

Statecraft and Insect Oeconomies in the Global French Enlightenment (1670-1815)

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ABSTRACT

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Naturalists, state administrators and farmers in France and its colonies developed a myriad set of techniques over the course of the long eighteenth century to manage the circulation of useful and harmful insects. The development of normative protocols for classifying, depicting and observing insects provided a set of common tools and techniques for identifying and tracking useful and harmful insects across great distances. Administrative techniques for containing the movement of harmful insects such as quarantine, grain processing and fumigation developed at the intersection of science and statecraft, through the collaborative efforts of diplomats, state administrators, naturalists and chemical practitioners. The introduction of insectivorous animals into French colonies besieged by harmful insects was envisioned as strategy for restoring providential balance within environments suffering from human-induced disequilibria.

Naturalists, administrators, and agricultural improvers also collaborated in projects to maximize the production of useful substances secreted by insects, namely silk, dyes and medicines. A study of these scientific and administrative techniques will shed light on how scientists, administrators and lay practitioners in the French Enlightenment came to assess and manage the risks and opportunities afforded by the related processes of commercial and ecological globalization.

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Introduction

What is an insect? In 1694, the *Dictionnaire de l'Académie Française* defined *insecte* as a word used to describe "several species of small animals that are believed to be less perfect than others."¹ For much of the early modern period, insects occupied the lowest rungs on the Great Chain of Being, the graduated scale of Creation on which natural philosophers ranked all sentient beings.² Insects were widely considered to be "excrements of nature," as it was believed that they were generated through putrefaction and corruption.³ When the Genevan naturalist Charles Bonnet (1720-1793) began observing insects in the 1730s, he rejected this commonly held view that they were imperfect creatures. Only vulgar spirits could look upon insects as beings less perfect than the larger animals that traditionally outranked them on the Chain of being. The intricate bodies of insects were as worthy of wonder as the orderly functioning of the cosmos. How could the "order, regularity, infinite variety, wisdom, marvelous harmony and elegant proportions" that one found in the insect kingdom, Bonnet asked, be seen as anything less than evidence for the perfection of Creation?⁴

¹ "Insecte," in *Le Dictionnaire de l'Académie Française* (Paris: Coignard, 1694), 1: 598.

² On the 'Chain of Being' and its centrality to eighteenth-century thought, see: A.O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge, Mass.: Harvard University Press, 1936); Ernst Cassirer, *The Philosophy of the Enlightenment* (Princeton: Princeton University Press, 1951), 61-64; Michel Foucault, *The Order of Things: An Archaeology of the Human Science* (New York: Vintage Books, 1973), 268.

³ Daniel Mornet, *Les sciences de la nature en France, au XVIIIe siècle: un chapitre de l'histoire des idées* (Paris: A. Colin, 1911), 4.

⁴ Charles Bonnet, "Essai sur les insectes," 1738-1739, MS Bonnet 1, BPU Genève, quoted in Virginia P. Dawson, "La Théologie des Insectes dans la Pensée de Charles Bonnet," in *Charles Bonnet: Savant et Philosophe, 1720-1793*, eds. Marino Buscaglia,

In the half century that elapsed between the first edition of the *Dictionnaire de l'Académie Française* and Charles Bonnet's "Essai sur les Insectes" (1738-1739), enthusiasm for insect observation had swept across European scientific academies. Knowledge about insects had undergone a profound mutation in this period: the theory of spontaneous generation was refuted, it was discovered that several species of insects did not need to mate in order to breed, naturalists relayed surprising new facts about insect metamorphosis and behavior in impassioned detail to scientific academies, and previously unknown species were named and described as new techniques and technologies for observing and depicting insects were developed.⁵ The historian Jacques

René Sigrist, Jacques Trembley and Jean Wüest (Genève: Passé Présent, 1994), 81. [Un tel ordre et une telle régularité, une telle profusion et une telle sagesse, une harmonie si merveilleuse et des proportions si élégantes, seront-elles donc le fruit de la corruption et du mouvement?]

⁵ On visual techniques used to depict insects in the seventeenth and eighteenth century see: Janice Neri, "Between Observation and Image: Representations of Insects in Robert Hooke's *Micrographia*," in *The Art of Natural History: Illustrated Treatises and Botanical Paintings, 1400-1850*, eds. Therese O'Malley and Amy Meyers (Washington: National Gallery of Art, 2008), 83-107; Domenico Bertoloni Meli, "The Representation of Insects in the Seventeenth Century: A Comparative Approach," *Annals of Science* 67, no. 3 (July 2010): 405-429; Janice Neri, *The Insect and the Image: Visualizing Nature in Early Modern Europe, 1500-1700* (Minneapolis: University of Minnesota Press, 2011), ch.3; On the development of the microscope as a tool for the observation of insects: Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton: Princeton University Press, 1995), ch. 6; Marian Fournier, *The Fabric of Life: Microscopy in the Seventeenth Century* (Baltimore: Johns Hopkins University Press, 1996), ch.6; Marc Ratcliff, *The Quest for the Invisible: Microscopy in the Enlightenment* (Burlington: Ashgate Publishing, 2009); On the practices of insect observation more generally see: Mary Terrall, "Following Insects Around: Tools and Techniques of Eighteenth-Century Natural History," *British Journal for the History of Science* 43, no. 4 (December 2010): 573-588; Brian Ogilvie, "Attending to Insects: Francis Willughby and John Ray," *Notes and Records of the Royal Society of London* 66 (2012): 357-372; Mary Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century* (Chicago: University of Chicago Press, 2014), ch.1; Brian Ogilvie, "Insect Species and Metamorphosis between Renaissance and

Roger remarked in his magisterial *Les sciences de la vie dans la pensée française du XVIIIe siècle* (1963) that the fashion for anatomy within European natural philosophical communities was diverted at the end of the seventeenth century into a generalized curiosity for all things pertaining to the insect kingdom.⁶ As Mary Terrall has recently shown, the eighteenth-century passion for insect observation exceeded the boundaries of scientific academies, to become part of a "culture of curiosity, amusement, and polite learning shared by urban and provincial elites."⁷

If the natural history of insects became a favorite pastime for leisured elites in the eighteenth century it was, as Daniel Mornet pointed out over a century ago, because the pursuit was well adapted to the contemporary "taste for collecting."⁸ The sensibility that had developed to legitimate the study of insects, grounded in natural theology and Enlightenment aesthetics, also helped make insect specimens desirable items to be displayed in private collections.⁹ Insects were not very common in private natural history

Enlightenment," in *The Life Sciences in Early Modern Philosophy*, eds. Ohad Nachtomy and Justin E.H. Smith (Oxford: Oxford University Press, 2014), 222-246.

⁶ Jacques Roger, *Les sciences de la vie dans la pensée française du XVIIe siècle: la génération des animaux de Descartes à l'Encyclopédie* (Paris: A. Colin, 1963), 182.

⁷ Terrall, *Catching Nature in the Act*, 3.

⁸ Mornet, 3-5 [L'histoire naturelle eût pour elle ce que n'avaient ni les mathématiques, ni la mécanique: le goût de la collection ... par le texte de Réaumur il devient de mode d'examiner les cirons et les mites on découvrit des insectes avec des yeux émerveillés.]

⁹ On this sensibility see: Marc Olivier, "Through a Flea-Glass Darkly: Enlightened Entomologists and the Redemption of Aesthetics in Eighteenth-Century France," in *Insect Poetics*, ed. Eric C. Brown (Minneapolis: University of Minnesota Press, 2006), 242-262; It should be noted, however, that insects were popular subjects for miniatures and paintings in the sixteenth and seventeenth centuries, and that they were also used in moldings on sculptures and other objects of art commissioned and collected by the

collections before the eighteenth century. When the physician Pierre Borel (1620-1671) published his description of 207 of the largest natural history collections in France and Europe in 1649, only two contained sizeable numbers of insect specimens.¹⁰ In the final decades of the seventeenth century, however, insect collecting became a highly popular pursuit, and as *exotica*, they became an integral part of the most fashionable curiosity cabinets and natural history collections of the eighteenth century.¹¹ The *Receveur Général des Finances* Jean-Baptiste-François Gigot d'Orcy's (1737-1793) natural history cabinet at Place Vendôme in Paris, for example, boasted one of the largest insect collections in Europe, containing thousands of specimens of butterflies and other insects,

nobility: Fritz Koreny, *Albrecht Dürer and the Animal and Plant Studies of the Renaissance* (Boston: Little, Brown and Co, 1998), 112-127; Yves Cambefort, "Artistes, Médecins et Curieux aux Origines de l'Entomologie Moderne (1450-1650)," *Bulletin d'histoire et d'épistémologie des sciences de la vie* 11, no.1 (2004): 6-16; Pamela Smith, *Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004), 101.

