoners is found in V. Lammanskii, *Secrets D'Etat de Venise,* no. 58 (New York: Burt Franklin, 1968), 83–84.

674 P. Bertolini, "Il Montello: Storia e Colonizzazione," *Nuova Antologia* (1905): 73 and 72, quotes Venetian officials on the destroyed state of the Venetian woodlands.

675 The quotes by Venetian authorities on the Arsenal's great need for wood and the reservation of all oaks for the Arsenal appear in ibid., 72 and 73.

676 The decree by the Senate forbidding the felling of timber at Montello is found in ibid., 72.

677 High-ranking officials are quoted in ibid., 73, regarding Venetian control of the woods of Montello.

678 The local population's continued destruction of the forest of Montello is described in Venice (Republic: to 1797), *Relazioni dei Rettori Veneti in Terraferma* (Venice: A. Giuffrè, 1973), 14.

679 Ibid., 57–58, describes the result of such destruction in a report to the Senate.

680 The very sinews of the republic is referred to in Michael S. Beaudoin, "Lawyers and Sawyers: Venetian Forest Law and the Conquest of Terraferma (1350–1476)" (master's thesis, Boise State University, 2014), viii.

681 The request for stiffer penalties appears in ibid., 46.

[682] P. Bertolini, "Il Montello: Storia e Colonizzazione," 75, tells of the severe penalties applied to those destroying oaks in Montello.
[683] The government official's report to the Senate on the large quantity of oak growing in Montello appears in Venice (Republic: to 1797), *Relazioni dei Rettori Veneti in Terraferma*, 70.
[684] Andrea Corner's attribution is in ibid., *77.*
[685] Corner's successor is quoted in ibid., 107.
[686] On the deforestation above Verona, see C. Ferrari, *La Campagna di Verona all'epoca Veneziana* (Venice: Deputazione di storia patria per le Venezie, 1930), 18–19.
[687] G. Paulini, *Un Codice del "I600" per le Acque e le Foreste* (1934), 12, tells of the destruction of all vegetation in the mountains above Venice.
[688] Evelyn, *Silva,* vol. 2, 294, calls the Montello forest a "jewel."
[689] The admission of the authorities as to the extent of deforestation appears in I. Cacciavillani, *Le Leggi Veneziane sul Territorio 1471-1709* (Signum Edizioni, 1984), 138.
[690] The description of the Arsenal comes from S. Clarke, *A Geographical Description of All Countries in the Known World* (London: Thomas Newberry, 1657), 222.
[691] M. Sanuto, *I Diarii,* vol. 24 (Venice, 1527), 652–653/369, tells of officials collecting wood for the Arsenal, and the amount of wood collected.
[692] Samuel Clarke is quoted in Clarke, *A Geographical Description of All Countries in the Known World,* 223.
[693] The amount of wood taken for fuel is reported in M. Sanuto, *Diarii,* vol. 5 (Venice, 1503), p. 174/184. Giuseppe Paulini is quoted in Paulini, *Un Codice del "I600" per le Acque e le Foreste*, 13.
[694] The value of pastureland compared to forested land is reported by Venice (Republic: to 1797), *Relazioni dei Rettori Veneti in Terraferma*, 14.
[695] The government document pinpointing the cause of silting of the lagoon appears in Cacciavillani, *Le Leggi Veneziane sul Territorio 1471-1709*, 142.
[696] Paulini's elaboration on the relationship of deforestation and increased deposition of alluvium in the lagoon is from Paulini, *Un Codice del "I600" per le Acque e le Foreste*, 12–13.
[697] Government sources reporting the high price of wood and its scarcity appear in Cacciavillani, *Le Leggi Veneziane sul Territorio 1471-1709*, 138.
[698] The testimony of one Venetian shipyard owner is reproduced in Frederic Lane, *Venetian Ships and Shipbuilders of the Renaissance* (Baltimore: Johns Hopkins Press, 1934), 124.
[699] M. Romano, "La marine marchande vénitienne au XVI siècle," *Les sources de l'histoire maritime en Europe du moyen âge …*, Actes du Quatrième Colloque International d'Histoire Maritime (Paris : S.E.V.P.E.N., 1962), 48, quotes the 1594 Venetian document.
[700] Concerning the percentage of foreign-built ships in the Venetian merchant fleet, see Frederic Lane, "Venetian Shipping during the Commercial Revolution," *American Historical Review* 38, no. 2 (January 1933): 234–236.
[701] *Journals* 43 (1787–1788), 560, discusses Holland's advantage in obtaining timber because of the many navigable rivers emptying into the Netherlands.
[702] Sir Walter Raleigh's observations come from Sir Walter Raleigh, *Observations Touching Trade and Commerce with the Hollander* (London, 1653), 13 and 26.
[703] The Ventian ambassador's admiration for the British woods is found in M. Harrison, *How They Lived*, vol. 2 (Oxford: Blackwell, 1962), 1.
[704] The "no lack of timber" quote appears in Robert Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy 1652–1862* (Cambridge: Harvard University Press, 1926), 121.
[705] Concerning the wood trade between southern England and Holland, Flanders, and northern France, see R. Pelham, "Timber Exports from the Weald during the Fourteenth Century," *Sussex Archaeological Collections* 69 (1928): 171.
[706] The number of shiploads of wood for Calais is reported in *LP*, vol. 15 (1540), 283, and the information on the export of wood to Boulougne is found in *LP*, vol. 20, part 2 (1545) 193.
[707] The description of hoys comes from Sir Walter Raleigh, *Observations Touching Trade and Commerce with the Hollander*, 8–9.
[708] The quote about hoys laden with timber and wood is found in R. Tawney and E. Power, *Tudor Economic Documents*, vol. 2 (London: Longmans, Green and Co., 1924), 100.
[709] On wood for fishermen in Dunkirk, see *LP*, vol. 14, part 1 (1539), 544, and *LP*, vol. 16 (1541), 84 and 466.
[710] The number of naval vessels built by Henry VII is found in J. Williamson, *Maritime Enterprise* (Oxford: Oxford

University Press, 1913), 372–373.

[711] *LP,* vol. 13, part 1 (1538), no. 1213, contains the comment on the treasure carried by Spanish ships.

[712] The quote extolling Spain and Portugal's maritime accomplishments is in Tawney and Power, *Tudor Economic Documents,* vol. 2, 21.

[713] Portugal's huge profits from the spice trade are mentioned in Great Britain, Public Records Office, *Calendar of State Papers, Venetian,* 1, no. 838.

[714] England depended on France for its salt [Edward Hughes, "The English Monopoly of Salt in the Years 1563–71," *English Historical Review* 40, no. 159 (July 1925), 334]; England imported iron [Tawney and Power, *Tudor Economic Documents,* vol. 3, 331] and dyed cloth (ibid., 3. 130-148); there were few glassworks in England according to a contemporary versifier [Eleanor Godfrey, *The Development of English Glassmaking* (Chapel Hill: University of North Carolina Press, 1975), 146–147]; and England bought most of its artillery pieces from abroad *[LP,* vol. 1, part 1 (1510), no. 325, and W. Rees, *Industry before the Industrial Revolution,* vol. 1 (Cardiff: University of Wales Press, 1968), 136–137].

[715] The quote on the English character appears in ibid., vol. 3, 131.

[716] The warning of the arms broker is in *LP,* vol. 14, part 1 (1539), 208.

[717] The English spy's report is in ibid., 165.

[718] Henry's worry is discussed in ibid., no. 489.

[719] Ibid., 111, quotes Joachim Gundelfynger.

[720] Ibid., 359, contains the quote of one of Henry's munitions brokers.

[721] The governess of the Netherland's prohibition is found in *LP,* vol. 16 (1541), 511.

[722] The "grand nursery" quote is found in J. Norden, *The Surveyors Dialogue,* vol. 5 (1618), 219.

[723] Holinshed's affirmation of the date that the first iron cannons were made in England is in R. Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland,* vol. 3 (London, 1807), 832.

[724] The song from Sussex is reproduced in G. Payne, "The Iron Industry of the Weald," *Archaeologia Cantania* 21 (1895): 312.

[725] John Stow, *Annales Continued and Augmented … by E. Howes* (London, 1631), 584; and *LP,* vol. 20, part 1 (1545), 632; and *LP,* vol. 20, part 2 (1545), 61 and 240, discusses the production of cannons at Buxted.

[726] The contracts to Levett are found in *LP,* vol. 20, part 1 (1545), 268; *LP,* vol. 20, part 2 (1545), 61 and 457; *LP,* vol. 21, part 1 (1546), 315 and 317; and *LP,* vol. 21, part 2 (1546–1547), 298, 447, 448, and 449.

[727] Concerning the monetary success early ironmasters experienced, see R. Fitzgerald-Uniacke, "The Barhams of Shoesmiths in Wadhurst," *Sussex Archaeological Collections* 56 (1914): 137–138 (John Berham), and William Page et al., ed., *VCH, Sussex,* vol. 2 (London, 1973), 246 (Lord Admiral Seymour). William Camden provides a contemporary view as to the lucrativeness of the iron industry. Writing in the sixteenth century, Camden testifies that "the proprietors of the mines, by casting cannon and other things, get a great deal of money" [W. Camden, *Camden's Britannia* (1695), 167].

[728] The number of forges and furnaces operating in Sussex is given in Tawney and Power, *Tudor Economic Documents,* vol. 1, 236.

[729] Gerard Boate, *Ireland's Natural History* (London, 1652), chapter 17, section 1, describes the flame in the hearth of a blast furnace.

[730] The description of a hammer at work appears in HMC, Series 29, part 2, *Thirteenth Report,* appendix 2, 309.

[731] The quotes about the noise of the great hammers is in Camden, *Camden's Britannia,* 167, 168. D. Crossley, "The Management of a Sixteenth Century Ironworks," *Economic History Review* (Series 2) 19 (1966): 273, compares the productiveness of making iron in a bloomery with making iron in a blast furnace and forge.

[732] The quantity of wood necessary to make one ton of bar iron is estimated by G. Hammersely, "The Charcoal Industry and Its Fuel 1540–1750," *Economic History Review* (Series 2) 26 (1973): 603–605.

[733] E. Straker, "Westall's Book of Panningridge," *Sussex Archaeological Collections* 72 (1931): 254, gives the number of woodcutters employed at Robertsbridge forge.

[734] The number of cords of wood burned at Worth is from Page et al., ed., *VCH,* vol. 2, 247.

[735] The complaints of the residents of Lamberhurst are found in Tawney and Power, *Tudor Economic Documents,* vol. 1, 231.

[736] Ibid., contains the complaints by the people of Sussex.

[737] Excerpts from the testimony of the local population to the commission come from ibid., 234–237.

[738] Crossley, "The Management of a Sixteenth Century Ironworks," 287, tells about the attack on the Robertsbridge forge.

[739] The rebels' accusations against those in power are found in Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland*, vol. 3, 963.
[740] The nobility's viewpoint toward the rebellion appears in J. Nichols, ed., *Literary Remains of King Edward VI*, vol. 2 (New York: B. Franklin, 1964), 225, no. 3.
[741] The charges leveled against the Lord Protector are in Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland*, vol. 3, 1019.
[742] J. Nichols Nichols, ed., *Literary Remains of King Edward VI*, vol. 2, 494, no. 2, presents all the bills introduced into Parliament to guarantee adequate supplies of wood for the English people.
[743] The quote on the trade imbalance appears in Mary Dewar, ed., *A Discourse of the Commonweal of This Realm of England* (Charlottesville: University Press of Virginia, 1969), 63.
[744] Sir William Cecil's view of the trade imbalance appears in Tawney and Power, *Tudor Economic Documents*, vol. 2, 124.
[745] The quote on the believed consequence of the encouragement of domestic manufacture of imported goods is in Dewar, ed., *A Discourse of the Commonweal of This Realm of England*, 63 and 89.
[746] The belief of social theorists of the time is in ibid., 87.
[747] The cost of one order of copper from the Continent is found in *LP*, vol. 21, part 2 (1546–1547), 141.
[748] *CSPD, 1601–1603; with Addenda, 1547–1565*, vol. xi, no. 94 (Feb. ? 1563), relates Henry and the duke of Suffolk's arduous search for copper.
[749] The blame for Henry's failure to find copper is found in M. Donald, *Elizabethan Copper* (Oxford: Pergamon Press, 1955), 12.
[750] Camden's report on the copper miners' success is in William Camden, *Annales* (1615), 42.
[751] The aspect that the smelting houses assumed appears in W. Collingwood, *Elizabethan Keswick* (Kendal: Titus Wilson, 1912), 13.
[752] The assistant governor's information to Cecil is found in Donald, *Elizabethan Copper*, 153.
[753] On the procurement of wood in Kent to evaporate seawater, see John Strype, *The Life and Acts of Matthew Parker*, vol. 3 (Oxford: Clarendon Press, 1821), 408.
[754] The combination of wind and solar energy to produce salt is described in Great Britain, Public Records Office, *State Papers, Foreign Series*, July 20, 1566, no. 582.
[755] Mount's quote on making salt with coal appears in Edward Hughes (1925), "The English Monopoly of Salt in the Years 1563-1571," *English Historical Review* 40 (1925): 341.
[756] The dismissal of glass products as "trifles" is found in Dewar, ed., *A Discourse of the Commonweal of This Realm of England*, 63.
[757] Ibid., tells of the critics' eventual acceptance of glass products "made within the Realme … ".
[758] Great Britain, Public Records Office, *Elizabeth I, Calendar of Patent Rolls*, vol. 6, xiii, no. 3209, announces the privileges granted to Jacob Verselyne.
[759] The quote on what the partners had to do to start production appears in *CSPD*, vol. xlviii (Sept. 6, 1568).
[760] On the Royal Navy's dependence on foreign ships, see Camden, *Annales*, 42.
[761] "For the better maintenance" quote appears in Tawney and Power, *Tudor Economic Documents*, vol. 2, 110.
[762] M. Oppenheim, *A History of the Administration of the Royal Navy* (London, 1896), 167, discusses the generous subsidies.
[763] Concerning the increase in tonnage of English-built ships, see Tawney and Power, *Tudor Economic Documents*, vol. 2, 122, and Oppenheim, *A History of the Administration of the Royal Navy*, 174–175.
[764] Camden, *Annals*, 42, extolls Elizabeth for her reputation with respect to shipping.
[765] G. Edelen, ed., *William Harrison: The Description of England* (Ithaca: Cornell University Press, 1968), 116–117, tells of the many new commodities carried by English shipping.
[766] John Stow's praise for the success of Elizabeth's economic policies is in John Stow, *The Annales* (London, 1615), 896.
[767] The trebling of the economy is told in Oppenheim, *A History of the Administration of the Royal Navy*, 167.
[768] One contemporary's comment on building appears in Edelen, ed., *William Harrison: The Description of England*, 279.
[769] A chronicler of note's observation appears in Camden, *Annales*, 276.
[770] Harrison's quote on the commoners using oak for building appears in William Harrison, *The Description of England*, book 2, chapter 22 (1807) in Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland*, vol. 1.

[771] *CSPD,* vol. ccxlv, no. 77 (Aug. 14,1593), tells how many oaks it took to repair four Royal Navy ships.
[772] G. Nash, "Ships and Shipbuilding," in *A History of Technology,* vol. 3, ed. C. Singer et al. (1969), 493, gives his estimate on the amount of oaks needed to build a large warship.
[773] Concerning the traffic carrying timber from Sussex to the dockyards in Kent, see *CSPD,* vol. ccxlv, no. 69 (Aug. 3, 1593).
[774] *CSPD Ja,* vol. 162, no. 63 (1624), reveals that glass workers prefered mature hardwoods for fuel.
[775] The letter that the steward wrote to his master is found in *VCH, Kent,* vol. 2, 401.
[776] John Evelyn, *Sylva* (London, 1664), 212, tells of metallurgists' preference for "good oak" as fuel.
[777] The number of oaks cut by lead miners in Derbyshire is given in *VCH, Derbyshire,* vol. 1 (1973), 418.
[778] Collingwood, *Elizabethan Keswick,* 14, tells of the countryside around the copper plants being denuded.
[779] M. Drayton's list of trees destroyed by the ironworks appears in M. Drayton, *Poly-Olbion* 17, 403–406 and 381. A contemporary of Drayton's, John Selden, greatly admired by his peers for his "stupendous learning" and "general knowledge," judged *Poly-Olbion* as "a truly great work, stored with learning of wide variety" [Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography,* vol. 17, (1917–1982), 1159, and ibid., vol. 6, 11].
[780] *VCH, Surrey,* vol. 2 (1905), 271–272, reports on the number of trees converted to fuel by two ironmasters in Surrey.
[781] The amount of wood destroyed in Tonbridge and Tunbridge Wells is reported by H.R. Schubert, *History of the British Iron and Steel Industry* (London: Routledge & Kegan Paul, 1957), 219.
[782] *VCH, Sussex,* vol. 2 (1973), 318, reports the removal of woods belonging to the queen at Claveridge.
[783] The amount of wood consumed by Sir Thomas Shirley's ironworks appears in ibid., 309.
[784] Harrison's quote on the waste of wood by ironworks is in Edelen, ed., *William Harrison: The Description of England,* 369. Other contemporaries of Harrison agreed with his assessment. William Camden noted, for instance, that "Sussex is full of iron mines everywhere; for the casting of which, there are furnaces up and down the country; and an abundance of wood is yearly spent" [Camden, *Camden's Britannia,* 167]. John Norden, whose thorough knowledge of the English countryside is discussed in this chapter, concurred with Harrison's and Camden's assessments. He stated, "Such a heat issueth out of the many forges and furnaces, for the making of iron, and out of glass kilnes, as hath devoured many famous woods …" [Norden, *The Surveyors Dialogue,* vol. 5, 219].
[785] On contemporaries' assessments of the combined demands on the forest by Elizabethan material culture, see A. Standish, *The Commons Complaint* (London, 1611), 1–2, and Stow, *Annales Continued and Augmented … by E. Howes,* 1025.
[786] The "mortal blow" quote is from Norden, *The Surveyors Dialogue,* vol. 5, 217.
[787] William Harrison's report on the destruction of oak is found in Harrison, *The Description of England,* book 2, chapter 22. Arthur Standish, a writer on agricultural matters, agreed wholeheartedly with Norden's and Harrison's assessments, writing in 1611, "We do all humbleness complain unto your Majesty of the general destruction and waste of wood made within your kingdom, more within twenty or thirty years last than in any hundred before" [A. Standish, *The Commons Complaint,* 1].
[788] The price of cordwood in Roger Gratwicke's will is found in J. Comber, "The Family of Gratwicke, of Jarvis, Shermanbury and Torrington," *Sussex Archaeological Collections* 60 (1919): 42.
[789] The document produced in Sussex twenty-four years later is reproduced in G. Kenyon, "Kirdford Inventories, 1611 to 1776," *Sussex Archaeological Collections* 93 (1955): 142.
[790] HMC, Series 77, *Report on the Manuscripts of Lord de l'Isle & Dudley,* vol. 1, 318, reports on the 1567–1568 price of a cord in Kent.
[791] Godfrey, *The Development of English Glassmaking,* 191, reports on the price glassmakers in Kent paid for a cord seventeen years later.
[792] The higher prices the people of Brighton paid for wood following the installation of iron furnaces nearby is told in E. Turner, "The Early History of Brighton," *Sussex Archaeological Collections* 2 (1849): 51.
[793] On wages paid to woodcutters as a percentage of the price of cordwood, see HMC, Series 77, 305, 311, and 318.
[794] Concerning the rise in wheat prices, see Joyce Youings, *Sixteenth-Century England* (London: Penguin Books, 1984), 151.
[795] Lord Admiral Howard's quote appears in *CSPD,* vol. ccxliii, no. 73 (Nov. 1592).
[796] Paul Hughes and James Larkin, eds. *Tudor Royal Proclamations,* vol. 2 (New Haven: Yale University Press, 1969), 135 (Proclamation no. 463), reproduce the queen's proclamation.