¹⁰ Pierre Borel, *Les antiquitez, raretez, plantes, minéraux et autres choses considerables de la ville et comté de Castres d'Alibegois. Avec le roole des principaux cabinets et autres raretez de l'Europe* (Castres: Arnaud Colomiez, 1649) (fascimile, Geneva: Minkoff, 1973), 139; Antoine Schnapper mentions a few other insect collectors that were evidently not known to Borel, namely the Parisian abbé François Filhol (1583-1648) and the gardener and seed-merchant Pierre Morin but also concludes that they were relatively rare in seventeenth century collections: Antoine Schnapper, *Le géant, la licorne et la tulipe. Collections et collectionneurs dans la France du XVIIe siècle. Histoire et histoire naturelle* (Paris: Flammarion, 1988) 1: 83-84.

¹¹ Bettina Dietz and Thomas Nutz, "Collections Curieuses: The Aesthetics of Curiosity and Elite Lifestyle in Eighteenth-Century Paris," *Eighteenth-Century Life* 29, no.3 (Fall 2005), 50; Dániel Margócsy, *Commercial Visions: Science, Trade and Visual Culture in the Dutch Golden Age* (Chicago: University of Chicago Press, 2014), 37.

which d'Orcey made available to curious travellers and the most eminent English and European naturalists.¹²

Men and women of the eighteenth century who turned in great numbers to observing, drawing, collecting, breeding and reading about insects, found an endless, morally edifying, source of amusement in these pursuits.¹³ For men and women of the Enlightenment, the seemingly infinite variety of the insect kingdom, their intricate physical constitutions, foresight and prescient behavior, often elicited rapturous wonder, aesthetic pleasure, curious amazement and comforting reassurance of God's Wisdom. But insects could also evoke less lofty emotions, namely, disgust, anxiety, fear and panic. The vermin and pests (*nuisibles*) that attacked the bodies, homes, gardens and crops of eighteenth-century men and women in France and its colonies provoked despair by threatening disease, famine and destitution, and also raised thorny questions about the (dis)-orderliness of Creation and the benevolence of the Divine Workman (chapters 2, 5).¹⁴ Other insects, those yielding and secreting useful substances employed in the

¹² Luc-Vincent Thiery, *Guide des amateurs et des étrangers à Paris, ou description raisonnée de cette ville, de sa banlieue, et de tout ce qu'elles contiennent de remarquable* (Paris: Hardouin and Getty, 1787), 167.

¹³ Lorraine Daston, "Attention and the Values of Nature in the Enlightenment," in *The Moral Authority of Nature*, eds. Lorraine Daston and Fernando Vidal (Chicago: University of Chicago Press, 2004), 100-126; Deirdre Coleman, "Entertaining Entomology: Insect and Insect Performers in the Eighteenth-Century," *Eighteenth-Century Life* 30, no. 3 (Summer 2006): 106-134; Sam George, "Animated Beings: Enlightenment Entomology for Girls," *Journal for Eighteenth-Century Studies* 33, no. 4 (December 2010): 487-505.

¹⁴ On 'vermin' as an early modern category, see: Mary Fissell, "Imagining Vermin in Early Modern England," *History Workshop Journal* 47 (1999): 1-29; Lisa T. Sarasohn, "'That Nauseous Venomous Insect': Bedbugs in Early Modern England," *Eighteenth-Century Studies* 46, no. 4 (2013): 513-530.

manufacturing of commodities, stimulated and fed contemporaries' appetite for 'luxury' (chapters 3, 4). It is these types of insects – 'pests' and useful insects – that are the subject of this dissertation.

In eighteenth-century France, insects became fixtures not only of the material culture of leisured elites (books, periodicals, natural history collections, parlor rooms, studies), but their presence also significantly increased in the material environment. The intensification and specialization of agricultural production in the province of Angoumois (chapter 1), the Mascarene Islands (chapter 5), and in provinces like Franche-Comté and Languedoc where an increasing proportion of the land was devoted exclusively to viticulture (chapter 2), created environments favorable to the reproduction and diffusion of insect pests.¹⁵ In the south of France, silkworm cultivation (chapter 3) and the harvest of dye producing kermes insects (chapter 4) reached its peak in the second half of the eighteenth century, as the textile industry boomed. The proliferation of harmful and useful insect populations abroad also made its impact felt in France. The decimation of wheat fields on the eastern seaboard of the United States by insect pests provoked fears of contagion from abroad (chapter 6), while cochineal cultivated in the Spanish Empire invaded French markets, (chapter 4) leading indigenous dye producing insects in France to fall into neglect.

In focusing on pests and useful insects, I have run the risk of projecting back into the eighteenth century a rather blunt, artificial and anachronistic distinction between

¹⁵ James E. McWilliams has made the argument that harmful insect populations were increasing everywhere in the eighteenth century in North America and Europe where intensive monoculture was taking root in response to market forces: James E. McWilliams, *American Pests: The Losing War on Insects from Colonial Times to DDT* (New York: Columbia University Press, 2008).

'practical entomology' and 'entomology', disciplinary fields which did not exist until the nineteenth century. None of the naturalists that are the focus of this dissertation specialized in the study of insects pests, useful insects or any type of insect for that matter, and none can be considered as 'entomologists,' so wide-ranging and porous were the boundaries of natural history in this period. As a result, the words entomology and entomologist are largely absent from this dissertation, except in instances where I consider the professionalization of the field in the first half of the nineteenth century (chapter 6 and conclusion). As will also be clear from this dissertation, what we might call "genteel natural history," the world of salons, curiosity cabinets, leisured elites and insect collectors, was by no means separate and distinct from the more utilitarian brand of natural history whose purpose was to increase agricultural yields and boost commodity production. Rather than trying to trace the pre-history of practical entomology, the purpose of this dissertation is to examine how insects were constitutive elements of socio-natural environments in eighteenth-century France and its colonies, and how farmers, colonists, merchants and state administrators' attempts to engineer prosperous futures were bound up with the study and control of insects and their habitats.

Insects have not been given their due in the vast literature on eighteenth-century natural history, where botany, and the economic dimensions of botanical knowledge, has taken center stage. This is surprising, not only because so much was written about insects in the period, but because knowledge about insects could be as economically valuable as knowledge about plants.¹⁶ Professional entomologists, whose main concern was to trace

¹⁶ The literature on eighteenth-century economic botany is too large to cite *in extenso*, but see the following recent works for an introduction to the subject: Emma Spary, *Utopia's Garden: French Natural History from the Old Regime to the Revolution* (Chicago:

the genealogy of practical or economic entomology, long dominated historical writing on the subject.¹⁷ Three notable works published in the past decade, however, have paved the way for writing more contextualized histories of insects, by considering these organisms as part of political, cultural and economic and environmental systems.¹⁸ J.F.M Clark's *Bugs and the Victorians* (2009), while looking forward to the professionalization and institutionalization of entomology (and particularly economic entomology) at the end of the nineteenth century, has shown how the boundaries between the science of insects and the realms of religion, politics and economic thought, were highly porous in the Victorian period.¹⁹

Whereas Clark's work is a cultural history of entomology, James E. McWilliams' *American Pests: The Losing War on Insects* (2008) and John R. McNeill's *Mosquito Empires: Ecology and War in the Greater Caribbean, 1620-1914* (2010) are works of

Chicago University Press, 2000); Richard Drayton, *Nature's Government: Science, Imperial Britain and the 'Improvement' of the World* (New Haven: Yale University Press, 2000); Emma Spary and Londa Shiebinger (eds.), *Colonial Botany: Science, Commerce and Politics in the Early Modern World* (Philadelphia: University of Pennsylvania, 2005); Harold J. Cook, *Matters of Exchange Commerce, Medicine and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007); Daniela Bleichmar, *Visible Empire: Botanical Expeditions and Visual Culture in the Hispanic Enlightenment* (Chicago: University of Chicago Press, 2012); On the general economic importance of insects in the early modern period and beyond, see: Edward D. Melillo, "Global Entomologies: Insects, Empires and the Synthetic Age in World History," *Past and Present* 223 (May 2014): 233-270.

¹⁷ The pioneers of this tradition are Howard and Essig: Leland Ossian Howard, *A History of Applied Entomology* (Washington D.C.: Smithsonian Institution, 1930); Edward Oliver Essig, *A History of Entomology* (New York: Hafner Publishing, 1931); Edward Oliver Essig, "A Sketch History of Entomology," *Osiris* 2 (1936): 80-123.