[797] The contents of "An Act that Timber Shall Not be Felled … " is reproduced in Laws, vol. 6, 1 *Elizabeth,* chapter 15.
[798] The descriptions of Lord Buckhurst and Viscount Montague appear in Stephen and Lee, eds., *Dictionary of National Biography*, vol. 17, 587, and vol. 3, 40, respectively.
[799] The petition sent by the inhabitants of Kingston-upon-Thames is in HMC, Series 6, *Seventh Report,* 616.
[800] Ibid., reports on the talk the petition catalyzed in London.
[801] The findings of the investigation of the activities of Thomas Erlington are in ibid., 683.
[802] Holinshed, *Holinshed's Chronicles of England, Scotland, and Ireland,* vol. 4, 899, tells of the plight of the people doing without fuel.
[803] Ibid., 233, describes the "extreme sharpe" weather; ibid., 345–346 tells of snow in London; and concerning the Thames freezing, see ibid., 228. About the time Elizabeth came to the throne, Europe entered into a prolonged cold spell, which lasted more than three centuries. Called by many the "Little Ice Age," the years from 1550 to 1900 saw "the greatest advances of the northern hemisphere glaciers" since the Ice Age, according to H. Lamb, *The English Climate* (London: English Universities Press, 1964), 162.
[804] Harrison's report on the fate of the poor who didn't have fuel is found in Edelen, ed., *William Harrison: The Description of England*, 356.
[805] The ejection of the glassmen from Warwickshire is told in *CSPD Ja*, vol. 162, no. 63 (1624).
[806] HMC, Series 31, *Thirteenth Report,* appendix IV, 57, contains Buckhurst's letter.
[807] On the dense concentration of ironworks in the area where Buckhurst built his iron mills, see G. Kenyon, "Wealden Iron," *Sussex Notes and Queries* 13, no. 11 and 12 (1952): 238, no. 1.
[808] HMC, *Thirteenth Report*, 75–76, and Jack Armstrong, *A History of Sussex* (Beaconsfield: Darwen Finlayson, 1961), 43 (map), show that glass furnaces and iron mills operated in three of the four parishes.
[809] See HMC, *Thirteenth Report,* 84–85, on wood being the primary source of income for Rye.
[810] The complaint of the mayors and aldermen to the Privy Council is found in *Acts*, vol. 10 (1577–1578), 265–266.
[811] The appeal of the fishermen of Brighton to a commission is in Turner, "The Early History of Brighton," 51.
[812] *Acts*, vol. 10 (1577–1578), 265–266, contains the instructions to the commission by the Privy Council.
[813] The instructions of the aldermen and mayors of various Sussex towns to their representatives in Parliament are found in HMC, *Thirteenth Report,* 75.
[814] The provisions of the new law are found in Laws, vol. 6, 23 *Elizabeth,* chapter 5.
[815] The order for the removal of the glassworks from Hastings appears in *Acts*, vol. 13 (1581–1582), 281–282.
[816] The contents of "An Act for the Preservation of timber in the weilds … " are found in Laws, vol. 6, 27 *Elizabeth,* chapter 19.
[817] On the declining condition of the woods in the Weald, see Norden, *The Surveyors Dialogue*, vol. 5, 219.
[818] The contents of Christopher Baker's white paper to the Privy Council are found in David Mathew and Gervase Mathew, "Iron Furnaces in South-Eastern England and English Ports and Landing-Places," *English Historical Review* 48, no. 189 (1933): 93.
[819] The command of the Privy Council to ironmasters is in *Acts*, vol. 8 (1571–1575), 186.
[820] Armstrong, *A History of Sussex*, 54, discusses the dual role of the Shirley brothers on the Continent.
[821] The order to all forges casting guns to halt production comes from *Acts*, vol. 11 (1578–1580), 345–346.
[822] On the percentage of iron in England to forge cannons for export, see Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of Elizabeth and James I,* Addenda 1580–1625, vol. 34, no. 43 (Dec. 16, 1601).
[823] The quote discrediting the ironmasters for making guns is found in *CSPD*, vol. 244, no. 116 (April 3, 1593).
[824] The attempt of the ironmasters to justify their actions is found in Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of Elizabeth and James I,* Addenda 1580–1625, vol. 34, no. 43 (Dec. 16, 1601).
[825] Cecil's order regarding casks is found in *CSPD,* vol. 186, no. 2 (Jan. 1586).
[826] Regarding the Privy Council's call to the lord mayor concerning the brewers, see *Acts,* vol. 10 (1577–1578), 214.
[827] On the brewers' use of coal, see *CSPD,* vol. 127, no. 68 (1578?).
[828] Harrison's warning on the possibility of widespread use of coal appears in Harrison, *The Description of England,* book 3, chapter 16.
[829] The observation of London officials in 1592 is in Tawney and Power, *Tudor Economic Documents,* vol. 1. 277.
[830] Cecil's observations on the reason London and other towns changed to coal are found in HMC, Series 9, *Ninth Report,* Part 14, *Salisbury (Cecil) MSS at Hatfield,* Addenda 1596–1603, 330. It seems that all sixteenth- and

seventeenth-century authorities agreed with Howe's 1631 assertion that because of "the great consuming of woods … and the neglect of planting woods, there is so great a scarcity of wood throughout the kingdom, that … many parts within the land, the inhabitants are constrained to make their fires of … coal" [Stow, *Annales Continued and Augmented … by E. Howes*, 1025].

[831] The quote concerning the transition from wood to coal by most trades comes from Tawney and Power, *Tudor Economic Documents*, vol. 1, 297.

[832] Edward I's prohibition of the use of coal is found in Great Britain, Public Records Office, *Calendar of the Close Rolls, Edward I*, vol. 5 (1302–1307), 532.

[833] *CSPD*, vol. 127, no. 68 (1578?), tells of Elizabeth's annoyance with coal smoke.

[834] The proposed "An Acte for the increase and preservation of ( )woods … " is printed in HMC, Series 2, *Third Report*, 7.

[835] The quote on the expensive lifestyle of the lords of manors and owners of woods is found in Molly Harrison, *How They Lived*, vol. 2 (Oxford: Blackwell, 1962), 58.

[836] HMC, Series 77, vol. 1, 29, preserves the agreement between the Sydneys and the two ironmasters.

[837] The "prodigality and pomp" quote is from Edelen, ed., *William Harrison: The Description of England*, 280.

[838] On the sale of wood as a rescue operation, see Norden, *The Surveyors Dialogue*, vol. 5, 217.

[839] The number of glasshouses and ironworks near Petworth is reported by Kenyon, "Wealden Iron," 239, no. 2.

[840] On the ninth earl of Northumberland's debt and his sale of wood for relief, see M. Byrne, *The Lisle Letters*, vol. 4 (Chicago: University of Chicago Press, 1981), 58.

[841] The amount of wood Northumberland had to fell to pay back his debt is extrapolated from data provided by J. Cornwall, "Forestry and the Timber Trade in Sussex 1560–1640," *Sussex Notes and Queries* 14, no. 5–6 (1955): 88–89.

[842] The destruction of an entire forest to raise dowries is reported in *CSPD*, vol. 140, no. 6 (July 7, 1580).

[843] The destruction of woods by wood sales is told by Harrison in Edelen, ed., *William Harrison: The Description of England*, 280.

[844] The reply to Harrison's criticism appears in Samuel Purchas, *Hakluytus Posthumus, or Purchas His Pilgrimes*, vol. 5 (Glasgow, 1905–1907), 281.

[845] Edelen, ed., *William Harrison: The Description of England*, 243, quotes Harrison on pitying the tenants. One of the first landowners to recognize the market value of the wood growing on his properties was Sir John Gostwick. In the mid-1540s, he warned his son and heirs "not to be too free in allowing his tenents to take his timber." As the sixteenth-century English historian J. Youings remarked, Sir John Gostwick perceived "the way the economic wind was blowing" [Youings, *Sixteenth-Century England*, 65], and as the sixteenth century wore on, many of his class were to follow his example.

[846] A detailed discussion concerning the end of the manorial system and the acceleration of the destruction of the woods in the sixteenth and seventeenth centuries appears in Linda Manetas, "The Evolution of Resource Use and Allocation in Waltham Forest During the Sixteenth and Seventeenth Centuries" (PhD diss., Kent State University, 1983), chapter 2.

[847] The quote "too many destroyers" appears in Standish, *The Commons Complaint*, 11.

[848] The quote "the great consuming of woods" appears in Stow, *Annales Continued and Augmented … by E. Howes*, 1025. The "universal inclination" quote appears in Norden, *The Surveyors Dialogue*, vol. 5, 218.

[849] The "profit present" quote appears in Standish, *The Commons Complaint*, "The Epistle Dedicatory."

[850] William Harrison's wish and pessimistic expectation for it to be fulfilled is in Harrison, *The Description of England*, book 2, chapter 22.

[851] The mention of the one ironmaster Christopher Darrell is found in Laws, vol. 6, 23 *Elizabeth*, chapter 5. Over the years, only a few other ironmasters seemed as concerned about preserving the woodlands they consumed. John Evelyn, in his important book on forestry, *Sylva*, published in the 1660s, mentioned his father telling him "that a forge and some other mills, to which he furnished much fuel, were a means of maintaining and improving his woods; I suppose by increasing the industry of planting and care, as what he left of his own planting, inclosing, and *cherishing … did … sufficiently envince."* But in the knowledgeable judgment of Evelyn, the care of the woods by Darrell and Evelyn's father was the exception to the rule. For this reason, as a lover of trees, Evelyn stood as "a declared denouncer" of ironmills [J. Evelyn, *Sylva* (1786), 264–265; the 1786 imprint is a later edition of J. Evelyn, *Sylva* (1664), with different pagination].

[852] On Norden's feeling that legislation was the only answer, see Norden, *The Surveyors Dialogue*, vol. 5, 218. The House of Lords' rejection of a proposed "Act for the increase of timber for ensuing times" is an example of those

in power refusing to take action by legislating planting. If passed, the act would have required "every possessor of a certain quantity of land to plant a portion with acorns, and afterwards to transplant the young trees" (HMC, Series 2, *Third Report,* 14).

[853] The contemporary estimate of the value of woodlands compared to cleared land is found in Standish, *The Commons Complaint*, 5.

[854] The denigration of timber by many is articulated in Norden, *The Surveyors Dialogue*, vol. 5, 220.

[855] Harrison's bleak prediction is in Harrison, *The Description of England*, book 2, chapter 22.

[856] John Norden's gloomy conclusion is found in Norden, *The Surveyors Dialogue*, vol. 5, 216.

[857] Norden's warning comes from ibid., 224.

[858] The comparison of the condition of England's woods in an earlier age with that during Harrison's lifetime is in Edelen, ed., *William Harrison: The Description of England*, 275.

[859] On the discussion of Gwinbach in Essex, see ibid., 423.

[860] John Norden's report on the state of the woods in southeastern England appears in Edelen, ed., *William Harrison: The Description of England*, 219–220.

[861] The quote on large wood losses in Glamorganshire is from R. Merrick, *A Book of Glamorganshire Antiquities* (1578), 12.

[862] The acreage of deforestation in Cranbrook appears in Rees, *Industry before the Industrial Revolution*, vol. 1, 238.

[863] The spoil of woods at Glascoyd is reported in Amy Locke, *The Hanbury Family*, vol. 1 (London: Arthur L. Humphreys, 1916), 130.

[864] R. Pelham, "The Migration of the Iron Industry towards Birmingham," *Transactions and Proceedings of the Birmingham Archaeological Society* 66 (1945–1946), 148, carries a detailed report of the damage done within Cannock Forest by Sir Fulke Greville, including the inquest report.

[865] *VCH, Staffordshire*, vol. 2 (1973), 343, tells of the extinction of Cannock Forest.

[866] Byrne, *The Lisle Letters*, vol. 4, 58, quotes the remorseful ninth Earl of Northumberland.

[867] G. Owen, *Description of Pembrokeshire* (1892), 76, discusses the change in building habits in south Wales.

[868] On the people's fear because of the Great Frost and wood scarcities, see Andrew Lang, *Social England Illustrated* (Westminster : Archibald Constable, 1903), 174.

[869] Standish, *The Commons Complaint*, "To the Reader," tells of the consequences of the scarcity of wheat.

[870] What Standish saw appears in A. Standish, *New Directions of Experience to the Commons Complaint* (London: N. Okes, 1613), 3 and 25. In a report most likely produced in 1608 entitled "Certaine necessarie considerations touching the raysing and mayntayning of copices within his Majesties Forestes, Chaces, Parkes and other Wastes, and the increasing of younge storers for timber, for future ages," which was addressed to the lord high treasurer, John Norden saw the same wholesale destruction of woods throughout England. According to Norden, an "observer can not but see, and understand, that his Majesties woods, both in trees, timber and others, as also in copices, are not onlie not carefullie preserved, but wilfullie wasted and consumed … " *(Ashmolean MSS*, 1148 f. 239).

[871] Standish articulates the people's fears in Standish, *The Commons Complaint*, 1–2.

[872] Standish's linking of deforestation and problems of fertility and yields is found in Standish, *New Directions of Experience to the Commons Complaint*, 6, and Standish, *The Commons Complaint*, 2. His brilliant conclusion appears in Standish, *The Commons Complaint*, 2.

[873] Once again, John Norden agrees with Standish, *New Directions of Experience to the Commons Complaint*, 22–23, concerning the relationships between the destruction of the woods and lack of feed for hogs. In a dialogue between a bailiff and surveyor presented by Norden, the bailiff tells the surveyor, "for oaks and beech that have been formerly very famous in many parts of this kingdom, for feeding the farmers' venison, are fallen to the ground and gone, and their places are scarcely known where they stood" [J. Norden (1608), in *Harrison's Description of England in Shakspere's Youth*, ed. F. Furnivall (London, 1878), 184].

[874] Standish's plans for raising timber appear in Standish, *The Commons Complaint*, 13.

[875] Standish's warning appears in Standish, *New Directions of Experience to the Commons Complaint*, 4.

[876] Standish's prophecy is found in Standish, *The Commons Complaint*, 2.

[877] Standish's praise for James I's conservation efforts appears in Standish, *New Directions of Experience to the Commons Complaint*, 3.

[878] The two acts proposed to Parliament are found in Great Britain, Parliament, House of Commons, *Journals of the House of Commons*, 1 (1547–1624), 394, and HMC, Series 2, *Third Report*, 14.

[879] James I's proclamation on firewood and house building appears in James Lindsay, Earl of Crawford, and Robert

Steele, *Tudor and Stuart Proclamations*, no. 1011 (Oxford: Clarendon Press, 1910), 193. W. Harrison discusses wood consumption and brick burning in Harrison, *The Description of England*, book 3, chapter 9. Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland,* vol. 1.

[880] The Privy Council's announcement that James would enforce the proclamation appears in *Acts*, vol. 33 (1613–1614), 589, and *Acts*, vol. 36 (1617–1619), 283.

[881] The contents of James's proclamation forbidding the use of wood as fuel for glass production are found in *CSPD Ja*, Royal Proclamation no. 42 (May 23, 1615).

[882] James's intervention in the litigation between glassmakers at a Privy Council meeting is reported in *Acts*, vol. 33, 69.

[883] Sir Edward Coke's suggestion to James appears in *CSPD Ja*, vol. 75 (Nov. 17, 1613).

[884] Actions taken against glassmakers who continued burning wood are recorded in *APC*, vol. 33 (1614), 545.

[885] William Petty, *Political Arithmetik* (1691), 102, 105, and 115, discusses the average income of the English working man and the wealthy of England in the late seventeenth century.

[886] Concerning the Spanish envoy's account of the debt James amassed and his plan to sell the woods to alleviate his debt, see *CSPD Ja*, vol. 74 (Sept. 22, 1613), 199.

[887] James's scheme to first sell off distant forests is related in *CSPD Ja*, vol. 87 (June 30, 1616), no. 75.

[888] *CSPD Ja*, vol. 90 (March 8, 1617), no. 105, relates the fight between the king and the lord chancellor over the sale of royal forests.

[889] The Privy Council's report on public outrage forcing James to change his mind is presented in *CSPD Ja*, vol. 93 (Sept. 27, 1617), no. 99.

[890] On the importance of the Forest of Dean, see William Page, ed., *VCH*, *Gloucestershire*, vol. 2 (London, 1907), 263.

[891] Cyril Hart, *Royal Forest* (Oxford: Oxford University Press, 1966), 90, quotes James on his insistence on the husbanding of the Forest of Dean's woods.

[892] The entire petition of the residents of the Forest of Dean against the Earl of Pembroke is found in ibid., 93, no. 40.

[893] The Privy Council's investigation and conclusion regarding the Earl of Pembroke's behavior in the Forest of Dean are found in *Acts*, vol. 33, 279.

[894] The quote about one-fourth of the kingdom without wood appears in Standish, *The Commons Complaint*, 15.

[895] John Speed's account of the wood resources of Staffordshire is in J. Speed, *England, Wales, Scotland and Ireland* (London: 1666), chapter 34, section 6. This is an abridgement of Speed's 1611 work, *Theatre of the Empire of Great Britain.*

[896] The number of furnaces and forges that Richard Foley owned in Staffordshire is reported in William Page, ed., *VCH, Staffordshire*, vol. 2 (London, 1908), 115.

[897] John Speed's observations on the timber resources of Shropshire appear in Speed, *England, Wales, Scotland and Ireland*, chapter 35, section 4.

[898] G. Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," *Hunter Archaeological Society, Transactions*, vol. 8 (1961), 124, quotes "The Description of the Manor of Sheffield".

[899] Fynes Moryson, *An Itinerary … ,* 4 (Glasgow: James MacLehose and Sons, 1908), 196, is quoted on the forested condition of Ireland during the late sixteenth and early seventeenth centuries.

[900] *CSPI*, Series 1, 3, vol. 127, no. 74 (1586–1588), tells of Longe's glass factories in Ireland. It appears that Longe was not alone in advocating the destruction of the Irish woodlands to enhance English control over the Irish. In a document entitled "A Discourse on Ireland" and reproduced in ibid., 11 (1601–1603), 253, the author writes, "The woods and bogs are a great hindrance to us and help to the rebels, who can, with a few men, kill many of ours in a wood … " The author therefore concluded, "It would have been a better course to have burnt down all the woods … "

[901] Information on Sir Henry Wallop and his exploitation of the Irish woods is found in *CSPI*, Series 1, 6, vol. cxcl, no. 40 (1596–1597).

[902] In Lang, *Social England Illustrated*, 303, an advocate of using Irish woods to build English fishing boats is quoted.

[903] On the London merchants' schemes on the Irish woods, see *CSPI*, Series 2, 4 (1611–1614), 227.

[904] Concerning the competition between the king and private interests for the Irish woods, see *Acts*, vol. 34 (1615–1616), 123–124.

[905] Boate, *Ireland's Natural History*, chapter 15, section 3, discusses the felling of the Irish woods for making barrels

and casks.

[906] The proposal of the lord deputy of Ireland to the duke of Buckingham is in HMC, Series 23, *Twelfth Report,* Appendix 1, *Earl Cowper (Coke mSS),* 119.

[907] The Privy Council's order to the lord deputy appears in *APC,* vol. 34 (1615–1616), 124. 200. For the lord deputy's response, see *CSPI,* Series 2, 4 (1611–1614), 64–65.

[908] Gerard Boate is quoted in Boate, *Ireland's Natural History*, chapter 15, section 3.

[909] On Boyle's success in Ireland, see *CSPI,* Series 2, 4 (1611–1614), no. 818, and Leslie Stephen and Sidney Lee, *Dictionary of National Biography,* vol. 2 (1917–1982), 1022.

[910] Robert Cecil's high repute as a civil servant is confirmed in Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography,* vol. 3 (1917–1982), 1311.

[911] Robert Cecil's collusion with the lord deputy of Ireland to set up ironworks in Ireland is reported in *CSPI,* Series 2, 3 (1608–1610), 530.

[912] Ibid., 5 (1615–1625), 429, contains the suggestion that James should involve himself in the Irish iron industry.

[913] The official policy of conserving the Irish woods is well articulated in ibid., 4 (1611–1614), 369.

[914] Ibid., Series 3, 1 (1625–1632), p. 505, reports on the low price of cordwood in Ireland.

[915] Boate, *Ireland's Natural History*, chapter 16, section 6, tells of exporting British iron ore to Ireland for smelting and refining and then shipping the iron back to England.

[916] *CSPD Ch* (1625–1626), 521, quotes one of Charles's party.

[917] Concerning the eight commissioners' discussion, see HMC, Series 16, *Eleventh Report,* Appendix 1, *Salvetti Correspondence,* 80, and HMC, Series 23, *Twelfth Report,* Appendix 1, *Earl Cowper (Coke mSS),* 291.

[918] On the commission's decision to sell forests and parks to raise revenues, see HMC, Series 23, *Twelfth Report,* 294, and HMC, Series 16, *Eleventh Report,* Appendix 1, *Salvetti Correspondence,* 80.

[919] *CSPD Ch*, vol. 2 (1627–1628), 202, reports the commissioners' decision to sell woods and forests in the south and the reasons for their decision.

[920] Sir Miles Fleetwood's pledge to the commission is in HMC, Series 33, *Thirteenth Report,* Appendix 7, *Earl of Landsdale,* 51.

[921] Sir Miles Fleetwood's letter to his superior can be found in *CSPD Ch*, vol. 2 (1627–1628), 372.

[922] The king's appreciation of Sir Miles Fleetwood's work is in ibid., 377.

[923] Ibid., 573, tells of the grant to John Lord Mordaunt.

[924] On the agreement between the king and the Earl of Northampton, see *CSPD Ch*, vol. 3 (1628–1629), 239

[925] *CSPD Ch*, vol. 5 (1631–1633), 476, tells of the sale of roots and stumps to a court favorite.

[926] Thomas Wentworth, First Earl of Strafford, *The Earl of Stafforde's Letters and Dispatches,* vol. 2, ed. William Knowler (London, 1739), 117, discusses the king's enlargement of Rockingham Forest.

[927] Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography,* vol. 16 (1917–1982), 997, tell of the Earl of Holland's rapid rise in James's court and the reasons for his success.

[928] J. Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635) (London, 1864), 33, describes the Earl of Holland's attempt at legitimizing his tribunal.

[929] Ibid., 34–35, covers the proceedings of the forest court at Waltham.

[930] Concerning Charles's various options having won his day in court, see Thomas Rymer, *Foedera*, vol. 19 (1726–1735), 688–689.

[931] Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 5 and 65, tells of the competition between the government and the private sector for timber.

[932] On the doubling of the price of timber in twenty years' time, see Hart, *Royal Forest*, 95, and *CSPD Ch,* vol. 6 (1634), 191.

[933] *CSPD Ch*, vol. 5 (1631–1633), 199 and 308, gives the number of trees cut for shipbuilding in Hampshire.

[934] The navy's want of wood is told in Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 231.

[935] The new forests chosen by Charles to provide timber to build the "great ship" are listed in ibid., 499.

[936] On grants and contracts for the use of wood in the Forest of Dean, see *CSPD Ch*, vol. 2 (1627–1628), 314 (a cooper); *CSPD Ch*, vol. 1 (1625–1626), 538 (Edward Villiers); and HMC, Series 23, *Twelfth Report,* Appendix 1, *Earl Cowper (Coke mSS),* 387 and 446 (Coke's father-in-law).

[937] The charges of the merchants and shipowners of Bristol against Charles's grantees are found in John Latimer, *History of the Society of Merchant Venturers of the City of Bristol* (Bristol: J.W. Arrowsmith, 1903), 132–133.

[938] Samuel Gardiner, *History of England from the Accession of James I to the Outbreak of the Civil War, 1603–1642,* vol. 7 (1884), 362, tells about Sir Basil Brooke's destructive ways.