¹⁸ See also Sheila Wille's unpublished Phd dissertation: Sheila Wille, *Governing Insects in Britain and the Empire, 1691-1816* (Phd dissertation, the University of Chicago, 2014).

¹⁹ J.F.M. Clark, *Bugs and the Victorians* (New Haven: Yale University Press, 2009).

environmental history.²⁰ Both works conceive of insects as actors within socio-material environments, and they attribute causal historical agency to these organisms.²¹ Their work has shown how insects have foiled historically contingent efforts to maximize the productive outputs of natural environments. McWilliams has shown how the American attempt to build a continental agrarian empire through Westward expansion was foiled by invasions of insects that proliferated in large tracts of deforested land devoted to monoculture, and McNeill has demonstrated how the efforts to form European settlements in the Greater Caribbean were consistently undermined by disease-carrying mosquitoes that thrived in plantation environments.

This dissertation partially draws on the methodological approaches described above. On the one hand, I have tried to remain sensitive to the cultural and intellectual frameworks through which naturalists and lay-observers of the Enlightenment attempted to make sense of insect pests and the disorders they caused within socio-natural environments. The question of how traditional providential and natural theological frameworks were mobilized and reworked in the course of the struggle against insect invasions are addressed in chapters 2 and 5. I have also tried to show how insects disrupted or thwarted well-known political economic projects such as the attempt to liberalize the grain trade in the 1760s (chapter 1), or the project to turn the Mascarene

²⁰ James E. McWilliams, *The Losing War on Insects from Colonial Times to DDT* (New York: Columbia University Press, 2008); John R. McNeill, *Mosquito Empires: Ecology and War in the Greater Caribbean, 1620-1914* (Cambridge: Cambridge University Press, 2012).

²¹ Both authors are indebted in their approach to the work of Alfred Crosby, who sought to show how pests and pathogens have had a determining impact on the course of history: Alfred Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Westport: Greenwood Publishing Company, 1972).

Islands into a theater for French colonial expansion in the Indian Ocean (Chapter 5). In chapters 3 and 4, I show how fussy insects like silkworms and *kermes vermillio* made projects to shore up French commercial power on the international stage more difficult by virtue of their fragile constitutions and high sensitivity to anthropic ecological change.

In writing a history of the entanglement between humans and insects in eighteenth-century France and its colonies I have found it necessary, like McWilliams and McNeil, to draw on work by biologists, entomologists and historical ecologists in order to complement my findings in books and archives. It is my hope that this approach will shed new light on the social, political, intellectual and economic history of eighteenth-century France and the French maritime world, and that it will provide a new interpretative prism for such well-known episodes of French history as the royal administration's attempts to liberalize of the grain trade in the 1760s and the 1770s (chapter 1), and the settlement of the Mascarene Islands (chapter 5). Three concepts, 'oeconomy,' 'patriotism' and 'globalization' will provide a source of continuity between the seven chapters, and it is to these that I now turn.

Insect Oeconomies and Natural Oeconomies in the French Enlightenment

"Oeconomy," or *oéconomie*, was a highly polysemous concept in eighteenth-century France. Etymologically rooted in the Greek words *oikos* (household) and *nomos* (law), which together speak to the ideal of a harmoniously ordered household, the term held multiple meanings in the early modern period.²² The term oeconomy cut across

²² For a genealogy of the term 'oikonomia' from Antiquity to the early modern period, see: Germano Maifreda, *From Oikonomia to Political Economy: Constructing Economic Knowledge from the Renaissance to the Scientific Revolution* (Farnham: Ashgate, 2012).

seemingly disparate disciplinary boundaries and fields of practice, and could be used to describe the physical constitution of organisms, the interactive relationship between organisms within an environment, or the management of household and state resources. A partial aim of this dissertation is to restore the unity of these various iterations of the term oecconomy, by showing how the observation of insects as organisms and as material components of complex natural systems was configured into a practice vital to the management of private and public wealth.

The dictionaries and lexical compendia of the late seventeenth- and eighteenth - centuries provide a useful starting point for understanding the multiple senses of the term oeconomie at it was used in the age of Enlightenment.²³ According to the *Dictionnaire de l'Académie Française* (1694), one definition of the word "oeconomie" concerned "the harmony that exists between the different parts and qualities of a physical body."²⁴ The pioneering works of Bernard Balan in the 1970s demonstrated how central the concept of the "animal oecconomy" was for practitioners of natural history from the classical Age to the Enlightenment.²⁵ Although occasionally given a polemical twist by natural philosophers like the Montpellier vitalist Jean-Joseph Menuret (1739-1815), who wrote the entry for *oeconomie animale* in Diderot and d'Alembert's *Encyclopédie*, the term was loose enough to constitute an overarching research program that cut across ideological

²³ Philippe Steiner, "L'économie au 18ème siècle: à propos d'un ouvrage récent," *Storia del pensiero economico* 2 (2006): 203-212.

²⁴ "Oeconomie," in *Le Dictionnaire de l'Académie Française* (Paris: Coignard, 1694), 2: 354.

²⁵ Bernard Balan, "Premières recherches sur l'origine et la formation du concept d'économie animale," *Revue d'histoire des sciences* 28, no. 4 (1975): 289-326.

divides between mechanists and vitalists.²⁶ As an object of investigation, the "animal oeconomy" referred in its most general sense to the "order, mechanism and overall set of the functions and movements which sustain life."²⁷

The concept of an *oeconomie animale*, a hidden order sustaining life within individual organisms, was central to naturalists' investigations of insects in the eighteenth century. For the naturalist Charles Bonnet (1720-1793), the "organic economy" of insects was the collection of principles that underlay the "structure, arrangement and interplay" of their parts, and the "various effects that result from this organization: nutrition, growth and reproduction etc."²⁸ Given the small size and general subtlety of the insect world, the natural oeconomy of insects was an elusive object of investigation that required intensive levels of disciplined attention.²⁹ New instruments and practices of observation and experimentation were developed over the course of the eighteenth century to assist naturalists in this quest.³⁰ The natural history of insects in the eighteenth century was thus, at its most basic level, a set of "tools and techniques" designed to unravel the hidden operations of the insect oeconomy.³¹

²⁶ On the 'animal oeconomy' as a concept central to vitalism see: Charles T. Wolfe and Motoichi Terada, "The Animal Economy as Object and Program in Montpellier Vitalism," *Science in Context* 21, no.4 (December 2008): 537-579.

²⁷ Jean-Joseph Ménéuret de Chambaud, "Oeconomie Animale," *Encyclopédie ou Dictionnaire Raisonné des Arts et Métiers* (Paris: Briasson, 1765) 11: 350-366.

²⁸ Charles Bonnet, "De la contemplation de la nature" in *Oeuvres d'histoire naturelle et de philosophie de Charles Bonnet* (Neuchatel: S. Fauche, 1779), 7: 292.

²⁹ Lorraine Daston, "Attention and the Values of Nature," 100-126.

³⁰ Terrall, *Catching Nature in the Act*, ch. 1

³¹ Terrall, "Following insects around," 573-588.

In a second iteration, oeconomy could refer not only to the providential harmony that reigned within a single physical body, but also between organisms within the natural world. The term oeconomy of nature first appeared at the beginning of the eighteenth century and has often been taken by historians of science as a precursor to the concept of oecology, coined by the biologist Ernst Haeckel at the end of the nineteenth century.³² The idea of a balance of nature, of a set of internal balancing mechanisms through which nature maintained its structural identity, can be traced back to the Ancient Greeks.³³ Early modern natural philosophers inherited a Christianized view of a natural order maintained in perpetual balance by the providential will of God.³⁴ Understanding the mechanisms that sustained the oeconomy of nature became a vocation for a number of eighteenth-century naturalists. For the Swedish naturalist Carl Linneaus (1707-1778), perhaps the best-known exponent of the concept, nature was a super-organism whose harmony was maintained by the constant warfare between its various components.³⁵

³² Jean-Marc Drouin, *L'Écologie et son Histoire* (Paris: Flammarion, 1993), 44-49.

³³ G.E.R. Lloyd, *The Revolutions of Wisdom: Studies in the Claims and Practice of Ancient Greek Science* (Berkeley: University of California Press, 1987), 319-336.

³⁴ Frank N. Egerton, "Changing Concepts of the Balance of Nature," *The Quarterly Review of Biology* 48, no. 2 (June 1973): 322-350; Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1977), chs. 1-2; John Kircher, *The Balance of Nature: Ecology's Enduring Myth* (Princeton: Princeton University Press, 2009).

³⁵ Camille Limoges, "Économie de la Nature et Idéologie Juridique Chez Linné," *Actes du XIIIe congrès international d'histoire des sciences* 9 (1971-1974): 25-30; Jean-Marc Drouin, "Linné et l'Économie de la Nature," in *Sciences, Techniques et Encyclopédies*, ed. D. Hüe (Paris: Association Diderot, 1991), 147-158; Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge: Harvard University Press, 1999), ch. 4; Lisbet Rausing, "Underwriting the Oeconomy: Linnaeus on Nature and Mind," in *Oeconomies in the Age of Newton*, ed. Margaret Schabas and Neil De Marchi (Durham: Duke University Press,

The concept of an oeconomy of nature resonated widely in eighteenth-century France, not only amongst the French Linnaeans, but also for bitter enemies of Linnaeus like the Comte de Buffon. For Buffon, Nature was like an "economical mother" whose judicious distribution of predators and preys kept the accounting books of nature in a perpetual state of balance.³⁶ As the most prodigious of God's creatures, insects played a particularly important role in this oeconomy of nature. For Linnaeus, insects were the "police of nature" that maintained law and order by consuming all that was "misplaced, superfluous, dead or decayed in her productions."³⁷ The French naturalist Philibert Commerson (1727-1773) similarly remarked on the important role that insects played in the "general oeconomy of nature, which uses them in an almost imperceptible manner to repress the excessive luxury of the vegetable kingdom, clear the surface of the earth of rotting carcasses with which it would be otherwise overrun," and "prevent the corruption of stagnant waters by consuming matter subject to putrefaction."³⁸ Insects also provided

2003), 173-203; Margaret Schabas, *The Natural Origins of Economics* (Chicago: University of Chicago Press, 2005), ch. 2.

³⁶ Georges-Louis Leclerc de Buffon, *Histoire Naturelle, générale et particulière* (Paris: Imprimerie Royale, 1774-1789) 4: 438; For a detailed discussion of Buffon's vision of nature as an oeconomical system see: Thierry Hoquet, *Buffon: histoire naturelle et philosophie* (Paris: Honoré Champion, 2005), 554-67; See also Goethe's analogy between accounting practices and Nature's inputs and outputs in: Myles Jackson, "Natural and Artificial Budgets: Accounting for Goethe's Economy of Nature," *Science in Context* 7, no. 3 (September 1994): 409-431.

³⁷ Carl von Linné, *L'Équilibre de la Nature*, trans. Bernard Jasmin (Paris: J. Vrin, 1972 [1760]), 14-15.

³⁸ Philibert Commerson "Sommaire d'observations d'histoire naturelle par le S. de Commerson," 24 December 1766, MS Arsenal 6660, Bibliothèque Nationale de France (BNF), Paris.

nourishment to other animals, which in turn acted as natural checks on their prodigious multiplication.

Finally, "oeconomy" referred, in its most widespread use, to the administration of household resources. The *Dictionnaire de l'Académie française* (1694) defined "oeconomie" as "the order that one brings in the management of the household and its expenses."³⁹ In his *Oeconomie générale de la campagne ou nouvelle maison rustique*, Louis Liger (1658-1717) defined *oeconomie* as a "science" and "art," "without which even the wealthiest of households cannot subsist for long."⁴⁰ Oeconomy was thus both an ideal of domestic orderliness, and a set of precepts for turning this ideal into a concrete reality. Liger's *Oeconomie générale* was part of a longer tradition of didactic literature that began in the sixteenth century with the *maisons rustiques* of Charles Estienne (1504-1564), Jean Liebault (1535-1596) and Olivier de Serres (1539-1619), and continued well into the eighteenth and nineteenth-centuries.⁴¹ By the mid eighteenth century, the term oeconomy had acquired a broader significance. As Jean-Jacques Rousseau (1712-1778) noted in his entry for *économie* in the *Encyclopédie*:

this word ... originally referred solely to the wise and legitimate administration of the household, for the collective well-being of the

³⁹ "Oeconomie," in *Le Dictionnaire de l'Académie Française* (Paris: Coignard, 1694), 2: 354.

⁴⁰ Louis Liger, *Oeconomie générale de campagne ou nouvelle Maison Rustique* (Amsterdam: Desbordes, 1701), 2.

⁴¹ Corinne Beutler, "Un chapitre de la sensibilité collective: la littérature agricole en Europe continentale au XVI^e siècle," *Annales ESC* 28, no.5 (1973): 1280-1301; Corinne Beutler, "La genèse de la maison rustique au XVI^e siècle," in *Traditions agronomiques européennes*, eds. Marie-Claire Amouretti and François Sigaut (Paris: Éd du CTHS, 1998), 43-53.

family. The sense of this term has since been extended to the governance of the *grande famille* which is the state.⁴²

By 1750, the term *oeconomy* referred more broadly to the judicious management of a kingdom or state resources, imagined as the collective sum of individual household resources within the polity.⁴³ Building on an older, more general, conception of political *oeconomy*, as the "order by which a political body principally subsists," the lexicographers and *philosophes* of the Enlightenment came to define the administration and maximization of material resources within a polity as the principal key to this order.⁴⁴

This dissertation examines how insects came to be configured as objects of eighteenth-century *oeconomie*. Connecting the varied meanings of the term *oeconomie*, it demonstrates how the scrutiny of these minute natural beings became part and parcel of broader projects of resource stewardship in France during the long eighteenth century.⁴⁵

Insects, of course, had a long established place in the *oeconomic* literature prior to the

⁴² Jean-Jacques Rousseau, "Économie," *Encyclopédie ou Dictionnaire Raisonné des Arts et Métiers* (Paris: Briasson, 1751-1757) 5: 337. [ce mot vient de οἶκος, *maison*, & de νόμος, *loi*, & ne signifie originairement que le sage & légitime gouvernement de la maison, pour le bien commun de toute la famille. Le sens de ce terme a été dans la suite étendu au gouvernement de la grande famille, qui est l'état.]

⁴³ See the discussion in: Schabas, *Natural Origins*, ch. 1; Lissa Roberts, "Introduction: Practicing Oeconomy in the Long Eighteenth Century," *History and Technology* 30, no.3 (2014): 133-148; Emma Spary, *Feeding France: New Sciences of Food, 1760-1815* (Cambridge: Cambridge University Press, 2014).

⁴⁴ "Oeconomie," in *Le Dictionnaire de l'Académie Française* (Paris: Coignard, 1694), 2: 354.

⁴⁵ On natural history and resource stewardship more generally, see: Phillippe Steiner, "Les revues économiques de langue française au XVIIIe Siècle," in *Les revues d'économie en France. Genèse et actualité, 1751-1994*, ed. Luc Marco (Paris: L'Harmattan, 1996), 33-77; Emma Spary, "Political, Natural and Bodily Economies," in *Cultures of Natural History*, eds. Nicholas Jardin, James Secord and Emma Spary (Cambridge: Cambridge University Press, 1996), 178-196.

eighteenth century. Authors from Olivier de Serres to Louis Liger, inescapably included instructions for rearing silkworms and bees in their *maisons rustiques* and oeconomic handbooks.⁴⁶ In the eighteenth century, however, the effectiveness of these techniques came to be seen as essentially dependent on the strict and disciplined regimes of observation and experiment that constituted the practice of natural history.⁴⁷ As several chapters in this dissertation will show, the men and women who turned in increasing numbers to the study of the natural oeconomy of insect bodies, whether it be fly-weevils (chapter 1, 2), silkworms (chapter 3) or kermes-insects chapter 4, understood their activities to be part of a broader range of oeconomic pursuits. Unlocking the secret operations of the insect oeconomy became, for state administrators, naturalists and agricultural improvers of the eighteenth century, the key to gaining mastery over both the productive and destructive potential of these creatures.