[939] The order of ironmasters to their workmen is in HMC, Series 23, *Twelfth Report,* Appendix 1, *Earl Cowper (Coke mSS),* 446.
[940] Ibid., 429–430, provides the account of the riots in the Forest of Dean.
[941] Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 607, outlines the steps recommended by the lord treasurer and the chancellor of the exchequer to preserve the timber. The bidding for cordwood and its effect on its price are presented in *CSPD Ch*, vol. 8 (1635), 83.
[942] The shipwrights' alternative proposal is in Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 561–562.
[943] On the unauthorized exploitation of the Forest of Dean, see *CSPD Ch*, vol. 6 (1633–1634), 292 (by shipbuilders), and Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 487 (by ironmasters).
[944] The report prepared for Charles on the resources of the forest appears in *CSPD Ch*, vol. 13 (1638–1639), 531.
[945] On Sir John Winter's offer, see *CSPD Ch*, vol. 15 (1639–1640), 567; *CSPD Ch*, vol. 13 (1638–1639), 276; and *Journals*, vol. 8 (1660–1667), 489.
[946] Henry Nicholls, *The Personalities of the Forest of Dean* (London: John Murray, 1863), 118, quotes the Parliamentary party's petition against Sir John Winter.
[947] On Sir John Winter's rapid destruction of the forest's trees, see Hart, *Royal Forest*, 129.
[948] Evelyn, *Sylva* (1664), 108, tells of the alleged plan of the Spanish to destroy the Forest of Dean.
[949] The treason quote by one opponent of Charles's regime is from Silvanus Taylor, *Common Good* (London, 1652), 32.
[950] "An Act for the certainty of forests … " is found in Laws, vol. 7, 16 *Charles I*, chapter 16.
[951] The quote on the earl of Southampton's reaction to the loss of his woodlands is in Wentworth, *The Earl of Stafforde's Letters and Dispatches,* vol. 1, 467.
[952] The grant to the earl of Lindsay is found in HMC, Series 23, *Twelfth Report,* Appendix 1, *Earl Cowper (Coke mSS),* 447.
[953] *HMC,* Series 3, *Fourth Report*, 464, quotes the Oxford University officials' complaint against the Earl of Lindsay.
[954] The abuse in these forests is attested to in *CSPD Ch*, vol. 5 (1631–1633), 331–332.
[955] Bruce, ed., *CSPD Ch*, vol. 7 (1634–1635), 514, and *CSPD Ch*, vol. 8 (1635), 134, give the number of trees felled in Chopwell Woods and West Park for the Royal Navy.
[956] *CSPD Ch*, vol. 11 (1637), 378, gives the number of timber trees remaining in Chopwell Woods and West Park.
[957] A.L.'s remarks are found in A.L., *A Relation of Some Abuses which are Committed Against the Commonwealth,* Camden Society (Great Britain) (1629), Publication no. 61.
[958] R.H. Whitelocke, *Memoirs of Bulstrode Whitelocke 1626–1628* (London, 1873), 46, tells of buying wood by the pound at Dartmouth.
[959] *CSPD Ch*, vol. 11 (1637), 290–291, covers the conflict between John Brown and the clothiers of Kent.
[960] John Winthrop's "Common Grievances Growning for Reformation" appears in J. Winthrop, *Winthrop Papers,* vol. 1 (1498–1628) (Boston: Massachusetts Historical Society, 1929), 297–298.
[961] The former mayor of Coventry is quoted in *CSPD Ch*, vol. 15 (1639–1640), 599.
[962] Carl Bridenbaugh, *Vexed and Troubled Englishmen* (New York: Oxford University Press, 1968), 100, tells of the theft of a piece of firewood.
[963] A full account of the fuel crisis in London during 1643 is given in *Acts & Ordinances*, vol. 1, 63 and 303.
[964] On the fate of the earl of Thanet's timber, see *Proceedings,* vol. 2, 839.
[965] The description of the suffering because of the scarcity of fuel appears in Hugh Adamson, *Sea-Coale, Char-Coale and Small-Coale* (London: Hugh Adamson, 1643).
[966] A compassionate observer's remarks on the suffering of the poor are found in John Nef, *The Rise of the British Coal Industry,* vol. 1 (London: George Routledge and Sons, 1932), illustration facing p. 247.
[967] The commissioners' responsibilities are set out in *Acts & Ordinances,* vol 2, 332.
[968] *Proceedings,* vol. 1, 484, contains Parliament's decision to pay its soldiers by the sale of trees.
[969] *Acts & Ordinances,* vol. 1, 423 and 457, reproduces the decision to place at the disposal of the navy and armed forces wood belonging to the king's party.
[970] HMC, Series 4, *Fifth Report,* 11, relates how George, Earl of Desmond, paid his assessment.
[971] *Acts & Ordinances,* vol. 2, 785, records Parliament's decision to sell trees standing on the king's lands.
[972] Ibid., 993, tells of selling wood from four of the seven previously exempt forests.
[973] The Commonwealth forces built the most powerful fleet in Europe according to Charles Derrick, *Memoirs of the Rise and Progress of the Royal Navy* (London: H. Teape, 1806), 77.

[974] The quote on English colonizers felling Irish woods appears in Boate, *Irelands Natural History*, chapter 15, section 3.
[975] Ibid., chapter 15, section 5, gives an account of the destruction of the woods in Ulster and Munster.
[976] A survey of England's forest resources at the beginning of Charles II's reign appears in Evelyn, *Sylva*, vol. 2 (1786), 278.
[977] "A Parliamentary Survey of Ashdown Forest" is found in J. Daniel-Tyssen, "The Parliamentary Surveys of the County of Sussex," *Sussex Archaeological Collections* 23 (1871): 266.
[978] *CSPD Ch II*, vol. 28 (Addenda 1660–1685), 42, and *Journals*, vol. 43 (1787–1788), 564, provide the pessimistic assessment of the condition of the Forest of Dean.
[979] The concerned forester is quoted in Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, Commonwealth*, vol. 13 (1659–1660), 413.
[980] The contents of the petition presented to the new king by an association of ship wrights are found in *CSPD Ch II*, vol. 28 (Addenda 1660–1685), 327.
[981] Remarks by Evelyn on the spoilation of the woods by supporters of the Commonwealth are in Evelyn, *Sylva*, (1664), "To the Reader". Because of Evelyn's royalist leanings, he did not mention the destruction of the woods during Charles I's reign. [Evelyn, *Sylva* (1664), is the first edition of the work. Other editions are also cited in the notes. They contain the same material but with different pagination.].
[982] Evelyn's plea for universal planting is found in ibid., 2.
[983] Evelyn's advice to would-be planters is in ibid.
[984] On the record sales of *Sylva*, see John Evelyn, *Sylva* (1669), "The Epistle Dedicatory."
[985] Ibid., tells of the many letters Evelyn received.
[986] *Journals*, vol. 8 (1660–1667), 156, and *Journals*, vol. 43 (1787–1788), 564, tell of the king's desire to preserve the timber in the Forest of Dean.
[987] Concerning the prevailing preservation sentiment of the House of Commons, see *Journals*, vol. 8 (1660–1667), 46.
[988] *Journals*, vol. 43 (1787–1788), 565, gives the number of trees left in the Forest of Dean in 1667.
[989] On the inhabitants of the Forest of Dean relinquishing their rights, see ibid., 49.
[990] Concerning Sir John Winter's reputation, see Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography*, vol.
21 (1917–1982), 686.
[991] The "Dean Forest (reafforestation) Act" is reproduced in Laws, vol. 8, 20 *Charles II*, chap. 3.
[992] The lawmakers' pathetic reference to the forest appears in Hart, *Royal Forest*, 296.
[993] The judgment of the lords of the treasury upon the king's ironworks is found in Great Britain, Public Records Office, *Calendar of Treasury Books*, vol. 4 (1672–1675), 228 and 489.
[994] The complaint of Charles Pett is in *CSPD Ch II*, vol. 4 (1664–1665), 319.
[995] The ominous warning by Charles Pett appears in *CSPD Ch II*, vol. 5 (1665–1666), 23.
[996] The description of the London fire appears in *CSPD Ch II*, vol. 6 (1666–1667), ix, and Laws, vol. 8, 20 *Charles II*, chap. 3.
[997] The quote on needing timber to rebuild London is in *CSPD Ch II*, vol. 8 (Nov. 1667–Sept. 1668), 489.
[998] A candid account by a naval shipwright of his negotiations is in ibid., 41.
[999] On the problems experienced by one naval official at the bargaining table, see *CSPD Ch II*, vol. 9 (Oct. 1668–Dec. 1669), 338.
[1000] Ibid., 290, gives the reasons for the Privy Council's decision.
[1001] Andrew Yarranton's quotes on the problem of finding timber appear in Andrew Yarranton, *England's Improvement by Sea and Land*, vol. 2 (London, 1677–1681), 61.
[1002] Sir Anthony Deane is quoted in J. Tanner, ed., *A Descriptive Catalog of the Naval Manuscripts in the Pepysian Library at Magdalene College, Cambridge*, vol. 1 (London: Navy Records Society, 1903), 49–50.
[1003] Yarranton's quote on where good timber remained is found in Andrew Yarranton, *England's Improvement by Sea and Land*, vol. 1 (London, 1677–1681), 61.
[1004] Ibid., 31, quotes Yarranton on the difficulty of timber carriage from Shelela.
[1005] Yarranton, *England's Improvement by Sea and Land*, vol. 2, 80, quotes Yarranton on the difficulty of timber carriage from remote areas of Sussex and Surrey.
[1006] Daniel Defoe writes about large timber in great quantity in remote areas of Sussex in D. Defoe, Letter 2: "Containing a Description of the Seacoasts of Kent, Sussex, Hampshire, and of parts of Surrey," in *A Tour*

Through the Whole Island of Great Britain (1962), 128.
[1007] Defoe's account of the carriage of trees appears in ibid., 128–129.
[1008] Samuel Pepys's lament is found in J. Tanner, ed., *Samuel Pepys's Naval Minutes* (London: Navy Records Society, 1926), 75.
[1009] On the dry-docked warships, see Yarranton, *England's Improvement by Sea and Land,* vol. 2, 59.
[1010] *Collection* 16, no. 489 (1701), reprints the chief shipwrights' conclusions about Baltic plank.
[1011] The critics' opinions about the navy's reliance on foreign timber appear in *Journals,* vol. 47 (1792), 265, and Thomas Hale, *An Account of Several New Inventions and Improvements Now Necessary for England* (London, 1691), 14.
[1012] The counterarguments to the critics of the navy's use of foreign timber are published in *Collection* 16, no. 491 (1701).
[1013] John Houghton's proposal for a strategic timber reserve is in ibid., no. 224. King James II's assessment of using foreign plank is in ibid., no. 490.
[1014] The correspondent's report on the fuel change at the saltworks in Worcestershire is found in T. Rastell, "An Account of the Salt Waters of Droytwich in Worcestershire," *Royal Society of London, Philosophical Transactions* 12 (1678): 1062. John Houghton attributes the change from wood to coal to "the iron works in the Dean Forest [that] have destroyed" all the wood *[Collection* 9, no. 214 (1696)].
[1015] John Houghton's remark on the people of Staffordshire changing to coal is in *Collection* 11, no. 253 (1697).
[1016] John Houghton's report on the widespread use of coal in industry comes from ibid., no. 241.
[1017] John Evelyn's critique of the use of coal in London is in John Evelyn, *Fumifugium* (London, 1661).
[1018] Ibid., 19, gives Evelyn's description of the filth spewing from chimneys.
[1019] The transformation of rain and dews by coal smoke appears in ibid., 20.
[1020] The canopy metaphor appears in ibid., 33.
[1021] John Houghton's quote on the ease of obtaining imported supplies of wood appears in *Collection* 2 (1683): 70 and 72.
[1022] John Houghton's open declaration favoring the destruction of timber is found in *Collection* 8, no. 174 (1695).
[1023] John Houghton's acceptance of the liberal economic doctrine is demonstrated in ibid. (1695), 2 #36.
[1024] On Houghton's real-life example of the economic advantage of ridding the land of trees, see *Collection* 2 (1683): 51–52.
[1025] Concerning Houghton's demonstration of the economic and social benefits of deforestation, see ibid., 52.
[1026] On Houghton's boast that many people were destroying their woods, see *Collection* 11, no. 288 (1698).
[1027] The eighteenth-century theologian is quoted in *Journals,* vol. 47 (1792), 343.
[1028] Robert Plot's observation on the use of coal is in *VCH, Staffordshire,* vol. 2 (1967), 114.
[1029] The confirmation of Plot's observations comes from Henry Powle, "An Account of Iron-Works in the Forest of Dean," *Philosophical Transactions of the Royal Society of London* 12 (1677): 934.
[1030] The claims of an inventor in 1589 are in Tawney and Power, *Tudor Economic Documents,* vol. 2, 263.
[1031] Dud Dudley is quoted in Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography,* vol. 6 (1917–1982), 99.
[1032] Gabriel Plattes's quote is found in Plattes, *A Discovery of Infinite Treasure, Hidden Since the World's Beginning,* 9.
[1033] Thomas Fuller's quotes are in Thomas Fuller, *The History of the Worthies of England,* vol. 2 (1662), 97.
[1034] Samuel Johnson's praise for Thomas Pennant appears in Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography,* vol. 15 (1917–1982), 767.
[1035] John Evelyn's instructions to landowners on raising trees to sell as fuel are found in Evelyn, *Silva,* vol. 2 (1786), 161–162.
[1036] Alfred Fell, *The Early Iron Industry of Furness and District* (London: Frank Cass and Co., 1968), 124, quotes Thomas Pennant on the success of the landowners in raising trees to fuel the ironworks and their system of crop rotation.
[1037] Yarranton's thanks to the iron industry for the number of trees standing appear in Yarranton, *England's Improvement by Sea and Land,* vol. 2, 72. The amount of trees grown for the iron industry remains a hotly contested issue to this day. Joshua Gee, a writer on economic issues during the early eighteenth century, took issue with Yarranton's claim. "It has been alleged our iron is made with copps-wood [coppice wood] and we should not have consumption enough for it, were it not for iron works," Gee wrote, in an obvious reference to Yarranton's claim. "But I believe," he countered, "upon proper enquiry, it will be found that copps-wood is

chiefly used for drawing [pig iron] into bars, which bears but a small proportion of the consumption of wood to that of melting down the oar [ore] into [pig iron]" [Joshua Gee, *A Letter to a Member of Parliament, Concerning the Naval Store-Bill* (London, 1720), 42].

[1038] Yarranton notes the destruction of old trees for fuel and the lack of timber growing in coppices in Yarranton, *England's Improvement by Sea and Land*, vol. 2, 71–73. The term "load" was the standard measurement for timber. It developed from the carrying capacity of a regular timber wagon, which was a little over a ton [Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy 1652–1862*, 103].

[1039] John Evelyn's admonishment to those raising trees appears in Evelyn, *Sylva*, vol. 2 (1786), 162. The law in question is Laws, vol. 5, 35 *Henry VIII*, chap. 17.

[1040] The ironmaster's testimony is in *Journals*, vol. 23 (1738), 114.

[1041] Josiah Tucker, *The Case of the Importation of Bar-Iron from Our Own Colonies of North America* (London: Thomas Trye, 1756), 23, tells of the damage done to timber trees by cropping them for fuel. The author, Josiah Tucker, is described by a twentieth-century scholar as "an eminent economist" [E. Hulme, "Statistical History of the Iron Trade of England and Wales, 1717-1750," *Transactions of the Newcomen Society* 9, no. 1 (1928): 29].

[1042] Concerning the destruction of timber trees by fuel cutters and tanners, see Yarranton, *England's Improvement by Sea and Land*, vol. 2, 74–75.

[1043] Ibid., 75–77, describes the bailiff, clerk, fuel cutter, charcoal maker, and ironmaster's destruction of timber trees.

[1044] The description of the proto-railroad's rails appears in Charles Lee, "Tyneside Tramroads of Northumberland," *Transactions of the Newcomen Society* 26, no. 1 (1947), 202.

[1045] Gabriel Jars's description of the ties appears in C. Lee, "The Wagonways of Tyneside," *Archaeologia Aeliana Series 4* 29 (1951), 148.

[1046] The wife of a major eighteenth-century coal user is quoted in Arthur Raistrick, *Dynasty of Iron Founders* (Newton Abbot: David and Charles, 1970), 174.

[1047] Nef, *The Rise of the British Coal Industry*, vol. 2, 385, no. 4, compares the efficiency of coal carriage by wagons that relied on roads and wagons that used rails.

[1048] The quote concerning the exhaustion of nearby coal pits appears in Lee, "The Wagonways of Tyneside," 137.

[1049] John Francis, *A History of the English Railway* (London: Longman, Brown, Green, and Longmans, 1851), 47, attests to the popularity of wagonways by 1750.

[1050] Nef, *The Rise of the British Coal Industry*, 384, no. 5, lists the types of wood used for rails. Lee, "The Wagonways of Tyneside," 142, provides the data concerning the amount of wood used to build a wagonway.

[1051] Gabriel Jars's brother's observation on the traffic along wagonways appears in ibid., 148.

[1052] The testimony of a county official from Derbyshire is in *Journals*, vol. 47 (1792), 330. Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," 132, tells of ironmasters diverting their wood to sell to wagonway builders.

[1053] Robert Fulton's boast on the number of canals built is in Robert Fulton, *A Treatise on the Improvement of Canal Navigation* (London: I. and J. Taylor at the Architectural Library, 1796), 11.

[1054] James Brindley's contention appears in J. Phillips, *A Treatise on Inland Navigation* (London, 1801), 114.

[1055] On the purchase of woodlands by the builders of the canal from Chesterfield to Stockworth, see Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," 131.

[1056] Richard Whitworth's listing of the carriage of farm products by land is reproduced in Phillips, *A Treatise on Inland Navigation*, 145.

[1057] The timber purveyor is quoted in *Journals*, vol. 47 (1792), 292.

[1058] The discussion of a county official from Derbyshire with the commission is in ibid., 325.

[1059] The description of water-powered machinery by an eighteenth-century Derbyshire man is found in ibid., 338.

[1060] A land surveyor's testimony to the commission appears in ibid., 306.

[1061] The offer of gold medals for planting and husbanding trees is in *Transactions of the Society, Instituted at London, for the Encouragement of Arts, Manufactures, and Commerce*, 3rd edition, vol. 1 (1806), 6–82.

[1062] Herbert Heaton, *Yorkshire Woolen and Worsted Industries* (Oxford: Clarendon Press, 1965), 333, describes the heating of the combs by combmen.

[1063] The account books in question are mentioned in A. Raistrick and E. Allen, "The South Yorkshire Ironmasters (1690–1750)," *Economic History Review* 9, no. 2 (1939), 177, https://doi.org/10.2307/2590222.

[1064] James Brindley is quoted on timber in Phillips, *A Treatise on Inland Navigation*, 175.

[1065] The quote on the wagonways' effect on the availability and price of wood appears in Raistrick, *Dynasty of Iron Founders*, 174.

[1066] Raistrick and Allen "The South Yorkshire Ironmasters (1690–1750)," 177, tell of the consequence of combmen and ironmasters competing for charcoal supplies.
[1067] Concerning changes in the amount of wood allocated with leases in the Sheffield region, see Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," 133.
[1068] The complaint of an ironmaster in the Midlands appears in R. Shafer, "Genesis and Structure of the Foley 'Ironworks in the Partnership' of 1692," *Business History* 13, no. 1 (1971): 24, https://doi.org/10.1080/00076797100000002
[1069] B. Johnson, "The Stour Valley Iron Industry in the Late Seventeenth Century," *Transactions of the Worcestershire Archaeological Society* 27 (1950): 38–39, gives the distances ironmasters in the Stour valley went for charcoal.
[1070] The distance ironmasters in Montgomeryshire, Wales, had to go for fuel is told by S. Davies, "The Charcoal Industry of Powys Land," *Collections Historical and Archaeological Relating to Montgomeryshire* 46 (1939): 32.
[1071] Concerning how far the Backbarrow works went for charcoal, see Fell, *The Early Iron Industry of Furness and District*, 130–131.
[1072] John Fuller's letter is reproduced in Herbert Blackman, "Gunfounding at Heathfield in the XVIII Century," *Sussex Archaeological Collections* 67 (1926): 46.
[1073] Fell, *The Early Iron Industry of Furness and District*, 437, reports the price charged for charcoal in northern Lancashire. 236. *CSPD Ch II*, vol. 28 (Addenda 1660–1685), 503, gives the amount an ironmaster could earn from a single forge or furnace.
[1074] Leonard Gale's testimony to his grown sons appears in Robert Blencowe, "Extracts from the Memoirs of the Gale Family," *Sussex Archaeological Collections* 12 (1860): 47–49.
[1075] Thomas Foley's success is told in *VCH, Worcestershire*, vol. 2 (1901), 269.
[1076] Fell, *The Early Iron Industry of Furness and District*, 135, reports the scavenging of slag for charcoal in northern Lancashire.
[1077] Ibid., 125 and 137, reports the purchase of wood in Scotland by northern Lancashire ironworks.
[1078] Smelting Roman iron slag in Worcestershire is discussed in Yarranton, *England's Improvement by Sea and Land*, vol. 2, 59–60.
[1079] Fell, *The Early Iron Industry of Furness and District*, 143, discusses joint purchasing efforts in northern Lancashire.
[1080] Raistrick and Allen "The South Yorkshire Ironmasters (1690–1750)," 177, report on the ironmasters of South Yorkshire supplying the combmen with charcoal.
[1081] Concerning the necessity of new machinery because of expensive fuel, see *Interest*, 4–5.
[1082] Yarranton's observation of the removal of forges from their furnaces is found in Yarranton, *England's Improvement by Sea and Land*, vol. 1, 57.
[1083] Hammersely, "The Charcoal Industry and Its Fuel 1540–1750," 600, estimates the amount of iron produced between 1600 and 1610. B. Johnson, "The Midland Iron Industry in the Early Eighteenth Century: The Background of the First Successful Use of Coke in Iron Smelting," *Business History* 2, no. 2 (1960): 69, estimates the amount of iron produced at the beginning of the eighteenth century, https://doi.org/10.1080/00076796000000002. Concerning the rise in imports of iron, see Hammersely, "The Charcoal Industry and Its Fuel 1540–1750," 603.
[1084] On the amount of iron imported from abroad in 1696, see *Collection*, no. 267 (1697).
[1085] The quote of the pamphleteer sympathetic to the iron industry is found in *Interest*, 7.
[1086] Eli Heckscher, *An Economic History of Sweden*, trans. Göran Ohlin (Cambridge: Harvard University Press, 1963) 180, quotes a Swedish visitor to England.
[1087] Malachy Postlethwayt's statement is from Malachy Postlethwayt, *Considerations on the Making of Bar Iron with Pitt or Sea Coal Fire* (London, 1747), 2.
[1088] The quote regarding insufficient "wood coal" comes from ibid.
[1089] An authority friendly to the industry is quoted in *Interest*, 9. Another pamphlet in support of the iron industry also confessed, "Cord wood, the want of a proper Quantity of which is the only Disadvantage we labour under" (*Reflections on the Importation of Bar Iron from Our Own Colonies of North America* (1757), 4). It cannot be overemphasized that the lack of wood was the major restraint to increased iron production in eighteenth-century England. In 1737, for instance, a bevy of pamphlets and newspaper articles championed the importation of American pig iron because, they argued, "we could not increase home production by reason of our woods so far exhausted," according to David Macpherson, who compiled economic material during the late eighteenth century

[David Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3 (London, 1805), 214].

[1090] The testimony of a gunfounder is in Blackman, "Gunfounding at Heathfield in the XVIII Century," 38.

[1091] The confession of one ironmaster comes from Sheffield Public Library, *Manuscripts Collection*, MS 118, 14.

[1092] John Parsons, "The Sussex Iron Works," *Sussex Archaeological Collections* 32 (1882): 25, presents the English ironmasters' contention.

[1093] Gabriel Jars gives a more objective analysis on why Swedish ironmasters could undersell their counterparts in G. Jars, *Voyages Metallurgiques*, vol. 3, 8th Memoire (Paris, 1781).

[1094] Karl-Gustaf Hilderbrand, *Fagerstabrukens Historia* (1957), 264–265, discusses the Swedish government's intervention in the nation's iron production.

[1095] Joshua Gee makes his point in Gee, *A Letter to a Member of Parliament, Concerning the Naval Store-Bill*, 15.

[1096] In the neighborhood where Darby's furnace was located, wood was sold for fifteen shillings per cord in 1720, almost fifteen times what it cost in Sussex a hundred years before. Darby had to pay nearly three pounds per load of charcoal. The cost of wood contributed to over three-quarters of the price of the charcoal purchased by Darby [R. Mott, "The Shropshire Iron Industry," *Transactions of the Shropshire Archaeological and Natural History Society* 56 (1958): 75].

[1097] Darby's daughter-in-law's account of Darby's experimentation with coal is in Raistrick, *Dynasty of Iron Founders*, 35.

[1098] On Darby's talks with William Rawlinson, see ibid., 41.

[1099] Sheffield Public Library, *Manuscripts Collection*, MS 118, 5 and 26, clearly show that refiners used coked coal.

[1100] Sheffield Public Library, *Manuscripts Collection*, *John Spencer Diary MSS*, tells of several furnaces mixing coal with charcoal.

[1101] The correspondent's report on Abraham Darby II's success appears in Charles Mason, "A Letter from the Rev. Mr. Mason, Woodwardian Professor at Cambridge … Concerning Spelter, Melting Iron with Pit-Coal, and a Burning Well at Broseley", *Philosophical Transactions of the Royal Society of London* 44 (1747): 371.

[1102] Josiah Tucker presents the reasons for the growing scarcities of timber in the mid-1700s in Robert Schuyler, ed., *Josiah Tucker: A Selection of His Economic and Political Writings* (New York: Columbia University Press, 1931), 120–121.

[1103] Tucker, *The Case of the Importation of Bar-Iron from Our Own Colonies of North America*, 10–11, notes the doubling of the price of cordwood by 1750. James Wheeler, *The Modern Druid* (London, 1747), 121, also noted, " … the present rise in value of [oak]. …".

[1104] On iron furnaces going out of blast early because of fuel problems, see A. Raistrick, "The South Yorkshire Iron Industry, 1698–1756," *Transactions of the Newcomen Society* 19, no. 1 (1938): 81.

[1105] The closing or conversion of most of the iron furnaces burning charcoal fuel between 1750 and 1788 is described in *An Account of Charcoal Blast Furnaces which Have Declined Blowing Since the Year 1750 Owing Either to Want of Woods or the Introduction of Making Coke Iron*, Birmingham Reference Library, Boulton and Watt MSS, Muirhead 2. The fate of charcoal-burning furnaces in Sheffield during this time period apparently typifies what was happening throughout England. The Foxbrooke furnace was described in 1749 to be "now ruinous and in great decay." Between 1750 and 1765 the Kirkby furnace was not in blast and the Whately furnace was in blast only twice. Barnaby and Bank furnaces had to be shut down in 1774 [Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," 133].

[1106] Estimating the amount of iron produced in England with charcoal after 1750 is a tricky business. Most of the figures come from pamphlets published in the heat of a recurring political debate focused on whether or not to import pig and bar iron from the American colonies (see Chapter 13 for a detailed account of the controversy). Those favoring American imports emphasized the inability of British ironmasters to provide adequate supplies of iron. They therefore biased their figures to minimize home production, claiming, in 1750, that England produced only about eight thousand tons of bar iron in 1749 [*An Answer to Some Considerations on the Bill for Encouraging the Importation of Iron from America* (1750)]. On the other hand, English ironmasters, who wished to keep American iron imports out of England, exaggerated production figures to show that the industry did not need help from abroad. A pamphlet issued by the ironmasters states that "upward of twenty thousand tons" were produced (Sheffield Public Library, *Manuscripts Collection*, MS 118, 7). A third estimate of English bar iron production comes in a letter written by Josiah Broadbent, an English ironmaster. He estimated that the English iron industry manufactured about 12,000 to 13,000 tons of bar iron (Sheffield Public Library, *Manuscripts Collections*, MS 118, 14). Broadbent's estimate seems more reliable than the political tracts' figures since he appears to be knowledgeable about the English iron industry and presented the figures to edify a friend rather than

as political propaganda. Furthermore, Broadbent's figures agree with other contemporary estimates. An authority on the coal industry, for instance, wrote in 1801 that "the quantity of bar iron made in Great Britain when wood only was used for that purpose … on account of the scarcity of wood, was reduced to less than 13,000 tons at the time when the mode of making iron with mineral coal was introduced [i.e., ca. 1750]" [H. McNab, *Observations on the Probable Consequences of Even Attempting by Legislative Authority to Obtain a Large Supply of Coal …* (1801), 49].

[1107] On the trebling of cast iron output, see Charles Hyde, *Technological Change and the British Iron Industry 1700–1800* (Princeton: Princeton University Press, 1977), 220.

[1108] Shiploads of foreign scrap iron, for instance, supplied the forge of Henry Cort [Reginald Mott, *Henry Cort, the Great Finer*, ed. Peter Singer (London: The Metals Society, 1983), 26]. Another forge, Carburton in Sheffield, received 870 tons of scrap iron in six years [Hopkinson, "The Charcoal Iron Industry in the Sheffield Region 1500–1775," 145]. Forges throughout England remelted a wide variety of scrap iron, ranging from their own worn-out iron materials such as discarded anvils to old cannons from Sweden [Raistrick, "The South Yorkshire Iron Industry, 1698–1756," 71 & 73].

[1109] Tucker, *The Case of the Importation of Bar-Iron from Our Own Colonies of North America*, 13, reports on the poor quality of English bar iron because of the expense of charcoal.

[1110] On the amount of bar iron imported to England in 1750, see Sheffield Public Library, *Manuscripts Collection,* MS 118, 14. McNab, *Observations on the Probable Consequences of Even Attempting by Legislative Authority to Obtain a Large Supply of Coal …*, 49, provides data on the dramatic rise in bar iron imports during the late 1700s. Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation,* vol. 3, 4–47, calculates that England imported a little over 44,000 tons of bar iron in 1776. J. Lucas, "Antiquities and History of the Parish and Parish Church of Warton in Lancashire," *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society* 8 (new series) (1908): 36–37, quotes from a manuscript written in 1780 which states, "… the Swedes … do yet furnish us with near 2/3 of the iron wrought up and consumed in this kingdom. …"

[1111] Darby's partner's communication to the president of the Privy Council is found in Raistrick, *Dynasty of Iron Founders*, 96.

[1112] Darby's wife is quoted on Darby's discovery in ibid., 68–69.

[1113] The drinking song is found in A. Palmer, "John Wilkinson and the Old Bersham Ironworks," *Transactions of the Honourable Society of Cymmrodorian Society* (1897-1898): 42–43.

[1114] Darby's partner's statement in 1784 appears in Raistrick, *Dynasty of Iron Founders*, 96.

[1115] Henry McNab is quoted in McNab, *Observations on the Probable Consequences of Even Attempting by Legislative Authority to Obtain a Large Supply of Coal …*, 49.

[1116] G. Jars, 15th Memoire (1774), tells that his brother was sent to England as an industrial spy.

[1117] Jars's quote on stone coal use in England appears in ibid.

[1118] The two surveys of the five forests appear in *Journals*, vol. 47 (1792), 351.

[1119] The conclusion of the special commission appointed by the House of Commons is in ibid., 271. The increasing value of timber over the years reflected its growing scarcity. Between the time of James I and 1792, the value of ship timber had increased sixfold, according to a report to the House of Commons (ibid., 266).

[1120] Thomas Pownall's quotes on forest matters are from Thomas Pownall, *Topographical Description of the Dominions of the United States of America* (Pittsburgh: University of Pittsburgh, 1949), 23.

[1121] Thomas Nicols is quoted in Richard Hakluyt, *The Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation*, vol. 6 (Glasgow: James MacLehose and Sons, 1904), 135.

[1122] Gerald Crone, ed., *The Voyages of Cadamosto* (London: Hakluyt Society, 1937), 8–9, tells of the naming of Madeira for its timber.

[1123] Cadamosto is quoted in ibid.

[1124] Diego Gomes's complaint is found in Vitorino Godinho, *Documentos sobre a Expansao Portugesa,* vol. 1 (1943–1956), 100.

[1125] Another early chronicler's comments appear in V. Fernandes, "Chronicas das Ilhas do Atlanta," *Revista Portugueza Colonial e Mahtima* (1899–1900): 163.

[1126] The reminiscence of one of the original exploration party appears in F. Alcoforado, *The Affecting Story of Lionel and Arabella …* (London: R. Griffiths, 1756), 33.

[1127] Vitorino Godinho, *Documentos sobre a Expansao Portugesa,* vol. 3 (1943–1956), 308, tells of Henry the Navigator bringing sugarcane to Madeira.

[1128] Doutor Gaspar Frutuoso, *Saudades da Terra, Livro 2, Madeira* (1586–1590), Capitulo Decimo Segundo.

[1129] Caddeo Rinaldo, ed., *Le Navigazioni Atlantiche di Alvise da Cà da Mosto* (1929), in *Viagens de Luis de Cadamosto e de Pedro de Sintra* (Academica Portuguesa de Historia, 1949), 9–13. Marilyn Newitt, trans., *The Portuguese in West Africa, 1415-1670: A Documentary History* (Cambridge: Cambridge University Press, 2010), 56.

[1130] A sixteenth-century traveler visiting a neighboring island is quoted in Samuel Purchas, *Hakluytus Posthumus or Purchas His Pilgrims*, vol. 18 (Glasgow: James MacLehose and Sons, 1906), 366.

[1131] The description of the "sweet inferno" is given by Rosario Gregorio, *Opere Rare Edite e Inedite Riguardanti la Sicilia* (Palermo, 1873), 752.

[1132] The amount of wood used in boiling cane on Madeira in 1494 is derived from the fact that 2,606,612 pounds of sugar were produced that year [Virginia Rau and Jorge de Macedo, *O Azucar da Madeira nos Fino do Seculo* XV (Lisbon, 1962), 13] and that for each pound of sugar produced, 46 pounds of wood were used [D. Domingos do Loreto Couto, *Desagravos do Brasil e Glorias de Pernambuco* (Fundação de Cultura, Cidade do Recife, 1981), Section 84.].

[1133] G. Frutuoso, *Saudades da Terra, Livro 2* (1876), 17, tells of the wood consumption of four of Madeira's sugar mills.

[1134] The lumberjacks' work on Madeira is told in ibid.

[1135] Doutor Gaspar Frutuoso, *Saudades da Terra, Livro 2, Madeira* (1586–1590), Capitulo Decimo Segundo.

[1136] Crone, ed., *The Voyages of Cadamosto*, 9, has Cadamosto's report on the sawmills.

[1137] Fernandes, "Chronicas das Ilhas do Atlanta," 163, tells of the examination of samples.

[1138] Gomes Eannes de Zurara, *The Chronicles of the Discovery and Conquest of Guinea,* trans. Charles Beazley and Edgar Presage, vol. 1, chap. 5 (1896), 18, testifies that the Portuguese received much lumber from Madeira.

[1139] The report by Sebastian Munster appears in Richard Eden, *The First Three English Books on America*, The Second Book (Birmingham, 1885), 404.

[1140] Gomes Eannes de Zurara, *The Chronicles of the Discovery and Conquest of Guinea,* trans. Charles Beazley and Edgar Presage, vol. 2: *The History of the Other Voyages of Prince Henry's Captains* (1899), 300.

[1141] For the chronicler Jerónimo Dias Leite's account, see João Franco Machado, ed., *Descobrimento da Ilha da Madeira* (Coimbra: University of Coimbra, 1949), 20.

[1142] Columbus's flagship was defined as a "nao" (C. Colón, *Diario de Colon* (Madrid: Yagues, 1962), Miercoles, 24 de Octubre, Folio 17), which translated means "a large … ship" [*A New Dictionary of the Spanish and English Languages*, Part the First, vol. 2 (1798), 421 and 425].

[1143] Columbus's orders to his crew to watch for land appear in Cecil Jane, trans., *The Journal of Christopher Columbus* (1960), 22.

[1144] Columbus's quote on the trees of Española is found in C. Colón, *Carta a Luis de Santángel* (1493).

[1145] Charles Ley, *Portuguese Voyages, 1498–1663* (London: J.M. Dent, 1953), 56, quotes, on Brazil's trees, a member of the first crew to land there.

[1146] Samuel Purchas, *Hakluytus Posthumus or Purchas His Pilgrims*, vol. 2 (Glasgow: James MacLehose and Sons, 1905), 75, and ibid., vol. 17 (1906), 262, tells of the prolific number of brazilwood trees sighted on the Brazilian mainland.

[1147] The priest-author is quoted on the woods of the New World in ibid., 15 (1906), 120.

[1148] The description of the giant trees and monstrous beast is found in Eden, *The First Three English Books on America*, The First Book, 98.

[1149] John Poyntz, *The Present Prospect of the Famous and Fertile Island of Tobago* (London, 1683), 13–15, describes the land animals of Tobago.

[1150] The various birds on Tobago are discussed in ibid., 24–26.

[1151] The complaint of an English military man is in V.T. Harlow, ed., *Colonising Expeditions to the West Indies and Guiana* (London: The Hakluyt Society, 1925), 69–70.

[1152] John Davis's quote comes from his translation of C. de Rochefort, *The History of the Caribby Islands* (London, 1666), 4.

[1153] Richard Ligon's love affair with the palmetto royal is in Richard Ligon, *A True and Exact History of the Island of Barbados* (London, 1657), 75.

[1154] The quotes on birds for human consumption appear in Poyntz, *The Present Prospect of the Famous and Fertile Island of Tobago*, 25–26.

[1155] Richard Ligon's appraisal of trees for their practical uses is found in Ligon, *A True and Exact History of the Island of Barbados*, 41.

[1156] Ligon's satisfaction is told in ibid., 78.
[1157] On the fertility of the West Indies, see Colón, *Diario de Colon,* 16 de Octubre, Folio 13; John Smith, *Capt. John Smith of Willoughby by Alford, Lincolnshire; President of Virginia and Admiral of New England,* ed. Edward Arber (Birmingham, 1884), 909–911; and Poyntz, *The Present Prospect of the Famous and Fertile Island of Tobago,* 3.
[1158] On sugar mills operating in the West Indies by the end of the sixteenth century, see Antonio de Herrera y Tordesillas, *The General History of the Vast Continent and Islands of America,* Decade 2, Book 2 (1740), chap. 2 (Española), and Purchas, *Hakluytus Posthumus or Purchas His Pilgrims,* vol. 17, 236 (Pernambuco and Bahia, Brazil).
[1159] Oviedo's quote on the consumption of wood appears in Gonzalo Fernández de Oviedo y Valdés (1944–1945), *Historia General y Natural de las lndias,* vol. 6 (Editorial Guaranía, 1944), chap. 46.
[1160] On the number of slaves employed in cutting wood for fuel, see Domingos do Loreto Couto, *Desagravos do Brasil e Glorias de Pernambuco,* Section 84, and Jean-Baptiste Labat, *Nouveau Voyage aux Isles de* L'Amérique, vol. 3 (Paris, 1722), 433–434.
[1161] J. Pizarro y Gardin, "La Reposicion de los Bosques que se consumen annual-mente en el combustible de los Ingenios," Sociedad Economica de Amigos del Pais, *Memoria de los Actividades y de Trabajos Realizados,* Habana, Series 4 (1846): 373, calculates the amount of forest needed to provide one mill with fuel for one year.
[1162] Richard Ligon's report on Madeira's deforested condition appears in Ligon, *A True and Exact History of the Island of Barbados,* 2.
[1163] Another traveler's description of Madeira's deforested condition is found in Karl ritter von Scherzer, *Narrative of the Circumnavigation of the Globe by the Austrian Frigate Novara,* vol. 1 (London, 1861), 64.
[1164] The report to Oviedo on changes in the vegetation of Española appears in Fernández de Oviedo y Valdés, *Historia General y Natural de las lndias,* vol. 6, chap. 46.
[1165] Ellen Ellis, *An Introduction to the History of Sugar as a Commodity* (Philadelphia: John C. Winston Co., 1905), 108, quotes the representatives of the planters of Barbados.
[1166] Rio de Janeiro, Biblioteca Nacional, *Documentos Historicos* 28 (1934): 26–28, 88, and 209–211, record the ameliorative action taken by authorities in Brazil.
[1167] Oviedo discusses the fuel problems of sugar mills in Española in Fernández de Oviedo y Valdés, *Historia General y Natural de las lndias,* vol. 6, chap. 46.
[1168] John Evelyn's report about Barbados appears in *Collection* 16, no. 485 (1698). On the volume of water in Madeira's most important river, see Scherzer, *Narrative of the Circumnavigation of the Globe by the Austrian Frigate Novara,* vol. 1, 64–65.
[1169] Von Humboldt and Bonpland's explanation of the consequences of deforestation is in Alexander von Humboldt and Aimé Bonpland, *Personal Narrative of Travel to the Equinoctial Regions of America,* vol. 2 (London: H.G. Bohn, 1852–1853), 9.
[1170] Caddeo Rinaldo, ed., *Le Navigazioni Atlantiche di Alvise da Cà da Mosto* (1929), in *Viagens de Luis de Cadamosto e de Pedro de Sintra* (Academica Portuguesa de Historia, 1949), 9–13. Marilyn Newitt, trans., *The Portuguese in West Africa, 1415-1670: A Documentary History* (Cambridge: Cambridge University Press, 2010), 56.
[1171] The governor of Barbados's complaint is recorded in *Colonial,* vol. 5 (1661–1668), 586.
[1172] Griffith Hughes, *The Natural History of Barbados* (London, 1750), 21–22, reports various anecdotes concerning the slippage of land after heavy storms.
[1173] *Colonia* (1661–1668), 45, and *Colonial,* (1669–1674), 477.
[1174] *Colonial,* (1669–1674), 477.
[1175] The Spanish chronicler is quoted in Purchas, *Hakluytus Posthumus or Purchas His Pilgrims,* vol. 15 (1906), 58.
[1176] Caddeo Rinaldo, ed., *Le Navigazioni Atlantiche di Alvise da Cà da Mosto* (1929), in *Viagens de Luis de Cadamosto e de Pedro de Sintra* (Academica Portuguesa de Historia, 1949), 9–13. Marilyn Newitt, trans., *The Portuguese in West Africa, 1415-1670: A Documentary History* (Cambridge: Cambridge University Press, 2010), 56.
[1177] Herrera's report on the slave trade appears in Antonio de Herrera y Tordesillas, *The General History of the Vast Continent and Islands of America,* Decade 2, Book 2 (1740), 155.
[1178] The number of slaves sent over to the West Indies is given by Dalby Thomas, "An Historical Account of the Rise and Growth of the West India Colonies," in *Harleian Miscellany,* vol. 9 (London, 1690), 419.
[1179] *CPSD,* vol. 44, no. 7 (Sept. 16, 1567), tells of Sir John Hawkins's great profit from the slave trade. John

Pinkerton, ed., *A General Collection of the Best and Interesting Voyages and Travels in All Parts of the World*, vol. 16 (1808–1814), 202, quotes J. Merolla de Sorrento (1682) on the life span of surviving slaves.

[1180] Lucca Landucci tells of his rush to buy sugar in Lucca Landucci, *A Florentine Diary from 1450 to 1516* (London: J.M. Dent and Sons, 1927), 9.

[1181] The comparison of sugar with honey appears in John Oldmixon, *The British Empire in America*, vol. 2 (London, 1741), 146.

[1182] The praise for the sweetness of sugar appears in ibid.

[1183] On ships unloading sugar from Madeira at Venice, see Marino Sanuto, *I Diarii*, vol. 1 (1496), 1270–1271.