At the same time, a broader understanding of the interconnections between insects and their socio-natural environments came to be seen as a vital precondition for proper oeconomic management. If insects were often described as the police of nature, the organisms that kept Nature within balance, they could also become potent emblems for the precariousness of the harmony that reigned within the oeconomy of nature. While God had placed predators to curb the expansion of noxious insects, their excessive multiplication could become signs of grave disequilibria within the agrarian environments of metropolitan (chapter 1, 2) and colonial France (chapter 5). Historians

⁴⁶ Louis Liger, "Des abeilles," *Oeconomie Générale*, 68-112; Louis Liger, "Des Meuriers," *Oeconomie Générale*, 293

⁴⁷ For this definition of natural history, see: Lorraine Daston, "The Empire of Observation, 1600-1800," in *Histories of Scientific Observation*, eds. Lorraine Daston and Elizabeth Lunbeck (Chicago: University of Chicago Press, 2011), 81-113.

have often noted that Linnaeus was one of the first naturalists to call for the use of natural predators as a means of equilibrating environments overrun with insect pests, without examining whether such prescriptions were ever carried out in practice.⁴⁸ In chapter 5, I provide a detailed history of one of the earliest instances of intentional predator introductions: the introduction of the South Asian mynah bird to the Mascarene Islands by the naturalist Pierre Poivre (1719-1786). As chapter 5 demonstrates, the term oecology was an operative concept in such early projects to re-equilibrate environments through biological redistribution of the earth's species. The attempts by naturalist-administrators like Pierre Poivre to engineer harmony and order within the natural and political worlds was also increasingly conceived as a duty for "patriotic" improvers and statesmen.

Insects, Patriotism and Citizen Science

Closely related to the eighteenth-century practices of oeconomic management was the concept of 'patriotism'. As Edmond Dziembowski has shown, the terms *patrie*, *nation* and *citoyen* erupted in French political discourse following the humiliating defeats of the French at the hands of the English and Prussians in the Seven Years' War (1756-1763). Commentators inevitably pointed to French subjects' lack of patriotism, of an attachment to king and country that could override their self-interest and *amour propre*, as a source of its underlying weakness.⁴⁹ The fashioning of patriotic citizens became a pressing

⁴⁸ R.K. Usinger, "Prefatory Chapter: The Role of Linnaeus in the Advancement of Entomology," *Annual Review of Entomology* 9 (1964): 48; Rausing, "Underwriting the Oeconomy," 190.

⁴⁹ Edmond Dziembowski, *Un Nouveau Patriotisme Français, 1750-1770: la France Face à la Puissance Anglaise à l'époque de la guerre de Sept-Ans* (Oxford: Voltaire, 1998).

concern for reformers of all stripes during the Ancien Régime. *Patriotisme, patrie, nation* and *citoyen*, although drawn from the lexicon of classical republicanism, were not terms that were incompatible with absolute monarchy and the hierarchical order of Ancien Régime France. Indeed, as David Bell has argued, it was largely through the Bourbon monarchy's program of "royal patriotism" that "the concepts of *nation* and *patrie* came to occupy a central position in French political culture."⁵⁰ Jay Smith, for his part, has emphasized the role played by the middling-nobility in fashioning a new language of patriotism out of the remnants of a traditional aristocratic culture.⁵¹

Agricultural improvement, as John Shovlin has argued, became the symbolic ground on which state administrators and landed elites in ancien régime France staked their moral claims as stewards of national prosperity who could regenerate the *patrie*.⁵² The spread of royally-sponsored agricultural societies after 1760, and the proliferation of periodicals devoted to agriculture in this period, was symptomatic of this convergence between the patriotic concerns reforming administrators and landed elites.⁵³ The alignment of 'patriotism' with projects of 'oeconomic' improvement was not of course limited to France, and indeed it was possibly even more pregnant elsewhere in Europe, as

⁵⁰ David Bell, *The Cult of the Nation in France: Inventing Nationalism, 1680-1800* (Cambridge: Harvard University Press, 2001), 53.

⁵¹ Jay Smith, *Nobility Re-imagined: the Patriotic Nation in Eighteenth-Century France* (Ithaca: Cornell University Press, 2005), ch. 4.

⁵² John Shovlin, "Political Economy and the French Nobility," in *The French Nobility in the Eighteenth-Century: Reassessments and New Approaches*, ed. Jay M. Smith (University Park: Pennsylvania State University Press, 2006), 111-139.

⁵³ John Shovlin, "Rethinking Enlightened Reform in a French Context," in *Enlightened Reform in Southern Europe and its Atlantic Colonies*, ed. Gabriel Paquette (Burlington: Aldershot, 2009), 47-62.

in the German lands.⁵⁴ Common to such projects was the belief that the oeconomical management of material resources underlay the strength of nations in a world of ruthless international competition.⁵⁵ The patriotic imperative of oeconomy was in part a moral injunction against the wasteful habits of consumers and their excessive inclination for "luxury," both of which were a detriment to the individual household and to the *patrie*.⁵⁶ It could also become, in France and elsewhere, an injunction to turn one's attention to the natural world, in order to relieve dependence on rival states by maximizing the exploitation of domestically available resources.⁵⁷

As a handmaiden of oeconomy, natural history acquired a status as a patriotic pursuit during the eighteenth century. "Utility," as Daniel Roche writes, "was the key

⁵⁴ Koen Stapelbroek and Jani Marjanen (eds.), *The Rise of Economic Societies in the Eighteenth-Century: Patriotic Reform in Europe and North America* (New York: Palgrave Macmillan, 2012).

⁵⁵ On rivalry as a theme in eighteenth-century political discourse see: Istvan Hont, *The Jealousy of Trade: International Competition and the Nation-State in Historical Perspective* (Cambridge: Harvard University Press, 2005); Sophus Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge: Harvard University Press, 2011). Sophus Reinert, "Rivalry: Greatness in Early Modern Political Economy," *Mercantilism Reimagined: Political Economy in Early Modern Britain and its Empire*, eds. Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2014), 348-363.

⁵⁶ Spary, *Feeding France*, ch. 1

⁵⁷ See the works of: Markus Popplow and Meyer Torsten, "To Employ each of Nature's Products in the Most Favorable way Possible: Nature as a Commodity in Eighteenth-Century German Economic Discourse," *Historical Social Research* 29, no. 4 (2004): 4-40; Markus Popplow, "Knowledge Management to Exploit Agrarian Resources as Part of Late-Eighteenth-Century Culture of Innovation," *Annals of Science* 69, no. 3 (July 2012): 413-433.

concept of the century of Enlightenment."⁵⁸ For many observers of the eighteenth century, the private pleasures of curious, solitary observation, no longer provided an adequate justification for the practice of natural history.⁵⁹ Enlightenment naturalists labored to show, not without eliciting a considerable degree of skepticism, that the practice of natural history could be aligned with the century's agenda of social and public utility. Perhaps no branch of natural history suffered from as much derision and opprobrium as entomology. The naturalist who attached himself to the study of these minute creatures, Linnaeus wrote in his essay *Cui Bono?* [*Of what use is natural history?*] (1752), "constantly labors under the weight of the insignificance that is attributed to the objects of his study."⁶⁰ A partial aim of this dissertation is to trace the development of a new agenda for the practice of insect observation across the long eighteenth century, demonstrating how the study of insects acquired increasing social and institutional legitimacy during the Ancien Régime, and into the Revolutionary, Napoleonic and Restoration periods.

The purported public utility of insect observation rested on two principles. Firstly, the observation of insect reproduction and metamorphosis came to be seen as vital to the

⁵⁸ Daniel Roche, *Le siècle des lumières en province: Académies et académiciens provinciaux: 1680-1789* (Paris: EHESS, 1978), 1: 19.

⁵⁹ Emma Spary, "Peaches which the Patriarchs Lacked: Natural History, Natural Resources and the Natural Economy in France," in *Oeconomies in the Age of Newton*, eds. Margaret Schabas and Neil De Marchi (Durham: Duke University Press, 2003 (Durham, N.C.: Duke University Press, 2003), 14-41.

⁶⁰ O. Söderberg, "Qui Bono?" in *L'Équilibre de la nature*, trans. Bernard Jasmin (Paris: J. Vrin, 1972 [1750]), 145-167; For a detailed history of this essay, see: Franz Römer, "Cui Bono? Eine von Linné inspirierte Dissertation über den Nutzen der Naturwissenschaften und parallel Reflexionen einse österreichischen Physikers," in *Acta Conventus Neo-Latini Upsaliensis* (Leiden: Brill: 2012), 903-913.

management of subsistence crises induced by insect pests. Understanding the natural oeconomy of insect pests was indispensable for developing the adequate technologies and preventative measures to halt their proliferation and spread (chapters 1, 2, 6, 7).

Secondly, natural historical observation provided a way of maximizing the production of useful substances secreted by insects, namely silk, dyes and medicines (chapters 3, 4).