[1184] Thomas, "An Historical Account of the Rise and Growth of the West India Colonies," 415, tells of the popularity of "the noble juice of the cane."

[1185] Thomas, "An Historical Account of the Rise and Growth of the West India Colonies," 14.

[1186] *CSPD Ch II*, vol. 4 (1674), 498, tells of replacing wooden rollers with iron ones.

[1187] On the replacement of wood by bruised cane for fuel, see Oldmixon, *The British Empire in America*, vol. 2, 148.

[1188] Jeremiah Dummer, *A Defense of the New England Charters* (1976), 11–12, and T. Hutchinson, *The Hutchinson Papers*, vol. 2 (Albany, 1865), 231, discuss the importation of timber from New England to the West Indies and its many uses there.

[1189] *CSPD Ch II*, vol. 8 (Nov. 1667–Sept. 1668), 519, reports on the rebuilding of Bridgetown with New England timber.

[1190] The representatives of Barbados in England are quoted in *Colonial*, vol. 7 (1669–1674), 476.

[1191] Emanuel Bowen, *A Complete System of Geography*, vol. 2 (London, 1747), 675, tells of the importance of wood from New England in making the production of sugar affordable.

[1192] The amount of wood exported from North America to the West Indies is compiled by Bryan Edwards, *The History, Civil and Commercial, of the British Colonies in the West Indies*, vol. 2 (London, 1794), 397–394.

[1193] Ibid., 399, gives the figures for the amount of rum the Yankee traders received.

[1194] Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 568, tells of the American trade of rum for slaves.

[1195] On bartering for molasses to make rum in Boston, see Edwards, *The History, Civil and Commercial, of the British Colonies in the West Indies*, vol. 2, 399.

[1196] Concerning the Indians dying of rum, see William Douglass, *A Summary, Historical and Political, of the first planting, progressive improvements, and present state of British Settlements in North America*, vol. 1 (Boston, 1749–1751), 540.

[1197] H. Sloane (1687) tells of vineyards covering Madeira in António Aragão, *A Madeira Vista por Estrangeiros, 1455–1700* (Madeira, 1982), 148.

[1198] Joshua Gee's report on the participants of the New England timber trade to the Iberian peninsula is in Joshua Gee, *The Trade and Navigation of Great Britain Considered* (London, 1729), 102 (chap. 31).

[1199] The "Timber being plenty" quote appears in Douglass, *A Summary, Historical and Political … of British Settlements in North America*, vol. 1, 403.

[1200] Bowen, *A Complete System of Geography*, vol. 2, 663, discusses New England's capability for shipbuilding.

[1201] The contrast between the timber resources of New England and England is in John Ashley, *Memoirs and Considerations Concerning the Trade and Revenue of the British Colonies in North America* (London, 1740), 22–23.

[1202] The Englishman writing in 1747 is Wheeler, *The Modern Druid*, 22.

[1203] Thomas Coram's shipbuilding career in New England is covered in *Colonial*, vol. 38 (1731), 58.

[1204] James Adams, *The Founding of New England* (Boston: The Atlantic Monthly Press, 1921), 9–10, records the sounds of the shipbuilding industry of early New England.

[1205] Malachy Postlethwayt, *Universal Dictionary of Trade and Commerce*, vol. 1 (London, 1776), xxv, discusses the role of timber in keeping capital costs down in the New England shipbuilding industry.

[1206] Hutchinson, *The Hutchinson Papers*, vol. 2, 231, tells of New England capturing the entire West Indian and North American trade.

[1207] Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 567–568, supplies the figures on the amount of candles exported.

[1208] Concerning the great yield of fish, see William Wood, *New England's Prospect* (London, 1634), 33.

[1209] Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 567, tells where the New England catch went.

[1210] On the size of logs burned in colonial times, see Alice Morse Earle, *Home Life in Colonial Days* (New York: Macmillan, 1926), 52.
[1211] The comparison of house heating in New England and Europe is in Rev. Higginson, "New England's Plantation," in *Collections of the Massachusetts Historical Society*, vol. 1 (Boston, 1792), 121–122.
[1212] The *Mayflower* passenger's quote is in William Bradford, *Of Plymouth Plantation 1620–1647* (New York: Alfred A. Knopf, 1970), 62.
[1213] Rev. Higginson, "New England's Plantation," 122, describes the snakes.
[1214] The quotes on the wolves appear in Maine Historical Society, *Documentary History of Maine*, vol. 3 (Portland, Maine: Bailey and Noyes, 1869), 216.
[1215] The pilgrims' first foray into the forest is described in Bradford, *Of Plymouth Plantation 1620–1647*, 65.
[1216] Thomas Morton is quoted in Thomas Morton, *New English Canaan* (Amsterdam, 1637), 62.
[1217] On the Massachusetts Bay Company's instructions to the trained workers of wood, see Nathaniel Shurtleff, ed., *Records of the Governor and Company of the Massachusetts Bay in New England*, vol. 1: 1628–1641 (Boston: William White, 1853), 394.
[1218] Ibid., 384, records what the governor of the company wrote.
[1219] The contents of Richard Saltonstall's letter is in *Colonial*, vol. 9 (1675–1676), 73.
[1220] The English agricultural writer's observation is in H. Carman, ed., *American Husbandry*, 48–49.
[1221] *Colonial*, vol. 5 (1661–1668), 347, lists the number of sawmills in operation in 1665.
[1222] *Colonial*, vol. 18 (1700), 563–564, compares the production of a sawmill and the production of two sawyers.
[1223] The report by the surveyor of woods on the number of sawmills appears in *Colonial*, vol. 23 (1706–1708), 278.
[1224] The old-timer's testimony is in Nathaniel Boughton, *Provincial Papers, Documents and Records Relating to the Province of New Hampshire*, vol. 1 (Manchester, 1867–1873), 551.
[1225] Viola Barnes, *The Dominion of New England* (New Haven: Yale University Press, 1923), 137, no. 1, has the transformation quote.
[1226] Hutchinson, *The Hutchinson Papers*, vol. 2, 231, describes the constant activity of New England shipping.
[1227] Samuel Morison, *Builders of the Bay Colony* (Boston and New York: Houghton Mifflin, 1930), 144, describes what New England ships brought back.
[1228] The pious rhymester's quote is in ibid., 145.
[1229] *Colonial*, vol. 18 (1700), 192, and Gee, *The Trade and Navigation of Great Britain Considered*, 102, tells of the great wealth earned in the transatlantic timber trade.
[1230] The noise of the sawmills is recorded in Rufus King Seawall, *Ancient Dominions of Maine* (Boston, 1859), 273.
[1231] New England's blessed state is told in Morton, *New English Canaan*, 92.
[1232] Morton's description of the moose appears in ibid., 74.
[1233] The bears' roaring is reported in John Josselyn, *New England's Rarities Discovered* (Boston: Massachuesetts Historical Society, 1972), 13.
[1234] On the great flocks of turkeys, see Morton, *New English Canaan*, 69.
[1235] Wood, *New England's Prospect*, 28, describes the hummingbird.
[1236] Praise for the wells of New England is in Morton, *New English Canaan*, 92.
[1237] Praise for the beaver appears in Wood, *New England's Prospect*, 25–26.
[1238] On the abundance of fish in New England and the varieties, see Morton, *New English Canaan*, 91 and 89.
[1239] Douglass, *A Summary, Historical and Political … of British Settlements in North America*, vol. 2, 54 and 296, discusses the relationship between deforestation and the drying up of rivers.
[1240] On the colonists robbing the Indians of their subsistence, see Jeremy Belknap, *The History of New Hampshire*, vol. 2 (Dover: O. Crosby and J. Varney, 1812), 38.
[1241] The Mohawks are quoted in *The Papers of Sir William Johnson*, vol. 11 (Albany, 1921), 555.
[1242] On the migration of colonists to the hinterlands, see *Colonial*, vol. 31 (1719), 76.
[1243] The number of pines destroyed by a mill each day is quantified in *Colonial*, vol. 38 (1731), 6.
[1244] The 1719 prediction by the surveyor of woods is in *Colonial*, vol. 31 (1719), 76 and 274. Chief Winwurna is quoted in Seawall, *Ancient Dominions of Maine*, 232.
[1245] Ibid., 238–239, quotes Loron.
[1246] The repentance of hospitality is reported by Belknap, *The History of New Hampshire*, vol. 2, 38.
[1247] John Ogilby, *America* (1671), 164–165, covers the Massachusetts-Maine affair.
[1248] On Charles's reaction to the news, see ibid., 164.
[1249] E.S. de Beer, ed., *John Evelyn: Diary*, vol. 3 (Oxford: Oxford University Press, 1959), 579, 580–581, and 584,

reports on the deliberations of the Privy Council over the Massachusetts-Maine affair.

[1250] On the Maine-Boston firewood run, see Douglass, *A Summary, Historical and Political … of British Settlements in North America*, vol. 2, 68.

[1251] Gorges's grandson's intention of preserving timber is told in *Colonial*, vol. 7 (1669–1674), 448.

[1252] The royal commission's findings are in *Colonial*, vol. 5 (1661–1668), 347.

[1253] Shurtleff, ed., *Records of the Governor and Company of the Massachusetts Bay in New England*, vol. 4, part 2, 318, presents a full account of Massachusetts's gifting masts to Charles.

[1254] Oliver Cromwell's speech is in W.C. Abott, ed., *The Writings and Speeches of Oliver Cromwell*, vol. 4 (Cambridge, Mass., 1937), 714 ("Speech to the Two Houses of Parliament … ," January 25, 1658).

[1255] T. Burton, *Diary of Thomas Burton*, vol. 3, ed. John Towill Rutt (London, 1828), 380–381, quotes Secretary Thurloe.

[1256] A member of the House of Commons is quoted in ibid., 472.

[1257] Ibid., 456, quotes Major General Kelsey.

[1258] The quote of John Brereton is in John Brereton, *A Treatise Touching the Planting of the North Part of Virginia* (London, 1602), 21.

[1259] A terse statement to Sir John Coke appears in HMC, Series 23, *Twelfth Report*, Appendix 2, *Earl Cowper (Coke mSS)*, 64.

[1260] Sir Henry Vane's advice is in Eva Taylor, *Late Tudor and Early Stuart Geography, 1583–1650* (New York: Octagon Books, 1968), 127.

[1261] On the conferring between the commissioners of the navy and New England men, see *Colonial*, vol. 1 (1574–1660), 392–393.

[1262] *Colonial*, vol. 9 (1675–1676), 87, records what the ruling Council of State wrote.

[1263] On the number of shiploads of masts arriving from New England, see *CSPD Ch II*, vol. 4 (1664–1665), 250.

[1264] Boughton, *Provincial Papers, Documents and Records Relating to the Province of New Hampshire*, vol. 2, 80, enumerates the number of masts carried by each ship.

[1265] The Privy Council's report on the loading of masts appears in *APC*, vol. 3 (1720–1745), 746.

[1266] Judge Sewall's account appears in S. Sewall, "Diary of Samuel Sewall," *Collections of the Massachusetts Historical Society*, 5th Series, vol. 1 (1878), 188–189.

[1267] As an example of the capture of mast ships by the Dutch, see J. Hull, "The Diary," *Transactions and Collections of the American Antiquarian Association* 3 (1857): 146.

[1268] *CSPD*, vol. 4 (1664–1665), 346, tells of the establishment of convoys for mast ships.

[1269] Samuel Pepys's anxiety over the arrival of the mast ships is in Robert Latham and William Matthew, ed., *The Diary of Samuel Pepys*, vol. 7: 1666 (Berkeley: University of California Press, 1972), 397.

[1270] On the king of Denmark's forbidding the export of large timber, see *Collection*, vol. 15, no. 412 (1700).

[1271] *Journals*, vol. 16 (1708–1711), 657, attests that no trees of size grew in the Baltic area by the eighteenth century.

[1272] John Houghton's observation and research on masts appear in *Collection*, vol. 15, no. 412 (1700).

[1273] Dummer, *A Defense of the New England Charters*, 10, tells of the great size of trees growing in New Hampshire and Maine. *Journals*, vol. 16 (1708–1711), 657, confirms that New England provided all the masts for ships of the line by the eighteenth century.

[1274] Captain Christopher Levitt's note to Sir John Coke is in HMC, Series 23, *Twelfth Report*, Appendix 1, *Earl Cowper (Coke mSS)*, 321.

[1275] The "ill news" quote appears in *Colonial*, vol. 9 (1675–1676), 74.

[1276] The fears of some over the Dutch moves in America are found in HMC, Series 23, *Twelfth Report*, Appendix 2, *Earl Cowper (Coke mSS)*, 64.

[1277] The findings of the Dutchman are in E. O'Callaghan, ed., *Documents Relative to the Colonial History of New York*, vol. 2 (Albany, 1856), 512.

[1278] A description of the contents of the intercepted letter appears in *Colonial*, vol. 18 (1700), 237.

[1279] Nicolas Denys, *The Description and Natural History of the Coasts of North America* (Toronto: The Champlain Society, 1908), 107–108, gives the governor's account of timber resources in Maine.

[1280] The contention of the Council of Trade and Plantations on French aspirations to Maine is in *Colonial*, vol. 24 (1709), 326–327.

[1281] The earl of Bellomont's opinion is in *Colonial*, vol. 18 (1700), 237.

[1282] On the vulnerability of mast trees to sabotage, see *Colonial*, vol. 24 (June 1708–1709), 245.

[1283] The Privy Council and Council of Trade and Plantations' advice to Queen Anne is found in ibid., 138, and *APC*,

vol. 2 (1680–1720), 571–572.

[1284] On Indian attacks against the English mast trade, see Edward Randolph, *Edward Randolph*, vol. 7 (1898) 482 and 410.

[1285] *Colonial*, vol. 22 (1704–1705), 448, quotes the governor on his success at protecting the mast cutters.

[1286] The mast purveyor's appreciation for the governor's protection is recorded in *Colonial*, vol. 24 (1709), 278.

[1287] The same governor's remarks several years later are in *Colonial*, vol. 23 (1706–1708), 237.

[1288] The settlers' complaint is found in *Colonial*, vol. 24 (1709), 315.

[1289] *Colonial*, vol. 22 (1704–1705), 18, quotes the lieutenant governor of New Hampshire.

[1290] The British Americans' argument is in *Colonial*, vol. 24 (1709), 317.

[1291] The commander of the English fleet in North America is quoted in William Shirley, *The Correspondence of William Shirley*, vol. 1 (New York: Macmillan, 1912), 351.

[1292] An observer familiar with European and American forest resources is quoted in *Colonial*, vol. 29 (1716), 5.

[1293] The contents of the petition from Nicholas Shapleigh to the king are in *Colonial*, vol. 7 (1669–1674), 448.

[1294] Edward Randolph's arguments for direct control of Massachusetts are in Edward Randolph, *Edward Randolph*, vol. 6 (1909), 89–94.

[1295] The duty of the surveyor in North America is spelled out in Great Britain, Public Records Office, *Calendar of Treasury Books*, vol. 8, part 1 (1685–1689), 365–366.

[1296] The quote "a perpetual supply" is found in *APC*, vol. 5 (1766–1783), 23.

[1297] The restrictive clause that reserves trees of size for masts is in "Charter of the Province of the Massachusetts Bay," *Publications of the Colonial Society of Massachusetts, Collections*, vol. 2 (1913), 29. As no other restriction was placed in the new charter, the document demonstrates the importance of New England's trees to England.

[1298] The attributes of the earl of Bellomont are given in *Colonial*, vol. 17 (1699), xxxvi.

[1299] Bellomont's observations on the destruction of the woods of Maine and New Hampshire are in *Colonial*, vol. 18 (1700), 563–564.

[1300] The information Bellomont provided to the Council of Trade and Plantations concerning the destruction of timber in New York is in *Colonial*, vol. 19 (1701), 7.

[1301] *Colonial*, vol. 17 (1699), 430–431, contains Bellomont's opinion of the surveyors and the deputy.

[1302] The earl's revelation that the governors defraud the Crown is in *Colonial*, vol. 18 (1700), 361.

[1303] Ibid., 695, contains Bellomont's opinion of Colonel Fletcher.

[1304] The incident in which the earl had to watch helplessly is presented in *Colonial*, vol. 17 (1699), 470–471 and 152.

[1305] Bellomont's allegations against Lieutenant Governor Partridge appear in *Colonial*, vol. 18 (1700), 192 and 354.

[1306] Partridge's rejoinder is in ibid., 706–707.

[1307] The earl's response to Partridge's arguments is in ibid., 193–194.

[1308] Ibid., 359, contains Bellomont's assurance to the Council of Trade and Plantations on the need for regulations. That Bellomont expected Americans to obey laws preserving timber when the English didn't leads one to question his judgment. William Harrison described English behavior toward conservation laws that closely paralleled the American experience: "such is the nature of our countrymen, that as many laws are made [to preserve timber], so they will keep none," Harrison lamented, himself in favor of saving the woods, "or if they be urged to make answer, they will seek some crooked construction of [the laws] to the increase of their private gain than yield themselves to be guided by the same for [the] commonwealth and profit of their country" [Harrison, *The Description of England,* book 2, chap. 22, in Holinshed, *Holinshed's Chronicles of England, Scotland and Ireland,* vol. 1].

[1309] Robert Livingston's assurance and warning are in *Colonial*, vol. 19 (1701), 237–238.

[1310] The vicissitudes of the surveyor are discussed in *Colonial*, vol. 24 (June 1708–1709), 448 (John Bridgets quote); *Colonial*, vol. 37 (1730), 22–23 (fatigue); ibid., (nearly smothered); *Colonial*, vol. 38 (1731), 4 (floating ice); and *Colonial*, vol. 30 (Aug. 1717–Dec. 1718), 140 (frostbite).

[1311] John Bridger's realizations of the obstacles he faced in preserving mast trees from the axe appear in *Colonial*, vol. 23 (1707), 354; ibid., 278; and *Colonial*, vol. 24 (1709), 48, respectively.

[1312] On woodsmen cutting trees marked with the Broad Arrow and then marking other trees, see *Colonial*, vol. 37 (1730), 20.

[1313] The Council of Trade and Plantations' negative evaluation of local officeholders is in *Colonial*, vol. 29 (1716–July 1717), 10.

[1314] Sewall's noncommittal stance is described in S. Sewall, "Diary of Samuel Sewall," *Collections of the Massachusetts Historical Society*, 5th Series, vol. 6 (1879), 207.

[1315] On Parliament's position regarding the preservation of mast timber growing in New England, see *Journals*, vol. 16 (1708–1711), 657. The well-being of the Royal Navy in the eighteenth century depended on the New England mast trade. Thomas Pownall, a highly respected English administrator in the American colonies, confirms this in his book *The Administration of the Colonies*, writing, "The navy office, finding that their mast ships come regularly hitherto to England, cannot entertain any fear of such want" [Thomas Pownall, *The Administration of the Colonies* (London, 1764), 127].

[1316] The provisions of "An Act for the Preservation of White and Other Pine Trees … " are found in Laws, vol. 12, 9 *Anne*, chap. 17.

[1317] Bridger tells of the difficulty of enforcing the new act in *Colonial*, vol. 29 (1717), 274; *Colonial*, vol. 32 (1720), 27; and *Colonial*, vol. 29 (1717), 274.

[1318] The sawmill owners' complaints against Bridger and the act are presented in Boughton, *Provincial Papers, Documents and Records Relating to the Province of New Hampshire*, vol. 19, 194–195.

[1319] Information from the mast provider to the naval commissioners is in *Colonial*, vol. 31 (1719), 232.

[1320] The provisions of the rewritten act are found in Laws, vol. 14, 8 *George I*, chap. 12.

[1321] *Colonial*, vol. 35 (1726–1727), 241, gives the measurements of the townships.

[1322] The estimate of one deputy surveyor appears in *Colonial*, vol. 32 (1720–1721), 231.

[1323] The comparative prices of timber in townships and timber left for the Crown are in *Colonial*, vol. 34 (1724–1725), 216.

[1324] The solicitor general's interpretation of the rewritten act appears in *Colonial*, vol. 35 (1726–1727), 120–121.

[1325] The complaints of the Royal Navy's principal supplier of masts are in ibid., 223–224, and *Colonial*, vol. 36 (1728–1729), 233.

[1326] Ibid., 63–64, shows the concern in London over preserving America's woods. The agents of the colonists are quoted in *Journals*, vol. 21 (1727–1732), 344.

[1327] The fear that England could be "deprived of any masts … " is told in *Colonial*, vol. 36 (1728–1729), 63–64.

[1328] Laws, vol. 16, 2 *George II*, chap. 35, contains the provisions of "An Act for the better preservation … ".

[1329] The original exemption appears in "Charter of the Province of the Massachusetts Bay," 29.

[1330] On the occupations of those in the New Hampshire administration, see J. Belcher, "The Belcher Papers," Part 2, *Collections of the Massachusetts Historical Society*, Series 6, vol. 7 (1894), 49, https://www.masshist.org/mhs-collections.

[1331] The problems Bridger had with the Vaughan administration are noted in *Colonial*, vol. 30 (Aug. 1717–Dec. 1718), 139–140.

[1332] On the Plaisted affair, see Great Britain, Public Records Office, *Calendar of Treasury Papers*, vol. 4 (1707), 18 (vol. 106, no. 17); *Colonial*, vol. 24 (June 1708–1709), 259; and *Colonial*, vol. 25 (1710–June 1711), 524.

[1333] David Dunbar's remark about Judge Byfield is in *Colonial*, vol. 39 (1732), 122.

[1334] Dunbar's trials and tribulations in attempting to enforce the ruling of the Vice-Admiralty Court are discussed in W. Gates, "The Broad Arrow Policy in Colonial America" (PhD diss., University of Pennsylvania, 1951), 202–203. Litigation in the suit, "Frost vs. Leighton," demonstrates the advantage American lumbermen enjoyed over English mast cutters in the local courts and among colonial officials. A thorough discussion of the case can be found in A. Davis, "The Suit of Frost vs. Leighton," *Publications of the Colonial Society of Massachusetts, Transactions*, vol. 3 (1896), 246–264.

[1335] Allen Johnson and Dumas Malone, eds., *Dictionary of American Biography*, vol. 2 (New York: Charles Scribner's Sons, 1929), 381, describe Cooke's "enmity."

[1336] Dunbar's arguments for the passage of the act appear in *Colonial*, vol. 39 (1732), 201. The arguments Cooke presented against Dunbar's bill are found in Great Britain, Public Records Office, *Calendar of Treasury Books and Papers*, vol. 2 (1731–1734), 418.

[1337] Dunbar's lament is in *Colonial*, vol. 37 (1730), 322 and 324.

[1338] A contemporary historian's description of Shute's character is in Douglass, *A Summary, Historical and Political … of British Settlements in North America*, vol. 1, 379.

[1339] Cooke's fight with Shute to publish in the House journal his derogatory remarks on Bridger is covered in detail in George Chalmers, *An Introduction to the History of the Revolt of the American Colonies*, vol. 2 (Cambridge: Da Capo Press, 1971), 19–20. Chalmers is quoted in ibid., 20.

[1340] *Colonial*, vol. 30 (Aug. 1717–Dec. 1718), 307, records Cooke's statements to the people of Maine.

[1341] Bridger's opinion on Cooke's proselytizing appears in ibid., 162.

[1342] On colonial support for Cooke's assertions, see *Colonial*, vol. 31 (1719–1720), 144.

[1343] Bridger's term for Cooke's assertions is found in *Colonial*, vol. 30 (Aug. 1717–Dec. 1718), 307.
[1344] Ibid., contains Bridger's stern warning to authorities in London concerning Cooke. The pejorative epithet directed to Cooke is in ibid., 162. On Dunbar's campaign for stricter penalties, see *Colonial*, vol. 39 (1732), 201.
[1345] *Colonial*, vol. 41 (1734), 150–151, relates the encounter between Dunbar and the vessel carrying illegally cut wood.
[1346] The risks Dunbar and his deputies faced are told in *Colonial*, vol. 37 (1730), 393.
[1347] *Colonial*, vol. 38 (1731), 123, gives the details on the assault of a man resembling a deputy surveyor.
[1348] The confrontation between Dunbar's men and the "Indians" is thoroughly covered in *Colonial*, vol. 41 (1734–1735), 92–93.
[1349] Governor Belcher's opinion of the attack on Dunbar is in ibid., 143.
[1350] Dunbar's bitter words appear in ibid., 95.
[1351] The attorney general's prediction of the consequences of the fall of Dunbar for England is in *Colonial*, vol. 37 (1730), 393.
[1352] An English gentleman's impression of America appears in *Colonial*, vol. 33 (1722–1723), 256–257. R. Sewall, in his *Ancient Dominions of Maine*, judged the confrontation between the Crown's representatives and the colonists over cutting white pines as "the entering wedge to a struggle between power and privilege, which finally sundered all national ties, and ended in the grand and glorious issues of the American revolution" [Seawall, *Ancient Dominions of Maine*, 330].
[1353] Dr. Daniel Coxe is quoted in G.D. Scull, "Biographical Notice of Doctor Daniel Coxe, of London," *Pennsylvania* 7, no. 3 (1883): 327–328, http://www.jstor.org/stable/20084616.
[1354] New Jersey's governor is quoted in Carl Woodward, *Ploughs and Politicks: Charles Read of New Jersey and His Notes on Agriculture* (New Brunswick: Rutgers University Press, 1941), 13–14.
[1355] The charges against Samuel Baldwin appear in *New Jersey*, vol. 6, 318–319.
[1356] The chastisement of those ordering Baldwin's incarceration is in ibid., 280.
[1357] The two defenses offered by Samuel Baldwin and his supporters appear in ibid., 7. 31 & 35.
[1358] The proprietors' reply to their defenses is in ibid., 6. 321-322.
[1359] Samuel Baldwin and his supporters' more visceral argument is found in *New Jersey*, vol. 7, 47–48.
[1360] *New Jersey*, vol. 6, 211–212, quotes Baldwin's supporters concerning the reasons for their distrust of the judicial system.
[1361] The communication describing the jailbreak is in ibid., 397–398.
[1362] *New Jersey*, vol. 7, 272–273, describes the assault on New Jersey's forests as well as those of Pennsylvania.
[1363] Ibid., tells of the rioters' disrespect for New Jersey's forestry laws. A large number of the names that appear on a list of those jailed in the riots (ibid., 456–458) also appear on a petition demanding a repeal of a law passed by the assembly for "Preserving the timber in the Province of New Jersey" [New Jersey, Bureau of Archives and History, *Manuscript Collection*, Manuscripts, Box 12, Item no. 25].
[1364] On the dispute between Phillip Kearney and Hendrick Hoagland, see *New Jersey*, vol. 16, 244–245.
[1365] Ibid., 30–31, records the confrontation between John Kenny and Jonathan Whittaker.
[1366] John Hackett and William Bird's fight with several tenants is told in *New Jersey*, vol. 7, 377–378.
[1367] The New Jersey law officer's observations on the popularity of the rioters' cause are in ibid., 425.
[1368] The "club law" quote is in ibid., 422 and 424.
[1369] On the devilishness of the proprietors, see *New Jersey*, vol. 16, 30–31.
[1370] The proprietors' opinion of the rioters is found in ibid., 331, and *New Jersey*, vol. 7, 200–201.
[1371] Judge Neville's opinion is in *New Jersey*, vol. 16, 551.
[1372] The report on America being a "fit place for iron works" is in S. Purchas, *Hakluytus Posthumus or Purchas His Pilgrims*, vol. 19 (1906), 145.
[1373] The 1609 call for the development of America's iron industry appears in Peter Force, *Tracts and Other Papers, Relating Principally to the Origin, Settlement, and Progress of the Colonies of North America*, vol. 1, no. 6, "Nova Brittania," (Gloucester: Peter Smith, 1963), 16.
[1374] John Evelyn is quoted in J. Evelyn, *Silva*, vol. 2 (1786), 274–275.
[1375] Yarranton's warning on dependency on Swedish iron appears in Yarranton, *England's Improvement by Sea and Land*, vol. 1, 63–64.
[1376] The description by the Council of Trade and Plantations is in *Colonial*, vol. 36 (1728–1729), 67.
[1377] The report of an Englishman transplanted to America is in ibid., 52–53.
[1378] On importing American pig iron to keep English forges operating, see *Reasons for Importing Naval Stores from*

Our Own Plantations and Employing People There (London, 1720).

[1379] Joshua Gee's advocacy of setting up furnaces in America appears in Gee, *The Trade and Navigation of Great Britain Considered*, 69.

[1380] The "humble opinion" of England's ambassador to Sweden is quoted in Gee, *A Letter to a Member of Parliament, Concerning the Naval Store-Bill*, 4–8.

[1381] Gee relates the success of encouraging the production of tar and pitch in the colonies in ibid., p. 9. The act he is referring to is in Laws, vol. 11, 3 and 4 *Anne*, chap. 10.

[1382] The Council's suggestion of using iron for tax payments is in *Colonial*, vol. 29 (1716–July 1717), 278–279.

[1383] John Oldmixon is quoted in Oldmixon, *The British Empire in America*, vol. 1, 232.

[1384] William Byrd's talk with Colonel Spotswood is recorded in William Byrd, "A Progress to the Mines in the Year 1732," in *The Prose Works of William Byrd of Westover*, ed. Louis Wright (Cambridge: Harvard University Press, 1966), 357 and 360.

[1385] William Byrd's discussion with Mr. Chiswell is found in ibid., 347–348.

[1386] For a comparison of the wages of American and British woodcutters and wood coalers, see William Whitely, "The Principio Company," *Pennsylvania* 11, no. 1 (April 1887): 192 (American); H. Blackman, "Gunfounding at Heathfield in the XVIII Century," *Sussex Archaeological Collections* 67 (1926): 28; and Fell, *The Early Iron Industry of Furness and District*, 434 (British).

[1387] On the comparison of the price of wood in America and England, see Whitely, "The Principio Company," 192 (America), and Mott, "The Shropshire Iron Industry," 575 (England).

[1388] The English iron manufacturer's observation on the cheapness of American wood in relation to its price in England is found in *An Answer to Some Considerations of the Bill for Encouraging the Import of Pig and Bar Iron from America* (1750). This tract was written to support the importation of American iron into England. Those opposing the encouragement of the importation of American iron agreed with their opponents on the low price of wood in America. As one pamphleteer opposing easier access to American iron wrote, "the price of … wood [in America] is little" [*Reflections on the Importation of Bar Iron* (1757), 2].

[1389] On the success of ironmasters in Virginia, see Whitely, "The Principio Company," 192, and Rufus Wilson, ed., *Burnaby's Travels Through North America* (New York: A. Wessels Company, 1904), 41.

[1390] James Logan's letter to Penn's widow is reproduced in "Letter of James Logan to Hannah Penn," *Pennsylvania* 33, no. 3 (1909): 351.

[1391] On Read's acquisition of woods for his furnaces, see Woodward, *Ploughs and Politicks: Charles Read of New Jersey and His Notes on Agriculture*, 88, 90, and 92.

[1392] The governor's report in 1755 appears in *New Jersey*, vol. 9, part 2, 79.

[1393] Byrd's judgment of Spotswood's cast ironwares is in Byrd, "A Progress to the Mines in the Year 1732," 370.

[1394] The manufacture of cast ironware in Massachusetts is reported in Douglass, *A Summary, Historical and Political ... of British Settlements in North America*, vol. 1, 541.

[1395] Israel Acrelius's judgment on American-made tools is found in Israel Acrelius, *A History of New Sweden* (1871), 167.

[1396] Henry Calvert wrote of Mr. Hazard's success in *Journals*, vol. 23 (1737–1741), 112.

[1397] *Some Remarks on the Present State of the Iron Trade of Great Britain* (1737) gives the percentage of exported English ironware consumed in the colonies.

[1398] The worry of Calvert and many of his profession is articulated in ibid.

[1399] The quote on the consequence of American self-sufficiency is in *Journals*, vol. 23 (1737–1741), 112.

[1400] Calvert's urging to Parliament appears in ibid.

[1401] Equating the development of America's iron industry with its independence is in HMC, Series 20, *Fourteenth Report*, Appendix 5, *Earl of Dartmouth*, vol. 2: *American Papers*, 137.

[1402] George Grenville's conciliatory approach is in HMC, Series *55, Reports on Various Collections*, vol. 6, 96. Grenville, adopting this posture, contradicts his other political moves toward the colonies, which, in the opinion of a biographer, "produced the American revolution'" [Leslie Stephen and Sidney Lee, eds., *Dictionary of National Biography*, vol. 5 (1917–1982), 559].

[1403] Postlethwayt argues for the bonding of America and England through trade in Malachy Postlethwayt, *Universal Dictionary of Trade and Commerce* (London, 1774), "Naval Stores" entry.

[1404] The ironmasters' rhetoric against passage is found in *Journals*, vol. 25 (1745–1750), 1019.

[1405] John Robinson's amusement on the masking of self-interest with high-sounding rhetoric is found in J. Robinson, *Some Reflections on the Iron Trade* (1756), 17. Concerning the fight in Parliament over the importation of iron

from America some years before, David Macpherson, the eighteenth-century economic compiler, made this comment: "The great and natural opposers were the proprietors of English iron works and those of the woodlands of England; but where particular interest is so strongly concerned against so visible a national benefit, that opposition seemed not much regarded by impartial men … yet so many jarring interests prevented the legislatures from doing anything at this time" [Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 215].

[1406] The reasons for Parliament's refusal to authorize the demolition are given in R. Charles, "Letter to Mr. Thomas Lawrence, 1750," *Pennsylvania* 7, no. 2 (1883): 232. The entire act is reproduced in Laws, vol. 20, 23 *George II*, chap. 29.

[1407] On John Robinson's interpretation of the new act, see Robinson, *Some Reflections on the Iron Trade*, 18.

[1408] The report of an English traveler on Americans' dissatisfaction with the law is in Wilson, ed., *Burnaby's Travels Through North America*, 115.

[1409] Jonathan Law is quoted in *Collections of the Connecticut Historical Society*, vol. 15 (1914), 410.

[1410] The biblical analogy to the Americans' plight is pointed out in ibid.

[1411] John Otis's rhetorical questions appear in J. Otis, *Considerations on Behalf of the Colonists* (London: J. Almon, 1765), 22.

[1412] The answer to Otis's questions is found in the *Pennsylvania Chronicle and Universal Advertiser*, April 6–13, 1772.

[1413] Jonathan Law's fears of the ramifications of the act are in *Collections of the Connecticut Historical Society*, vol. 15 (1914), 410.

[1414] John Dickinson's condemnation of the new law is in J. Dickinson, *Letters from a Farmer in Pennsylvania to the Inhabitants of the British Colonies* (1768), 12–13.

[1415] On America's boundless woods, see Postlethwayt, *Universal Dictionary of Trade and Commerce*, "Naval Stores" entry.

[1416] Concerning the ability of America's trees to provide building material to construct and repair the entire English fleet, see *Colonial*, vol. 13 (1689–1692), 529 (all colonies); Randolph, *Edward Randolph*, vol. 7, 529 (one estate in New Jersey); and *Colonial*, vol. 7 (1669–1674), 581 (New Hampshire and Maine).

[1417] The suggestions from a pamphlet entitled *England's Improvement Temporall* are found in Taylor, *Late Tudor and Early Stuart Geography, 1583–1650*, 127.

[1418] Another English author elaborated on schemes for constructing English ships in Carman, ed., *American Husbandry*, 522.

[1419] The opinion of one deputy surveyor on the quality of oak sent to France and Spain is in *Colonial*, vol. 36 (1728–1729), 303.

[1420] *Colonial*, vol. 30 (Aug. 1717–Dec. 1718), 442, records one custom official's appeal to the Council of Trade and Plantations.

[1421] A concerned citizen's letter to David Dunbar appears in *Colonial*, vol. 36 (1728–1729), 326.

[1422] Governor Shute's order is found in *Colonial*, vol. 32 (1720–1721), 214.

[1423] On the difficulties England had in obtaining boards and timber from the Baltic states, see *Reasons for Importing Naval Stores from our own Plantations and Employing People There* (London, 1720).

[1424] Joshua Gee's advocacy of encouraging Americans to send lumber to England appears in Gee, *A Letter to a Member of Parliament, Concerning the Naval Store-Bill*, 9–10.

[1425] The note from the Council of Trade and Plantations to King George I is found in *Colonial*, vol. 28 (Aug. 1714–Dec. 1715), 220.

[1426] The new law that rescinded all duties on lumber from America is found in Laws, vol. 14, 8 *George I*, chap. 12.

[1427] The Council of Trade and Plantations' misgivings appear in *Colonial*, vol. 33 (1722–1723), 66.

[1428] The writings of one proponent to a member of the House of Commons are in *A Letter to a Member of Parliament on the Importance of the American Colonies* (1757).

[1429] Thomas Whately is quoted in "The Bowdoin and Temple Papers," *Collections of the Massachusetts Historical Society*, Series 6, vol. 9 (1897), 53–54.

[1430] The new piece of legislation is found in Laws, vol. 26, 4 *George III*, chap. 11.

[1431] The restriction on unloading lumber or iron is found in Harrold Gillingham, "The Philadelphia *Windsor Chair* and Its Journeying," *Pennsylvania* 55, no. 4 (1931): 308.

[1432] Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 573, provides the statistics on the amount of lumber imported to England in 1770.

[1433] On the reaction of Americans to restrictions on their trade of lumber and iron, see J. Dickinson, *The Writings of John Dickinson*, vol. 1 (Philadelphia: Historical Society of Pennsylvania, 1895), 226.
[1434] John Dickinson's warnings to his English friends are found in ibid., 216, and note on 216–217.
[1435] Dickinson's opinion on why the Stamp Act seemed so odious is in ibid., 228.
[1436] John Wentworth is quoted in Gates, "The Broad Arrow Policy in Colonial America," 287.
[1437] On enraged farmers, see William Little, *The History of Weare, New Hampshire 1735–1888* (Lowell, MA, 1888), 188.
[1438] On the Pine Tree Riot, see Pamela Murrow, "The Pine Tree Riot," *Journal of the American Revolution* (February 4, 2013), https://allthingsliberty.com/2013/02/the-pine-tree-riot/.
[1439] Little, *The History of Weare, New Hampshire 1735–1888*, 188, for the notorious offenders.
[1440] On the pine trees being fit for the Royal Navy, see ibid., 191.
[1441] The quote comparing the Rebellion and Boston Tea Party to the Pine Tree Riot is found in ibid., 187–191.
[1442] The remarks are in Nicholas Ray, *The Importance of the Colonies of North America and the Interest of Great Britain with Regard to Them, Considered* (London and New York, 1766), 5.
[1443] Postlethwayt, *Universal Dictionary of Trade and Commerce*, vol. 1, xxv.
[1444] On the great tonnage of Boston's pre-revolutionary commercial vessels, see Bernard Bailyn and Lotte Bailyn, *Massachusetts Shipping, 1697–1714* (Cambridge, MA: Harvard University Press, 1959), 21–22.
[1445] The quality of "Best Principio" for manufacturing firearms is evaluated in Tucker, *The Case of the Importation of Bar-Iron from Our Own Colonies of North America*, 11.
[1446] Richard Penn's testimony before the House of Lords is in Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, vol. 3, 566.
[1447] The quote on "America … growing … inviting …" is from Ray, *The Importance of the Colonies of North America and the Interest of Great Britain with Regard to Them, Considered*, 13.
[1448] Another English author's discussion on England's dependence on America for the survival of its navy appears in Dickinson, *Letters from a Farmer in Pennsylvania to the Inhabitants of the British Colonies*, 6.
[1449] Samuel Thompson's appointment and task can be found in Maine Historical Society, *Collections of the Maine Historical Society*, Series 3, vol. 1 (1904), 434.
[1450] Samuel Thompson's success can be found in ibid., 435.
[1451] Wentworth's message to Captain Barkley can be found in Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy 1652–1862*, 278.
[1452] Regarding Graves's inability to sail to Yorktown, see ibid., 309–310. As Robert Albion pointed out, "It is futile, of course, to stress a single factor as the sole cause for victory or defeat in a contest so complex as the American Revolution, but certainly the lack of masts deserves more of a place than it has yet received…" [Ibid., 292].
[1453] On prohibiting citizens of the thirteen colonies from settling in the American West, see Thomas Perkins Abernethy, *Western Lands and the American Revolution* (New York: Russell and Russell, 1959), 21; and Jack Sosin, *Whitehall and the Wilderness: The Middle West in British Colonial Policy, 1760–1775* (Lincoln: University of Nebraska, 1961), 250.
[1454] George Bancroft, "The American Revolution. Epoch Second. How Great Britain Estranged America, 1763–1774," *History of the United States from the Discovery of the American Continent, Vol. 5, 13th edition* (Boston: Little, Brown, and Company, 1860), 110 ("May–September, 1763"), https://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A2001.05.0330%3Achapter%3D7%3Apage%3D110.
[1455] The description of the lands Americans gained access to after the Revolutionary War comes from W. McIntosh, *History of Ontario County, New York 1788–1876* (Philadelphia: Everts, Ensign, and Everts, 1876), 216.
[1456] Edmund Dana is quoted in E. Dana, *Geographical Sketches on the Western Country* (Cincinnati: Looker, Reynolds, and Co., 1819), 31.
[1457] The quote of another person who viewed the forest is found in Morris Birkbeck, *Notes on a Journey in America* (London: James Ridgway, 1818), 73–75.
[1458] Dana's "uncommon height" quote is in Dana, *Geographical Sketches on the Western Country*, 31.
[1459] Francis Baily's quote appears in F. Baily, *Journal of a Tour in Unsettled Parts of North America in 1796 & 1977* (London, 1856), 214.
[1460] Martin Birkbeck's measurements appear in Birkbeck, *Notes on a Journey in America*, 73–75.
[1461] On the huge size of sycamores on the banks of the Ohio, see Grenville Mellen, *A Book of the United States* (Hartford: H.F. Sumner and Co., 1840), 241.

[1462] The "one vast forest" quote appears in Baily, *Journal of a Tour in Unsettled Parts of North America in 1796 & 1977*, 214.

[1463] H. Tuckey is quoted on the trees of southern Michigan in the early 1800s in Eugene Davenport, foreword to *Timberland Times* (Champaign: University of Illinois Press, 1950).

[1464] On "plenty of timber" in Illinois, see Elias Fordham, *Personal Narrative of Travels in Virginia, Maryland, Pennsylvania, Ohio, Indiana, Kentucky; and of a Residence in the Illinois Territory: 1817–1818* (Cleveland: The Arthur H. Clark Company, 1906), 190.

[1465] The quote about the Wisconsin woods comes from S. Stambugh, "Report and Condition of Wisconsin Territory," *Wisconsin Historical Collections*, vol. 25 (1900), 402.

[1466] Nelson Jones, *The Squirrel Hunters of Ohio* (Cincinnati: Robert Clark and Co., 1898), 242, describes Ohio's forest.

[1467] One English official's admission is found in *Journals*, vol. 47 (1792), 344.

[1468] Concerning whom the commission queried and its general conclusion, see ibid., 267–268.

[1469] The response of the surveyor of shipping appears in ibid., 362–363.

[1470] On the construction of waterwheels from iron in England, see Gary Kulik, Roger Parks, and Theodore Penn, eds., *The New England Mill Village* (Cambridge, MA: MIT Press, 1982), 107.

[1471] Robert Fulton's statement on the construction of bridges appears in Fulton, *A Treatise on the Improvement of Canal Navigation*, 126.

[1472] Jefferson's opinion is found in J. Boyd et al., ed., *The Papers of Thomas Jefferson*, vol. 14 (Princeton: Princeton University Press, 1950), 252.