Knowledge of insects came to be seen as vital for relieving domestic industries of their dependence on the foreign products of rival states and their colonial empires. In the Ancien Régime and Revolutionary periods, the science of insects came to be construed as a kind of citizen-science, as natural historical observation was idealized as a civic-minded pursuit that directly contributed to the material and moral strength of the *patrie*. The naturalist Duhamel du Monceau (1700-1782), for instance, referred to the correspondents in the entomological network that he developed after the Angoumois grain moth outbreak in the 1760s (chapter 1) as "philosopher-citizens" [*philosophe-citoyen*].⁶¹

The ubiquitous proximity of men, women and insects in this period facilitated and encouraged lay participation in this branch of natural history, making entomology a 'citizen-science' *par excellence* during the eighteenth and early nineteenth centuries.⁶² A partial aim of this dissertation is to shed light on the place of these "philosopher-citizens" in the broader terrain of eighteenth and early nineteenth century natural history, and to

⁶¹ Henri-Louis Duhamel du Monceau, *La Physique des Arbres où il est Traité de l'Anatomie des Plantes et de l'Économie Végétale* (Paris: Guerin and Delatour, 1758), x.

⁶² On citizen-science and lay participation in the natural sciences see: François Charvolin, André Micoud, Lynn K Nyhart (eds.), *Des Sciences Citoyennes? La Question de l'Amateur dans les Sciences Naturalistes* (La Tour -d'Aigues: Éditions de l'Aube, 2007); Jeremy Vetter, "Lay Participation in the History of Scientific Observation," *Science in Context* 24, no. 2 (June 2011): 127-141; Deborah R. Coen, *The Earthquake Observers: Disaster Science from Lisbon to Richter* (Chicago: University of Chicago Press, 2012).

understand the motivations that led lay participants to turn their attention to such great numbers to the insect kingdom. Against the backdrop of recurrent subsistence crises and food shortages faced by France and its colonies from the Ancien Régime to the Revolutionary period, and of 'mercantilist' efforts to attain self sufficiency in key industrial sectors, this dissertation shows how a variety of actors outside scientific institutions (artisans, farmers, rural clergymen and improving landowners), took to observing nature's minutiae as a solution to problems that afflicted state and society during the long eighteenth century.⁶³

In the pages that follow, I will examine the circulation of observations and experimental reports written by lay entomological observers and academic naturalists within a broad field constituted by periodicals, newspapers, private, commercial and clerical correspondence networks, and within the administrative networks of the royal administration and the diplomatic corps. The line between amateur and professional was highly fluid for most of the period under consideration. Yet the distinction was beginning to harden in the final decades of the eighteenth century, as state administrators came to increasingly rely on the expertise of academic naturalists, chemists and physicians to control the spread of invasive insect populations across domestic and international borders.

⁶³ On the politics and science of subsistence in ancien régime France see especially: Steven Kaplan, *Bread, Politics and Political Economy in the Reign of Louis XV* (The Hague: Martinus Nijhoff, 1976); Steven Kaplan, *Provisioning Paris: Merchants and Millers in the Grain and Flour Trade During the Eighteenth-Century* (Ithaca: Cornell University Press, 1984); Spary, *Feeding France*; On science and mercantilism, see: Philippe Minard, *La fortune du Colbertisme: État et industrie dans la France des Lumières* (Paris: Fayard, 1998); Liliane Hilaire-Perez, *L'invention technique au siècle des Lumières* (Paris: Albin Michel, 2000).

Insects, Globalization and Global Anthropogenic Change

I began this project with the intention of focusing exclusively on metropolitan France. I assumed that metropolitan France, where the problem of insect pests was likely to be endemic due to the predominantly agrarian character of the eighteenth-century economy, where the provincial scientific academies and agricultural societies were numerous, where the administrative archives are rich and voluminous, would yield sufficient stores of evidence upon which to build a dissertation. It quickly became clear to me that my project would have to be more expansive in geographical scope. French colonies in the Caribbean and in the Indian Ocean were not spared the scourge of insect pests. On the contrary, they were even more prone to be overrun by invasive insects because plantation economies because their densely packed acres of single-variety crops attracted and provided breeding grounds for pests.⁶⁴ Moreover, colonial environments, as it turned out, provided a theater for the development of novel techniques of eighteenth-century pest-control, such as the introduction of non-native insectivorous species in the Mascarene Islands (chapter 5) and the application of mineral-based chemical remedies developed in laboratories on sugar cane plantations of the Caribbean (chapter 7).

The introduction of the insectivorous South Asian mynah bird to the Mascarene Islands, and the projects to introduce this bird in province of Languedoc discussed in (chapter 5), provide an example of how French naturalists, administrators and farmers utilized intra-imperial networks to manage the food supply in metropolitan France and its colonies. Useful insects and entomological knowledge travelled in a similar fashion along

⁶⁴ James E. McWilliams refers to this phenomenon as the "insect paradox": James E. McWilliams, *American Pests: The Losing War on Insects from Colonial Times to DDT* (New York: Columbia University Press, 2008, chs. 4-5).

the expansive communication networks that tied France to the rest of the globe. The French, of course, were not the only ones to utilize the tremendous fecundity of insects for the purposes of commodity production during the early modern period.⁶⁵ On the contrary, as Edward Melillo has pointed out, early modern Europeans were "on the knowledge periphery of insect commodity production."⁶⁶ As I show in chapter 3, travel, espionage and surreptitious transfers of specimens and entomological knowledge by naturalists, diplomats, and missionaries situated in silk-producing regions in the Ottoman Empire and in China were envisioned as strategies for keeping the French textile industry competitive in a context of ruthless international commercial rivalry. Chapter 4 examines changes in the Languedocian textile industry and rural economy in light of the commercial dominance of Mexican cochineal, an insect domesticated by the indigenous peoples of South America and cultivated in the Spanish Empire, on global dye markets. Both these chapters show how insects were part of early modern global commodity networks, and emphasize the importance of transnational connections for understanding the economic history of eighteenth-century France.

While chapters 3 and 4 examine instances of deliberate introductions of non-native insect species into French territories, several other chapters of this dissertation show how insects spread across borders through unintentional introductions, by furtively inserting themselves into global commodity networks. Insects were often unwelcome

⁶⁵ Debin Ma, "The Great Silk Exchange: How the World Was Connected and Developed," in *Pacific Centuries : Pacific and Pacific Rim Economic History Since the 16th Century*, eds. Dennis O. Flynn, Lionel Frost and A.J. H. Latham (Routledge, New York), 38-69; Edward D. Melillo, "Global Entomologies: Insects, Empires and the 'Synthetic Age' in World History," *Past and Present* 223 (May 2014): 234-270.

⁶⁶ Melillo, "Global entomologies," 234.

travellers on the ships that carried people, commodities and food crops across oceans and continents. Despite its name, the so-called "Angoumois grain-moth" (*sitotroga cerealella*), (chapter 1) is in fact indigenous to South Africa, and it was most likely introduced to France in the 1730s by ships returning from the Cape to the Mediterranean.⁶⁷ The 'Hessian Fly' (*cecidomya destructor*), which decimated crops on the eastern seaboard in the United States in the 1780s, incited panic amongst state administrators in France, Britain and Continental Europe, as it was feared that infected shipments of American wheat would spread this noxious insect to the Old World (chapter 6). A partial aim of this dissertation is to examine how the spread of insects across borders was a significant effect of primitive or early globalization.⁶⁸ Insects benefited from the increased connectivity of the incipient global order, as it provided the precondition for their inter-continental and planetary dispersal.

Human induced biological redistribution and biotic invasions led naturalists and *philosophes* at the end of the eighteenth century to reflect of the planetary impact of European commercial activity. In his "Discours sur l'origine des animaux et des plantes du nouveau monde," (1798) the pharmacist-naturalist Joseph Julien Virey (1775-1846) remarked that since Columbus' voyage to the New World, "the entire planet has taken on

⁶⁷ Buckland, "Granaries Stores and Insects: The Archeology of Insect Synanthropy," in *La Préparation Alimentaire des Céréales*, eds. by François Sigaut and D. Fournier, (Rixensart: Pact, 1990), 70.