[1473] Josiah Tucker's expectation of Americans is found in J. Tucker, *The True Interest of Great Britain Set Forth in Regard to the Colonies* (New York: Arno Press, 1972), 50.

[1474] Edwards, *The History, Civil and Commercial, of the British Colonies in the West Indies*, vol. 2, 401, no. c, quotes William Pitt.

[1475] Bryan Edwards's coverage of the proceedings is found in ibid., 414–417.

[1476] The lords' contention is recorded in ibid., 416.

[1477] The testimony by the Land Revenue Commission appears in *Journals*, vol. 47 (1792), 267–268 and 272. An earlier report to the House of Commons agreed with the commissioners' findings, stating, "The great addition to the Navy and commerce of Great Britain, with the rapid increase of valuable business in this country since the close of the last war, and since the employment of American built ships in our trade has been restricted, are circumstances which render any other evidence of an immense demand for naval timber unnecessary" *[Journals*, vol. 43 (1787–1788), 560].

[1478] The drop in the percentage of boards and timber exported to England is extrapolated from data presented by Tench Coxe, *A Brief Examination of Lord Sheffield's Observations on the Commerce of the United States* (Philadelphia, 1791), 9–10, and D. Macpherson (1805), *Annals of Commerce, Manufactures, Fisheries, and Navigation, 3. 573.*

[1479] On the increase in English shipbuilding between 1774 and 1785, see Coxe, *A Brief Examination of Lord Sheffield's Observations … ,* 59.

[1480] On Ireland's tanners importing bark from Great Britain, see Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation,* vol. 3, 73. The lord-lieutenant of Ireland, after touring the country, blamed the iron industry "for the almost total destruction of timber of this kingdom" [Great Britain, Public Records Office, *Calendar of State Papers, Domestic Series, of the Reign of Anne,* vol. 2 (1703–1704), 59].

[1481] Edwards, *The History, Civil and Commercial, of the British Colonies in the West Indies*, vol. 2, 397, compares the amount of wood the West Indian planters received from Canada and America before the Revolution. Canada and Nova Scotia produced so little lumber that of the 1,208 cargoes of wood and other provisions exported from North America to the West Indies in 1782, all but seven came from the United States [ibid., 409].

[1482] The planters' representatives' demand is reported in Great Britain, Historical Manuscripts Commission, Series 55, *Reports on Manuscripts in Various Collections*, vol. 6, 219.

[1483] Edwards, *The History, Civil and Commercial, of the British Colonies in the West Indies*, vol. 2, 432, reports on the French admitting ships duty-free, carrying American timber.

[1484] Coxe, *A Brief Examination of Lord Sheffield's Observations … ,* 10–11, compares the prices paid by French and English planters for pine boards and staves.

[1485] Father Louis Hennepin's account appears in Louis Hennepin, *A New Discovery of a Vast Country in America*, vol. 2 (Chicago: A.C. McClurg and Co., 1903), 556.

[1486] Father Hennepin's suggestion on the use of American trees and why appears in ibid., vol. 1, 151.
[1487] F. Michaux, "Memoire sur la Naturlaisation des Arbres Forestiers de l'Amerique Septentrionale," *Societe du Departement de la Seine, Memoires*, vol. 7 (1805), 6–8, tells of the expense of obtaining seeds before the American Revolution, the work of his father, Andre, in America after the Revolution, and the plans for reforesting France with trees grown from American seeds.
[1488] Michaux's complaint on the distribution of seeds in France appears in Michaux, "Memoire sur la Naturlaisation des Arbres Forestiers de l'Amerique Septentrionale," 8–9.
[1489] Francois Michaux explains the difference between his work and his father's in François Michaux, *North American Sylva*, vol. 1 (1854), 15, and F. Michaux, *North American Sylva*, vol. 1, part 1 (1819), 331. For clarification of François Michaux's aim, see Michaux (1854), vol. 1, part 2.
[1490] F. Michaux (1819), vol. 1, part 1, and F. Michaux (1805), 34, compare trees that grew in France with those of the United States.
[1491] The reasons for François Michaux's most recent trip to the United States are given in F. Michaux, introductory remarks to *Histoire des Arbres Forestiers de l'Amérique Septentrionale* (Paris, 1810).
[1492] The description of Francois Michaux's work by an American admirer is given in J. Lowell, "Remarks on the Gradual Diminuation of the Forests," *Massachusetts Agricultural Repository and Journal* 5 (1810): 39.
[1493] On the number of trees that grew in France because of Francois Michaux's work, see F. Michaux (1810), "Introductory Remarks."
[1494] On French shipowners buying hulls in the United States, see Boyd et al., ed., *The Papers of Thomas Jefferson*, vol. 13, 69.
[1495] Pierre Malouet's advice to the French government is in Carl Lokke, "A French Appreciation of New England Timber," *The New England Quarterly* 8, no. 3 (1935): 409–411.
[1496] The quote from the report of the commissioner on agriculture appears in W. Bates, "Ship Timber in the United States," United States Department of Agriculture, *Report of the Commissioner of Agriculture for the Year 1866* (Washington, 1867), 490.
[1497] Alexander Hamilton is quoted by Harold Syrett, ed., *The Papers of Alexander Hamilton*, vol. 10 (New York: Columbia University Press, 1961–1987), 314.
[1498] Tench Coxe's quotes on the importance of wood and timber appear in T. Coxe, *A View of the United States of America* (Philadelphia, 1794), 450–451 and 456.
[1499] On the construction of waterwheels and their accompanying machinery from wood, see Tench Coxe, *A Statement of the Arts and Manufactures of the United States for the Year 1810* (Philadelphia: A. Cornman, 1814), 17.
[1500] Oliver Evans, *The Young Mill-Wright and Miller's Guide* (New York: Arno Press, 1972), 377–378, reports on the size of waterwheels.
[1501] On wooden cogs, see F. Michaux (1854), vol. 1, 137-138.
[1502] Zachariah Allen's remarks on timbers for mill dams appear in Kulik, Parks, and Penn, eds., *The New England Mill Village*, 105.
[1503] Allen's testimony as to the preeminence of water mills is found in ibid., p. 6. 334. Tench Coxe's enumeration of the different types of mills is in Tench Coxe, *An Address to the Assembly of Friends of American Manufactures* (Philadelphia, 1787), 9.
[1504] Robert Sears explains the importance of a mill site in R. Sears, *A New and Popular Pictorial Description of the United States* (1843), 584 and 334. Sears's comments on sawmills appear in ibid.
[1505] One lumberman's boast is quoted by N. Egleston, "Forests and the Census," *Popular Science Monthly*, vol. 22 (New York, 1883), 783.
[1506] Edward Kendall's discussion on the development of villages and towns around water mills appears in E. Kendall, *Travels Through the Northern Parts of the United States in the Years 1807 and 1808*, vol. 3 (New York: I. Riley, 1809), 33–34.
[1507] On the decentralized location of manufacturing villages, see Kulik, Parks, and Penn, eds., *The New England Mill Village*, 6.
[1508] J.S. Buckingham, *America: Historical, Statistic, and Descriptive*, vol. 2 (London: Fisher, Son, and Co., 1841), 280, reproduces the report issued in 1835 on the industrial development of New York.
[1509] Carroll Wright, "Factory System of the United States," *Tenth Census*, vol. 4 (Washington, 1884), 8, tells of the number of factories operating in the United States in 1831, while Kulik, Parks, and Penn, eds., *The New England Mill Village*, 10–12, report on the number employed in them.

[1510] Coxe's praise for the factory system is in Coxe, *A Statement of the Arts and Manufactures of the United States for the Year 1810*, 25.
[1511] The unhappy worker is quoted in Steve Dunwell, *The Run of the Mill* (Boston: David R. Godine, 1978), 49.
[1512] Tench Coxe lists the types of manufacturers that needed heat to process their products in Coxe, *An Address to the Assembly of Friends of American Manufactures*, 9.
[1513] Coxe's opinion about the nation's charcoal supply is found in Coxe, *A Statement of the Arts and Manufactures of the United States for the Year 1810*, 32.
[1514] On the use of pitch pine for fuel, see F. Michaux (1854), vol. 3, 120.
[1515] Concerning maple as fuel, see ibid., vol. 1, 148.
[1516] On the saltworks in upstate New York and their consumption of wood, see Frederick Marryat, *Diary in America* (New York: Alfred A. Knopf, 1962), 85.
[1517] David Stevenson, *Sketch of Civil Engineering of North America* (London: John Weale, 1838), 170, reports the burning of wood by steam engines.
[1518] T. Coxe's optimistic prediction for iron manufacturers appears in Coxe, *A Statement of the Arts and Manufactures of the United States for the Year 1810*, 32.
[1519] John Pearse, *A Concise History of the Iron Manufacture of the American Colonies Up to the Revolution, and of Pennsylvania until the Present Time* (New York: Burt Franklin, 1970), 275 and 278, reports that Pennsylvania produced one-quarter of the nation's iron in 1847.
[1520] One familiar with the Pennsylvania iron industry is quoted in James Swank, *Introduction to a History of Ironmaking and Coal Mining in Pennsylvania* (Philadelphia, 1878), 47.
[1521] An early settler of Scioto county presents his story in Frank Rowe, *History of the Iron and Steel Industry in Scioto County* (Columbus: Ohio State Archaeology and Historical Society, 1938), 96.
[1522] Concerning the output of the ironworks in Scioto county, see ibid., 75.
[1523] Harlan Hatcher, *A Century of Iron and Men* (Indianapolis: Bobbs-Merrill, 1950), 102, reports on the production of the ironworks in upper Michigan.
[1524] The statistics on the amount of iron produced with charcoal between 1830 and 1890 are found in Pearse, *A Concise History of the Iron Manufacture of the American Colonies Up to the Revolution, and of Pennsylvania until the Present Time*, 278, and J. Swank, *History of the Manufacture of Iron in all Ages* (Philadelphia: American Iron and Steel Association, 1892), 376. The amount of iron smelted with charcoal in America far exceeded the quantity of iron produced in England with charcoal in an earlier age not only because of America's superior wood supplies, but also because its vast river system allowed American ironmasters the option of transporting ore by water to areas where fuel was abundant or bringing timber to the ore [J. Birkinbine, "The Distribution and Proportions of American Blast Furnaces," *Transactions of the American Institute of Mining Engineers*, vol. 14 (1885), 567].
[1525] Statistics on the population during these time periods are found in United States, Department of Commerce and Labor, Bureau of the Census, *A Century of Population Growth* (1909), 47.
[1526] The *Forestry* magazine article is by William Little, "Alarming Destruction of American Forests," *Forestry* 7 (1883): 254.
[1527] Michaux' s calculations are found in F. Michaux (1854), vol. 3, 98.
[1528] Moritz Busch, *Travels between the Hudson and the Mississippi, 1851–1852* (Lexington: University Press of Kentucky, 1971), 95, tells of the noises made by carpenters.
[1529] Daniel Brush's experience as a portable-sawmill operator is told by Daniel Brush, *Growing Up with Southern Illinois, 1820 to 1861* (Chicago: Lakeside Press / R.R. Donnelley, 1944), 172.
[1530] On material used to construct large buildings in northern states, see F. Michaux (1854), vol. 3, 129.
[1531] On timbers essential in even non-wood buildings, see Little, "Alarming Destruction of American Forests," 254.
[1532] John Bristed, *The Resources of the United States of America* (New York: James Eastburn and Co., 1818), 5, gives the United States this high ranking in size.
[1533] Buckingham, *America: Historical, Statistic, and Descriptive*, vol. 2, 274, tells his British audience about the size of the United States.
[1534] The "roving impulse" quote appears in Busch, *Travels between the Hudson and the Mississippi, 1851–1852*, 105.
[1535] Martin Birbeck is quoted in Birkbeck, *Notes on a Journey in America*, 31.
[1536] Busch, *Travels between the Hudson and the Mississippi, 1851–1852*, 105, describes the traveling family units.
[1537] On wood used for land transport, see F. Michaux (1854), vol. 1, 137 (axles); ibid., 24–25 (wheel spokes); and

Birkbeck, *Notes on a Journey in America*, 73 (whip).

[1538] The "leaps and starts" quote appears in Stevenson, *Sketch of Civil Engineering of North America*, 216.

[1539] Henry Tudor recounts his experience in Henry Tudor, *Narrative of a Tour of North America* (1844), 148–149, 339. John Beste's experience on a plank road is found in J. Beste, *The Wabash*, vol. 1 (London: Hurst and Blackett, 1855), 296 and 298.

[1540] Jedidiah Morse's observations on American waterways are found in Jedidiah Morse, *The American Geography* (London, 1794), 125.

[1541] The engineer quoted on bridge building is George Vose, *Handbook of Railroad Construction* (Boston and Cambridge: James Munroe and Company, 1857), chap. 8, section 139.

[1542] Concerning the bridges spanning the Schuykull and Delaware rivers, see F. Michaux (1854), vol. 3, 129–130.

[1543] The English tourist's comments about the bridge crossing Lake Cayuga appear in A. Mackay, vol. 3 (1849), 173.

[1544] Jedidiah Morse's observation on the ease of water travel in the United States is found in Morse, *The American Geography*, 126.

[1545] The praise for America's inland navigation system is in Francis Wyse, *America, Its Realities and Resources*, vol. 1 (London: T.C. Newby, 1846), 368.

[1546] Stevenson, *Sketch of Civil Engineering of North America*, 178–179, is quoted on floating logs down rivers.

[1547] Mark Twain's recollections on log rafts appear in S. Clemens.

[1548] On flatboatmen, see Kate Rabb, *A Tour Through Indiana in 1840* (1840), 330, and J. Kennedy, *Agriculture of the United States in 1860* (Washington, 1864), cxxx.

[1549] For details concerning the work of keelboatmen, see "Western Keel-Boatmen," *American Pioneer* 2 (1843): 271.

[1550] Mark Twain's recollections about keelboatmen appear in S. Clemens.

[1551] The comparison between packhorses and keelboats is found in "Western Keel-Boatmen," *American Pioneer* 2 (1843): 273.

[1552] Mark Twain's quote about the intrusion of the steamboat is found in S. Clemens.

[1553] R. Wickliffe, "Navigation by Steam," *American Pioneer* 1 (1842): 37, gives the date of the first steamboat voyage upriver.

[1554] Twain's quote on the death of keelboating appears in S. Clemens.

[1555] Tudor, *Narrative of a Tour of North America*, vol. 2, 36, compares steamboats to keelboats.

[1556] Wickliffe, "Navigation by Steam," 37, compares steamboats to wagons.

[1557] The "without parallel" quote is from ibid.

[1558] John Bristed's praise for the steamboat appears in Bristed, *The Resources of the United States of America*, 65.

[1559] James Hall's praise for the steamboat appears in J. Hall, *The West* (Cincinnati: H.W. Derby and Co., 1848), 108–109.

[1560] A comparison of steamboat traffic on the Atlantic and that in rivers is found in T. Purdy, "Report on Steam Navigation in the United States," *Tenth Census*, vol. 4 (1884), 13.

[1561] Emmeline Stuart-Wortley, *Travels in the United States 1849–1850* (New York: Harper and Brothers, 1851), 115, observes steamboat traffic at night.

[1562] François Michaux's observation on building ships at Pittsburgh is found in F. Michaux, *Travels to the West of the Alleghany Mountains* (Cleveland: Arthur H. Clark Company, 1904), 160.

[1563] On floating white pine logs down to Pittsburgh, see F. Michaux (1854), vol. 3, 133.

[1564] Bates, "Ship Timber in the United States," 475, reports on the use of white oak in steamboat construction.

[1565] Robert Fulton's reply to Francois Michaux is found in F. Michaux, "Historical Anecdote of Robert Fulton by F. Michaux," *Journal of the Franklin Institute,* 3rd Series, vol. 18, no. 39 (1849): 343. The consumption of wood by the *Eclipse* is told by Josephy Hanson, *The Conquest of the Missouri* (Chicago: A.C. McClurg and Co., 1909), 17.

[1566] The problems of finding fuel for steamboats in the early days of steamboating are discussed in Wickliffe, "Navigation by Steam," 69, and William Howells, *Recollections of Life in Ohio from 1813 to 1840* (Gainesville: Scholars' Facsimiles and Reprints, 1963), 75.

[1567] John Oldmixon, *Transatlantic Wanderings* (London: G. Routledge and Company, 1855), 135–136, describes the backwoodsmen who supplied the steamboats with fuel.

[1568] The quote about fueling in midstream is in Florence Dorsey, *Master of the Mississippi* (Boston: Houghton Mifflin, 1941), 261–262.

[1569] Gustaf Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1 (Minneapolis: University of Minnesota Press, 1950), 98–99, describes the woodchoppers on the shores of Lake Huron.

[1570] On poor Irish immigrants supplying wood to steamboats at Natchez, see C. Arfwedson, *The United States and*

Canada in 1832, 1833 and 1834, vol. 2 (London: Richard Bentley, 1834), 98.

[1571] Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1, 96, describes timber traffic on Lake Huron.

[1572] Concerning scarcities of lumber in New England by the 1830s, see H. Hall, "Shipbuilding Industry of the United States," *Tenth Census* (1884).

[1573] The captain and owner of the *J. W. Van Sent* is quoted in Walter Blair, *A Raft Pilot's Log* (Norman, OK: Arthur H. Clark Co., 1930), 200.

[1574] Ibid., 203, describes the biggest timber raft ever pulled down the Mississippi.

[1575] The meaning of "clipper" is given by B. Bathe, "The Clipper's Day," in *The Great Age of Sail*, ed. J. Jobé (Switzerland: Edita Laousanne, 1967), 202.

[1576] Ibid., 46, gives the number of wooden ships in service in 1880.

[1577] On New York's preeminence among seaports along the Atlantic, see M. Kern, "The Relation of Railroads to Forest Supplies and Forestry," United States Department of Agriculture, *Forest Service Bulletin*, no. 1 (1887), 11.

[1578] Ibid., discusses the construction of the Baltimore and Ohio Railroad.

[1579] Alex Mackay's intentions for writing a book on America appear in A. Mackay, vol. 1 (1849). "Introduction."

[1580] Alex Mackay's account of crossing the James River is in ibid., vol. 2, 151.

[1581] William Nowlin's description of building rails from wood is in William Nowlin, *The Bark Covered House* (Chicago: Lakeside Press, 1937), 192.

[1582] Alex Mackay's discussion on the availability of timber to American railroad builders is found in A. Mackay, vol. 2 (1849), 243.

[1583] Stevenson, *Sketch of Civil Engineering of North America*, 253, and A. Mackay, vol. 2 (1849), 244, show that cheap timber kept the construction costs low on American railroads while the higher cost of timber in England made such construction more expensive.

[1584] On the number and size of woodsheds along the New York Central Line, see Frank Stevens, *The Beginnings of the New York Central Railroad* (New York: G.P. Putnam's Sons, 1926), 317.

[1585] Concerning the woodsheds of an Indiana railroad and their size, see Frank Hargrave, *A Pioneer Indiana Railroad* (Indianapolis: William B. Burford, 1932), 68.

[1586] Everett Dick, *Vanguards of the Frontier* (New York, 1944), 388, gives the size of the Columbus, Nebraska, woodshed.

[1587] Beste, *The Wabash*, vol. 1, 164, tells of boys selling lemonade while his train "wooded-up."

[1588] On Ogden's profitting from his purchase of timberlands near the Galena railroad's track, see Robert Casey and W. Douglas, *Pioneer Railroad* (New York: Whittlesey House / McGraw-Hill, 1948), 62.

[1589] Mackay's opinion on canals and his account of why railroads supplanted them are in A. Mackay, vol. 2 (1849), 223–224.

[1590] On increased accessibility to timberlands because of the railroad, see Ray Billington, "The Forty-Second Annual Meeting of the Mississippi Valley Historical Association," *Mississippi Valley Historical Review* 36, no. 2 (1949), 290 (Wisconsin), and D. Thompson, "Destruction of American Forests and the Consequences," *American Baptist Review* 2 (1883), 486–487 (lower Michigan peninsula).

[1591] Thomas Nichols, *Forty Years of American Life* (London: John Maxwell and Co., 1864), 24–25; Orsamus Turner, *Pioneer History of the Holland Purchase of Western New York* (Buffalo: Jewett, Thomas, and Co., 1849), 563; and Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1, 215, describe the use of timber and wood to build the settler's house.

[1592] The number of rails split by a good worker is given in Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1, 235.

[1593] Ibid, tells of the necessity of having a fire constantly burning in the winter in a settler's house.

[1594] For the size of logs burned by settlers in their hearths, see Nowlin, *The Bark Covered House*, 112.

[1595] An Englishman's observation on hog raising by settlers is found in William Oliver, *Eight Months in Illinois* (Chicago: Walter M. Hill, 1924), 34. Edmund Dana's account of the fertility of the soil in the Ohio wilderness appears in Dana, *Geographical Sketches on the Western Country*, 29.

[1596] Oliver, *Eight Months in Illinois*, 37, describes the work of the American chopper.

[1597] The younger Nowlin's recollection of "slaying" trees with his father is found in Nowlin, *The Bark Covered House*, 167.

[1598] Oliver, *Eight Months in Illinois*, 38, describes a "chopping bee."

[1599] Arfwedson, *The United States and Canada in 1832, 1833 and 1834*, vol. 1, 199, reports that northeastern settlers paid for their land by selling the wood they cleared for cord wood.