⁶⁸ There is a growing literature on the impact of globalization on Ancien Régime and Revolutionary France: Paul Burton Cheney, *Revolutionary Commerce: Globalization and the French Monarchy* (Cambridge: Harvard University Press, 2010); Suzanne Desan, Lynn Hunt and William Max Nelson (eds.), *The French Revolution in Global Perspective* (Ithaca: Cornell University Press, 2013); See the review of recent works on the subject in: David Bell, "Questioning the Global Turn: The Case of the French Revolution," *French Historical Studies* 37, no. 1 (2014): 1-24.

a new appearance." In order to "nourish his luxury and to attend to his needs," man had willfully and unintentionally caused the "emigration" of innumerable species of plants, insects and animals to all corners of the earth.⁶⁹ In South Carolina, the naturalist and diplomat Louis-Augustin Bosc D'Antic (1759-1828) began to write a "natural history of the globe" in the late 1790s after noticing how many insect species from France had been accidentally imported into the United States by the coming and going of ships and travellers (chapter 6).⁷⁰ Incipient globalization, as contemporaries began to notice, marked the beginnings of the Anthropocene, an age in which man himself became a biological agent and inhabited a planet that was no longer "arranged solely by the simple hands of nature."⁷¹

Intensified commercial relations within France, and between France and its colonies and trading partners brought new risks and opportunities. In the pages that follow, I will trace the strategies devised by various actors within France and the French maritime world to take advantage of these opportunities and to mitigate the biological risks of commercial activity. These strategies were logistical, material, political and intellectual in nature, ranging from the formation of long-distance observation networks,

⁶⁹ J-J Virey, "Discours sur l'origine des animaux et des plantes du nouveau continent," *Magasin Encyclopédique* 3 (1798): 433-458.

⁷⁰ Bosc to Brongniart, 26 Mars 1798, MS 2354, Bibliothèque Centrale du Muséum d'Histoire Naturelle (BCMHN), Paris.

⁷¹ Virey, "Discours," 457; On eighteenth-century theories of anthropogenic environmental change see: Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism* (Cambridge: Cambridge University Press, 1995), ch.4; Jan Golinski, *British Weather and the Climate of Enlightenment* (Chicago: University of Chicago Press, 2007), ch. 6; Fabien Locher and Jean-Baptiste Fressoz, "Modernity's Frail Climate: A Climate History of Environmental Reflexivity," *Critical Inquiry* 38 (2012): 579-598; Anya Zilberstein, *A Temperate Empire: Making Climate Change in Early America* (Oxford: Oxford University Press, 2016).

to the search for chemical substances that could effectively exterminate insect pests, the imposition of embargos on shipments of contaminated wheat, and the development of universal classification systems. As a whole, my dissertation documents the hard and painstaking work that went into the struggle to know, manipulate and contain insects.

Part 1: Observing Pests: Insects and Patriotic Natural History

Chapter 1: Fighting the Angoumois Grain Moth: Henri-Louis Duhamel du Monceau and the Problem of Insect Pests in the French Enlightenment

Introduction

In the spring of 1760, the controller general of finances, Henri Léonard Jean-Baptiste Bertin (1720-1792) received an alarming report on the devastation caused by an infestation of insect pests in the wheat fields of the western province of Angoumois.⁷² Christophe Pajot de Marcheval (1724-1792), the intendant of the *généralité* of Limoges, informed Bertin that the crops in Angoumois had been devastated for several years by an insect that consumed the grain on the stalks before the harvest, leaving the inhabitants of the province without sustenance and unable to pay their taxes.⁷³ Even more cause for alarm was that these insects were "spreading with fury in neighboring jurisdictions," and had already begun to advance in the neighboring provinces of Poitou, Aunis and Saintonge. Fearing that this "contagion might spread throughout the kingdom," Bertin summoned two naturalists from the *Académie Royale des Sciences*, Henri-Louis Duhamel du Monceau (1700-1782) and Mathieu Tillet (1714-1791), two naturalists with prior experience in the study of agricultural epidemics, and instructed them to travel to

⁷² Henri-Leonard Jean-Baptiste Bertin, "À propos d'une récolte d'Angoumois attaquée par un insecte," Versailles, 28 June 1760, Pochettes de Séances, Archives de l'Académie des Sciences (AAS), Académie des Sciences, Paris.

⁷³ The *généralité* of Limoges was an administrative district in Ancien Régime France composed of the three provinces of Limousin, Angoumois and Marche.

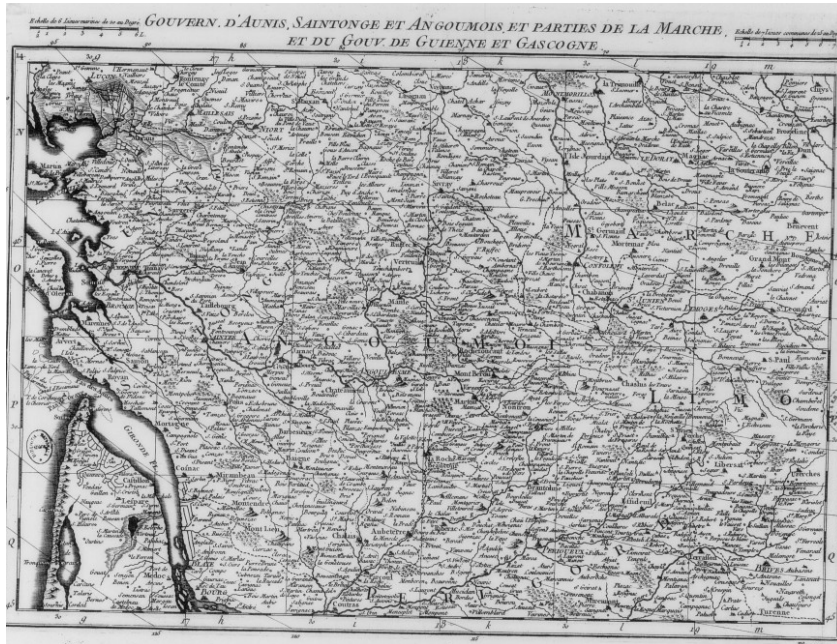
Angoumois in order to "conduct the investigations necessary for putting an end to this calamity."⁷⁴

Often described as poor, isolated and archaic by historians of Ancien Régime France, the province of Angoumois in fact underwent a period of accelerated economic development and integration in the period that preceded the mid-century reforms of the intendant Anne-Robert-Jacques Turgot (1727-1781).⁷⁵ Farmers in Angoumois devoted an increasing proportion of their labor to the commercial cultivation of wheat, as the construction of a dense network of roads between 1715 and 1760 connected rural settlements in the province to other localities within the *généralité* of Limoges and beyond, spurring the development of a carefully regulated, but brisk export-trade with the

⁷⁴ Mathieu Tillet was awarded a prize from the *Académie des Sciences, Belles-Lettres et Arts de Bordeaux* for his work on wheat smut, while Duhamel du Monceau was elected to the *Académie des Sciences* in the 1720s following his research on parasitic weeds that destroyed saffron crops: *Couronnes Académiques ou Recueil des Prix Proposés par les Sociétés Savantes, avec les Noms de ceux qui les ont Obtenus*, (Paris: Cuchet, 1787), 320; For a brief account of Tillet's : Gilles Denis, "La Représentation de la Maladie des Plantes: Ruraux, Botanistes et Agronomes," in *La Nature en Révolution 1750-1800*, ed. Andrée Corvol (Paris: Harmattan, 1993), 94-106; Henri-Louis Duhamel du Monceau, *Histoire d'un Insecte qui Dévore les Grains de l'Angoumois* (Paris: H.L. Guerin et L.G. Delatour, 1762), 6-7. [Le danger de voir cette contagion se répandre dans tout le royaume, est manifeste. Toutes ces raisons me persuadent que vous ne pouvez me refuser la satisfaction de m'envoyer des commissaires de l'Académie assez promptement pour qu'ils puissent examiner l'origine de l'insecte qui cause nos alarmes, pendant que les bleds sont encore sur pied, en suivre l'histoire, et nous indiquer, soit par eux-mêmes, soit d'après les rapports qu'ils feront à l'Académie, les moyens de les détruire." [6-7]

⁷⁵ This image was cultivated by Turgot himself, and his nineteenth- and twentieth-century hagiographers: Gustave D'Hugues, *Essai sur l'Administration de Turgot dans la Généralité de Limoges* (Paris: Guillaumin et Compagnie, 1859), 6-24; Michel C. Kiener and Jean-Claude Peyronnet, *Quand Turgot Régnait en Limousin* (Paris: Fayard, 1979), 117-138; For a challenge to this view, see: Jean-Pierre Delhoume, "L'élevage bovin en Limousin au XVIIIe siècle," *Histoire et Sociétés Rurales* 22, no. 2 (2004): 65-101.

surrounding cereal-deficient provinces.⁷⁶ Yet rural population growth, the extension of commercial wheat cultivation and the multiplication of trade networks, as Duhamel du Monceau and Mathieu Tillet came to recognize, provided favorable material conditions for the proliferation and spread of invasive insects like the Angoumois grain moth (*Sitotroga cerealella*).⁷⁷