[1600] The advertisement by land sellers appears in N. Egleston, "What We Owe to the Trees," *Harper's New Monthly* 64 (1882): 675.
[1601] James Hall, *Statistics of the West* (Cincinnati: J.A. James and Co., 1836), 144, suggests that farmers sell wood for fuel.
[1602] Nowlin's father's remark about their wood gaining value is in Nowlin, *The Bark Covered House*, 171.
[1603] William Nowlin's comment about locomotives' appetite for wood is in ibid., 177.
[1604] The quote of the son of an Indiana settler is in George Finley, "A Quaker Pioneer in Indiana: James Milton Finley," *Indiana Magazine of History* 26, no. 1 (March 1930): 36.
[1605] On settlers in Pennsylvania selling bark to tanneries, see C. Sargent, "Report on the Forests of North America," *Tenth Census*, vol. 9 (1884), 509.
[1606] Gustaf Unonius's earnings from hauling logs to sawmills are discussed in Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1, 233–234.
[1607] William Nowlin's estimate of the number of cords he and his father burned is in Nowlin, *The Bark Covered House*, 166.
[1608] Nichols, *Forty Years of American Life*, 24–25, describes a "log rolling bee."
[1609] The making and sale of potash by settlers are discussed in ibid., 26, and Coxe, *A View of the United States of America*, 452–456.
[1610] The quote on the deciding role of wood in setting down a farm is from *A New and Popular Pictorial Description of the United States*, 545.
[1611] The populations of Ohio, Illinois, Indiana, Kansas, and Nebraska in 1860 are found in United States, Bureau of the Census, *Historical Statistics of the United States*, vol. 1 (1976), 27, 28, 30, and 31.
[1612] Concerning where the majority of Kansas's population lived in 1860, see United States, Census Office, *Population of the United States in 1860* (Washington: Government Printing Office, 1864), 158–159.
[1613] As to where the majority of oak, black walnut, cottonwood, and hickory grew in Kansas, see Richard Douglas, "A History of Manufactures in the Kansas District," *Collections of the Kansas Historical Society* 11 (1909–1911): 85.
[1614] Zebulon Pike's observations appear in Zebulon Pike, *The Expedition of Zebulon Montgomery Pike*, vol. 2 (New York: Francis P. Harper, 1895), 523.
[1615] Edwin James, *Account of an Expedition from Pittsburgh to the Rocky Mountains*, vol. 1 (Cleveland: Arthur Clark Company, 1905), 260, records Big Elk's conversation with an American officer.
[1616] The Daniel Boone quote comes from *A Face in the Crowd*, directed by Elia Kazan, written by Budd Schulberg, Burbank, CA: Warner Bros. Pictures, 1957, http://www.script-o-rama.com/movie_scripts/f/face-in-the-crowd-script.html.
[1617] The problem of finding timber on the prairies is discussed in Sears, *A New and Popular Pictorial Description of the United States*, 548.
[1618] Francis Parkman's discovery regarding the supply of buffalo chips is in Francis Parkman, *The Oregon Trail*, 7. 1.
[1619] On the high cost of fencing on the Great Plains, see United States, Department of Agriculture, "Statistics of Fences in the United States," *Report of the Commissioner of Agriculture for the Year of 1871* (Washington: Government Printing Office, 1872), 497.
[1620] On fence building in Michigan, see L. Watkins, "Destruction of the Forests of Southern Michigan," *Michigan Pioneer and Historical Society*, vol. 28 (1897–1898), 149.
[1621] Unonius, *A Pioneer in Northwest America 1841–1858*, vol. 1, 191, describes pioneers picking up lumber shipped to Milwaukee via the Great Lakes.
[1622] Sargent, "Report on the Forests of North America," 489 and 522, reports that railroads carried timber from Chicago and Milwaukee to the Great Plains.
[1623] The opinion of John Wesley Powell appears in John Powell, *Report on the Lands of the Arid Region of the United States* (Cambridge: Belknap Press of Harvard University Press, 1962), 196.
[1624] Increase Lapham's statements on the contribution of wood to the development of the United States appear in Increase Alan Lapham, "The Forest Trees of Wisconsin," *Transactions of the Wisconsin State Agricultural Society*, vol. 4 (Maddison: 1855), 196–197, and I. Lapham, *Report on the Disasterous Effects of the Destruction of Forest Trees Now Going on So Rapidly in the State of Wisconsin* (Madison, 1867), 26–27.
[1625] The quote that begins, "Villages, cities, institutions of religion and learning…" comes from Orsamus Turner, dedication in *History of the Pioneer Settlement of Phelps and Gorham's Purchase, and Morris' Reserve*

(Rochester: William Alling, 1852).

[1626] Samuel Sherman, *Increase Allen Lapham* (Milwaukee: Milwaukee News Company, 1876), 17, outlines the main points of Lapham's report.

[1627] A reviewer's praise for Lapham's report is found in ibid., 18.

[1628] R. Reynolds and A. Pierson, "Fuel Wood Used in the United States, 1630–1930," *United States Department of Agriculture Circular No. 641* (Washington, D.C., 1942), 12, give the estimate of 5 billion cords. In 1879, for example, Americans burned over 140 million cords of wood just to heat their homes and cook [Sargent, "Report on the Forests of North America," 489]. That same year, iron furnaces consumed about 2 million cords (ibid.). During the time period when locomotives and steamboats burned wood, they probably consumed at least 25 million cords [Reynolds and Pierson, "Fuel Wood Used in the United States, 1630–1930," 3].

[1629] The opinion of two experienced foresters concerning the damage fuel cutters did is in Reynolds and Pierson, "Fuel Wood Used in the United States, 1630–1930," 7–8.

[1630] Ibid., 15, calculates the amount of trees cut for building between 1810 and 1867. The disproportionate amount of wood consumed for fuel in comparison to the amount of wood consumed by builders is vividly pointed out by a report prepared by one of America's premier foresters that breaks down the uses of wood by consumers in 1887. That year, according to the report, Americans consumed 20 billion cubic feet of wood. Only 2.5 billion cubic feet went for lumber. Another 0.36 billion cubic feet were used for railroad construction. Fence material required an outlay of a half-billion cubic feet. Charcoal burners consumed a quarter of a billion cubic feet. A whopping 17.5 billion cubic feet were spent for fuel [B. Fernow, "Our Forestry Problems" *Popular Science Monthly* 32 (Dec. 1887): 231]. All totaled, more than 87 percent of all the wood consumed in 1887 was burned as fuel!

[1631] On selecting young trees for ties, see Sargent, "Report on the Forests of North America," 493; 30 million healthy, young, vigorous trees were needed each year to make railroad ties (ibid.).

[1632] "Waste of Wood," *Van Nostrand Engineering Magazine*, vol. 1 (1869), 155, provides the statistics on the amount of timberlands cleared by farmers from 1850 to 1860.

[1633] Sargent, "Report on the Forests of North America," 492–493, provides rich detail concerning the destruction of woodlands by livestock.

[1634] On the annual loss of timberlands for cultivation, lumber, and fuel, see Felix Oswald, "The Preservation of Forests," *North American Review* 128, no. 266 (Jan. 1879): 37.

[1635] The declining percentage of dense forest is revealed in "Spare the Trees," *Appletorís Journal* 1 (New Series) (1876), 471. For example, forest land primarily located in Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Missouri originally covered about 439,062 square miles. By the beginning of the twentieth century 60 percent had been cleared for farming and only 5 percent remained untouched by human hands [Raphael Zon and William Sparhawk, *Forest Resources of the World*, vol. 2 (New York: McGraw Hill, 1923), 523].

[1636] Frederick Marryat's description of the destruction of forests in upstate New York is in Marryat, *Diary in America*, 84.

[1637] Beste, *The Wabash*, vol. 1, 168–169, describes the destruction of trees in Ohio.

[1638] A German forestry expert's observations are in W. Fisher, "Forestry in North America," *Nature* 44 (1891): 62.

[1639] On the propensity of the waste wood to be engulfed by fire, see Frederick Merk, *Economic History of Wisconsin During the Civil War Decade* (Madison: Wisconsin Historical Society, 1916), 101.

[1640] The findings of a member of one of the founding families of Ohio are in John Williams, "Our Cabin," *American Pioneer* 2 (1843): 448–449.

[1641] Nowlin's remarks on the changes in his family's land are in Nowlin, *The Bark Covered House*, 49 and 170. Other changes due to deforestation were reported. A veteran steamboat pilot noticed that the tributaries of the Mississippi had become more difficult to navigate as time passed. The pilot grew up in Galena, Illinois. Galena was on the Fevre River, five miles from where the river emptied into the Harris Slough, which opened into the Mississippi River. During the late 1850s, he recalled that the "Fevre River and [the] Harris Slough were both deep then. Boats fully loaded had no trouble getting into the Mississippi [from Galena], and boats like the *'Northern Light'* and *'Grey Eagle,'* two hundred and fifty feet long, could turn around at Galena harbor." But when the pilot returned to Galena sometime during the first part of the twentieth century in a much smaller boat, he reported that he "had to back all the way out of the river and turn in [to] Harris Slough" even though his boat "was only one hundred and eighty feet long." According to the pilot, this was because "the old, Fevre River has been filled up by the cultivated hills" [Blair, *A Raft Pilot's Log*, 23–24].

[1642] The "melting away" quote appears in Nowlin, *The Bark Covered House*, 167.

[1643] The "light of civilization" quote is found in ibid., 170. Many people in the 1800s shared Nowlin's sentiment. A

contemporary versifier, for instance, captured such feelings in the following lines: "Through the deep wilderness, where scarce the sun / Can cast his darts, along the winding path / The pioneer is treading. In his grasp / Is his keen axe, that wondrous instrument / That like the talisman, transforms / Deserts to fields and cities" [Turner, *Pioneer History of the Holland Purchase of Western New York*, 562].

[1644] The remarks of the unrepentant mill owner are in "A Letter," *Northwestern Lumberman* (November 18, 1876).

[1645] The judgment of a knowledgeable government official is found in United States, Department of Agriculture, *Monthly Reports of the Department of Agriculture for the Year 1869*, 23.

[1646] Mannaseh Cutler reports his encounter in Manasseh Cutler, *An Explanation of the Map of Federal Lands* (Salem: Dabney and Cushing, 1787), 15.

[1647] Oliver, *Eight Months in Illinois*, 68; Hall, *Statistics of the West*, 114; and Mellen, *A Book of the United States*, 173, confirm that the elk and buffalo had disappeared from the Midwest by the 1840s. Nowlin credited people such as his father in Nowlin, *The Bark Covered House*, 170.

[1648] The complaint of a surviving Indian is found in Dorothy Dondore, *The Prairie and the Making of Middle America* (Cedar Rapids: The Torch Press, 1926), 121. Many contemporaries saw the connection between deforestation and the destruction of America's indigenous population. One writer, for instance, stated, "To cut down trees and shoot Indians seems to be our national instinct" ["How the Destruction of Trees Affects the Rain," *Harper's New Monthly Magazine* 12 (1855–1856), 666].

[1649] The viewpoint of the writer of the census of 1810 is in Coxe, *A Statement of the Arts and Manufactures of the United States for the Year 1810*, 58.

[1650] The viewpoint of Charles Sargent in the census of 1880 is found in Sargent, "Report on the Forests of North America," 493.

[1651] C. Sargent's lesson for the American people appears in Charles Sargent, "The Protection of Forests," *North American Review* 135, no. 311 (1882): 401.

[1652] The detailed look at the condition of the forests east of the Mississippi appears in Sargent, "Report on the Forests of North America," 501 (New York); ibid., 506 (Pennsylvania); ibid., 547 (Ohio); ibid. (Indiana); ibid., 550 (Michigan); and ibid., 490 (northern Michigan, Wisconsin, and Minnesota).

[1653] Another alarming report that preceded the 1880 census by three years appears in Felix Oswald, "Climatic Influence of Vegetation—A Plea for Our Forests," *Popular Science Monthly* 11 (August 1877): 388.

[1654] N. Egleston's lament is in Egleston, "What We Owe to the Trees," 675–676.

[1655] Egleston's quote on the warnings of history appears in ibid., 686.

[1656] On the prosperity engendered by deforestation see Orsamus Turner, "Dedication to the Surviving Pioneers and the Descendants of Pioneers of Phelps and Gorham's Purchase, and Morris' Reserve," *History of the Pioneer Settlement of Phelps and Gorham's Purchase, and Morris' Reserve* (Rochester: William Alling, 1852)

[1657] The manifest destiny quote come from W.H. McIntosh, History of Ontario County, New York (Philadelphia: Everts, Ensign, and Everts, 1876), 205.

[1658] Greeley's celebration of the axe can be found at Horace Greeley, et al., *The Great Industries of the United States* (Hartford: J.B. Burr and Hyde, 1872), 127.

[1659] Gifford Pinchot, *Breaking New Ground* (New York: Harcourt, Brace and Company, 1947), 23.

[1660] The remarks made about William Russel Dudley at his funeral can be found in *Dudley Memorial Volume* (University of California Libraries, 1913), 13–14.

[1661] David Foreman, in his article "The Big Woods and Ecological Wilderness Recovery," in *Clearcut: The Tragedy of Industrial Forestry*, ed. Bill Devall (San Francisco: Sierra Club Books / Earth Island Press, 1993), well illustrates the perceived dichotomy between Muir and Pinchot. Foreman writes: "Many conservationists, particularly John Muir, hoped that these forest reserves would be off-limits to logging of any kind. But Gifford Pinchot, the soon-to-be first chief of the United States Forest Service, convinced Congress to allow logging on these reserves" (*Clearcut*, 43). Likewise, the National Forest Products Association—the predecessor of the American Forest Products and Paper Association—used a quote from Pinchot, to imply his support for clear-cutting, in a handout supporting such practices (National Forest Products Association, *The Monongahela Issue: A Spreading Economic Malady* [March 9, 1976], 5).

[1662] Muir's quotation, supporting controlled logging, appeared in John Muir, "Plan to Save the Forests—Forest Preservation by Military Control" *Century Magazine* 49 (February, 1895). The aim of the article was to support the extension of the national forest reserves, the forerunner of America's National Forests. The statement was not an anomaly to Muir's thoughts on logging in the national reserves. He reiterates his support for controlled logging in other articles. Muir writes, for example, "under wise management, selecting the trees that should be cut for

lumber, these forests would be a never failing fountain of wealth and beauty" (John Muir, "The American Forests," *Atlantic Monthly* [August 1897], 155). Later on in the article, Muir welcomes the new immigrant "to the woods" where "the pines will come down from the mountains for their homes as willingly as the cedars came from Lebanon for Solomon's temple. Nor will the woods be worse for this use" (ibid., 156).

[1663] The "reaction" quote of Pinchot appears in ibid., 26.

[1664] John Muir's "lovers … " quote appeared in J. Muir, "The American Forests," *Atlantic Monthly* 80 (August 1897), 147.

[1665] The Pinchot "reaction … "; "get timber … "; and "as impractical … " quotes appear in G. Pinchot, *Breaking New Ground* (Seattle: University of Washington Press, 1972), 26, 23, and 27. Regarding John Muir's analysis of forests and in regards to the welfare of America, see Muir, "The American Forests," 155.

[1666] Regarding Pinchot's description of the many functions of forests, see G. Pinchot, "Part I —The Forest," *A Primer of Forestry*, U.S. Department of Agriculture, Division of Forestry, *Bulletin No. 24* (Washington, D.C.: Government Printing Office, 1903), 7–8.

[1667] Pinchot's careful instructions appear in G. Pinchot, "Part I—The Forest," *A Primer of Forestry*, U.S. Department of Agriculture, Division of Forestry, *Bulletin No. 173* (Washington, D.C.: Government Printing Office, 1909), 34.

[1668] Pinchot's "denuded" quote appears in A. Smyth, "Seventh American Forestry Congress," https://archives.yale.edu/repositories/12/resources/3740. Pinchot added, " … so that the character of watersheds should not be altered with the resulting injury to streams."

[1669] Regarding destructive lumbering, see G. Pinchot "Part I—The Forest," *A Primer of Forestry*, U.S. Department of Agriculture, Division of Forestry, *Bulletin No. 173* (Washington, D.C.: Government Printing Office, 1909), 34.

[1670] Pinchot wrote in admiration of old growth in Pinchot, *Breaking New Ground*, 127.

[1671] Muir's praise for the giant redwood is found in J. Muir, "Hunting Big Redwoods," *Atlantic Monthly* 81 (1898): 304.

[1672] Pinchot's quotes on his admiration of the giant redwoods and his disgust at their destruction can be found in G. Pinchot (1900), "A Short Account of the Big Trees in California," U.S. Department of Agriculture, Division of Forestry, *Bulletin No. 28,* 7 and 30, and Pinchot, *Breaking New Ground*, 103.

[1673] The discovery by the Western world of Giant Sequoias and story behind it can be found in James M. Hutchings, *In the Heart of the Sierras: The Yo Semite Valley, Both Historical and Descriptive* (Old Cabin, 1886), 10–12.

[1674] James Mason Hutchings's quote, "Who can picture in language…" is found in James M. Hutchings, *Scenes of Wonder and Curiosity in California* (London: Chapman and Hall, 1865), 143.

[1675] Hutchings's quotes about the size of trees and grandeur of the forest come from ibid., 147.

[1676] "It is much to be questioned…" quote comes from ibid., 10.

[1677] Alfred Russel Wallace's quote comes from Charles H. Smith and Megan Derr, eds., *Alfred Russel Wallace's 1886–1887 Travel Diary: The North American Lecture Tour* (United Kingdom: Siri Scientific Press, 2013), 117.

[1678] Pinchot's praise of the trees can be found in U.S. Department of Agriculture, Division of Forestry, Gifford Pinchot, *A Short Account of the Big Trees of California* (Washington: Government Printing Office, 1900), 7.

[1679] John Muir's quote about the skinned tree can be found in Linnie Marsh Wolfe, ed., *John of the Mountains: The Unpublished Journals of John Muir* (Madison: University of Wisconsin Press, 1979), 429.

[1680] Hutchings's quote about cutting down the tree can be found at Hutchings, *In the Heart of the Sierras*, 219–220.

[1681] The quote about dancing on the tree stump comes from James M. Hutchings, *Scenes of Wonder and Curiosity in California* (University of California Libraries, 1870), 43.

[1682] John Muir's description of cutting down a big tree can be found in Wolfe, ed., *John of the Mountains: The Unpublished Journals of John Muir*, 323.

[1683] Pinchot's quote about fragments of logs can be found in U.S. Department of Agriculture, Division of Forestry, Gifford Pinchot, *A Short Account of the Big Trees of California*, 29.

[1684] William Dudley's observation on lumbering can be found in William Russell Dudley, "The Vitality of the Sequoia Gigantea, California Alumni Association of California," (1905) in *Dudley Memorial Volume*, 34.

[1685] Muir's criticism of the government can be found in Wolfe, ed., *John of the Mountains: The Unpublished Journals of John Muir*, 323.

[1686] "Even in death…" quote appears in Hutchings, *In the Heart of the Sierras*, 226.

[1687] Hutchings's quote about young trees growing at the bottom of the fallen big tree can be found in Hutchings, *In the Heart of the Sierras,* 229.

[1688] "Every fallen leaf…" quote is from John Muir, *The Mountains of California* (New York: Modern Library, 2001), 141.

[1689] William Russel Dudley's quotes about the forest being a remarkable wonder of the world can be read in *Dudley Memorial Volume*, 40.
[1690] The timeline of the tree Dudley measured can be found in *Dudley Memorial Volume*, 38–39.
[1691] "Any fool…" quote is found in Wolfe, ed., *John of the Mountains: The Unpublished Journals of John Muir*, 431.
[1692] "It is feared…" quote is found in David A. Wells, ed., "Notes by the Editor on the Progress of Science for the Year 1856," *Annual of Scientific Discovery* (Boston: Gould and Lincoln, 1857), iv.
[1693] The second coming of the double-bladed axe is discussed in Ronald Jager, "Tool and Symbol: The Success of the Double-Bitted Axe in North America," *Technology and Culture* 40, no. 4 (October 1999): 841–842.
[1694] Stephen C. Sillett et al., "Structure and Dynamics of Forests Dominated by *Sequoidendron giganteum*," Forest *Ecology and Management* 448, no. 9 (2019): 236, and Stephen Sillett et al., introduction to "Above Ground Biomass and Growth Efficiency of *Sequoia sempervirens* Forests," *Forest Ecology and Management* 458 (15 February 2020), https://doi.org/10.1016/j.foreco.2019.117740.
[1695] For the quote "…most wonder full specimens," see Wells, ed., "Notes by the Editor on the Progress of Science for the Year 1856," *Annual of Scientific Discovery*, iv.
[1696] The quote "greatest sequesters of carbon," is found in Sillett et al., "Above Ground Biomass and Growth Efficiency of *Sequoia sempervirens* Forests," 15, and Stephen C. Sillett et al., "How do tree structure and old age affect growth potential of California redwoods?," *Ecological Monographs* 85, no. 2 (May 2015): 209, https://doi.org/10.1890/14-1016.1.
[1697] Juliet Eilperin, "This tree has stood here for 500 years. Will it be sold for $17,500?," *Washington Po*st (Dec. 30, 2021), https://www.washingtonpost.com/climate-environment/interactive/2021/tongass-national-forest-old-growth-tree-climate/?utm_campaign=wp_post_most&utm_medium=email&utm_source=newsletter&wpisrc=nl_most&carta-url=https%3A%2F%2Fs2.washingtonpost.com%2Fcar-ln-tr%2F35a28ad%2F61cde8579d2fda6d17253315%2F60b13f2b9bbc0f652711008b%2F9%2F74%2F61cde8579d2fda6d17253315.
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[1702] Pinchot's advocacy of public control of lumbering is found in Pinchot, "Foreword," in *Deforested America*, Ahern, vi.
[1703] Observations in post-World War II behavior of the U. S. Forest Service comes from an interview with professor Char Miller, author of *Gifford Pinchot and the Making of Modern Environmentalism* (Washington, D.C.: Island Press, 2001). For the best book on what happened to the National Forests after World War II, see Paul Hirt, *A Conspiracy of Optimism: Management of the National Forests Since World War II* (Lincoln and London: University of Nebraska Press, 1994). The poor forest practices deplored by Ahern and Pinchot led to private industry's increased logging in the National Forests. The tremendous demand for wood after World War II also forced industry to look to the National Forests for its timber. Another factor after World War II in increasing logging in National Forests was that production in all fields, including the forests', became America's chief concern in its battle to win the Cold War.
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