⁷⁶ René Lafarge, *L'agriculture en Limousin au XVIIIe siècle et l'intendance de Turgot* (Paris: A. Chevalier-Marescq, 1902), 69-70, 234-239; Prosper Boissonade, "La Province de l'Angoumois au XVIIIe siècle," *Bulletin de la Société Archéologique et Historique de la Charente* (Angoulême: Coquemard, 1889), 33-84; Michel Boiron, *L'action des Intendants de la Généralité de Limoges de 1683 à 1715* (Limoges: Presses Universitaires de Limoges, 2006), 393-400; On the general proliferation of road networks in France between 1730 and 1780 see: Guy Arbello, "La Grande Mutation des Routes en France au XVIIIe siècle," *Annales, Économies, Sociétés, Civilisations* 28, no. 3 (1973): 765-790; J-P. Pousson, "Sur le rôle des transports terrestres dans l'économie du Sud-Ouest au XVIIIe siècle," *Annales du Midi: Revue de la France Méridionale* 90, no. 138 (1978): 389-412; Nicolas Verdier, "Le réseau technique est-il un impensé du XVIIIe siècle? Le cas de la poste aux Chevaux," *Flux* 68, no. 2 (2007): 7-21.

⁷⁷ John D. Sedlacek, Paul A. Weston and Robert J. Barney, "Lepidoptera and Pscocoptera," in *Integrated Management of Insects in Stored Products*, ed. Bhadriraju Subramanyam (Marcel Dekker: New York, 1996), 44-47.

Figure 1: Map of Angoumois, carte de Cassini. Source: César-François Cassini de Thury, *Carte de France divisée en XXXI gouvernements militaires et et ses provinces* (Paris: Daumont, 1756)

Denser farm settlements and the conversion of wasteland to wheat production facilitated the reproduction of the insect as the moths could, before the end of their brief life span, flutter from field to field and lay their eggs on unripened stalks of wheat and in granaries.⁷⁸ Above all, it was the extensive circulation of infected grain that accounted for the rapid geographical spread of the insect.⁷⁹ For Duhamel du Monceau it was clear that grain merchants were the primary vectors for the diffusion of the Angoumois moth. Grain merchants were the "true source of this curse [*malédiction*]," surreptitiously introducing this pest, either through ignorance, neglect or blind self-interest, into neighboring provinces by exporting grain that contained the insect in its larval and moth stage.⁸⁰

For Duhamel du Monceau, the vigilance of public authorities was of the utmost necessity for containing and putting an end to the scourge afflicting the provinces of western France, especially in the context of liberalization of the grain trade in the 1760s.⁸¹ Only the imposition of strict regulations over the production, storage and sale of

⁷⁸ Duhamel du Monceau, *Histoire d'un insecte qui dévore les grains de l'Angoumois, avec les moyens que l'on peut employer pour le détruire* (Paris: Guérin et Delatour, 1762), 14, 90-91, 93; Duhamel du Monceau and Mathieu Tillet, "Sur l'insecte qui dévore les grains de l'Angoumois," *Histoire de l'Académie Royale des Sciences* (Paris: Imprimerie Royale, 1763), 289.

⁷⁹ Duhamel du Monceau, *Histoire d'un Insecte*, 16, 78, 173; Duhamel du Monceau and Tillet, "Sur L'Insecte qui Dévore les Grains de l'Angoumois," 289.

⁸⁰ Duhamel du Monceau, *Histoire d'un Insecte*, 78. [La plupart des paysans prévenus du mauvais sort qu'éprouvent leurs grains, se hâtent de les vendre à des marchands, qui en les transportant dans les provinces voisines y portent la contagion; c'est-là la vraie source de l'extension du mal.]

⁸¹ Duhamel du Monceau was the likely author of an anonymous political tract on the issue: Louis-Paul Abeille [Duhamel du Monceau], *Réflexions sur la Police des Grains en France et en Angleterre* (Paris: Regnard, 1764).

wheat by the *police*, the administrators who regulated the trade in wheat, could prevent the spread of this epidemic that threatened the entire kingdom.⁸² It was just as imperative that such administrative measures be based on a proper understanding of the life cycles of these insects. This natural knowledge, in turn, could only be gained through disciplined regimes of patient observation and repeated experimentation that characterized the expanding field of eighteenth-century natural history.⁸³ Histories of insect metamorphosis and reproduction could be more than "amusements" for curious readers, Duhamel du Monceau and Mathieu Tillet wrote, as they could provide the foundation for the development of effective measures for eradicating agricultural pests.⁸⁴

The highly mediatized expeditions of these two *académiciens* in the summer of 1760 and 1761 sparked a flurry of interest in the natural history of insect pests amongst

⁸² The term *police* was much expansive in the eighteenth century, and referred to a wide-range of administrative activities directed at increasing the security and strength of the state. For definitions see: Paolo Napoli, *Naissance de la police moderne: Pouvoir, normes, société* (Paris: Éditions Découverte, 2003), ch. 5; Vincent Denis, "La Circulation des Savoirs Policiers en Europe dans la Seconde Moitié du XVIIIe siècle," in *Les Circulations Internationales en Europe années 1680-années 1780*, eds. Pierre Yves-Beaurepaire and Pierrick Pourchasse (Rennes: Presses Universitaires de Rennes, 2010), 213-224.

⁸³ On the emergence of observation as an epistemic genre and as a set of embodied practices, see: Lorraine Daston, "The Empire of Observation, 1600-1800," in *Histories of Scientific Observation*, eds. Lorraine Daston and Elizabeth Lunbeck (Chicago: University of Chicago Press, 2011), 81-113.

⁸⁴ Duhamel du Monceau, Henri-Louis and Mathieu Tillet, "Mémoire sur l'insecte qui dévore les grains de l'Angoumois," *Histoire de l'Académie Royale des Sciences avec les mémoires de mathématiques et de physique pour la même année tirés des registres de cette académie* (Paris: Imprimerie Royale, 1761), 297; The two men had in mind here René-Antoine Ferchault de Réaumur's (1683-1757) highly popular *Mémoires pour servir à l'histoire des insectes* (1734-1742). On Réaumur's observations of insects, see: Mary Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century* (Chicago: University of Chicago Press, 2014).

agricultural improvers throughout the kingdom.⁸⁵ As one of the most emblematic public figures of the royally sponsored agronomic movement, brought to fame for his translation and commentary on the English agricultural improver Jethro Tull's writings in the 1750s, Henri-Louis Duhamel du Monceau became the center of an informal network of geographically dispersed entomological observers made up of farmers, clergymen and enlightened state officials.⁸⁶ These "philosopher-citizens" as Duhamel du Monceau referred to his correspondents, supplied him with useful observations, experimental reports, and insect and plant specimens, which were to act as the raw materials for a comprehensive natural history of crop-eating insects.⁸⁷ By contributing in this manner to the improvement of agricultural production, civic-minded amateur naturalists accomplished a "patriotic" duty, while also fulfilling more self-interested aspirations of gaining public credit for their efforts in Duhamel du Monceau's agronomic publications.⁸⁸

⁸⁵ The Economic society of Bern also launched an investigation of agricultural pests in 1762: Martin Stuber and Regula Wyss, "Useful Natural History? Pest control in the Focus of the Economic Society of Bern," In *Scholars in Action: The Practice of Knowledge and the Figure of the Savant in the 18th Century*, eds. André Holenstein, Hubert Steinke and Martin Stuber (Leiden: Brill, 2013), 891-920.

⁸⁶ On Duhamel du Monceau's role in the agronomic movement see: André Bourde, *The Influence of England on the French Agronomes* (Cambridge: Cambridge University Press, 1953); André Bourde, *Agronomie et Agronomes en France au XVIIIe siècle* (Paris: SEVPEN, 1967); Bruno Dupont de Dinechin, *Duhamel du Monceau: un Savant exemplaire au siècle des lumières* (Paris: Connaissance et mémoires européennes, 1999); Jean Boulaine, "L'oeuvre agronomique de Duhamel," in *Duhamel du Monceau: Un Européen du siècle des lumières*, ed. Andrée Corvol (Orléans: Académie d'Orléans, 2001), 27-41.

⁸⁷ Duhamel du Monceau first used the term 'philosophe-citoyen' in: Duhamel du Monceau, *La Physique des Arbres où il est Traité de l'Anatomie des Plantes et de l'Économie Végétale* (Paris: Guérin et Delatour, 1758), x.

⁸⁸ Duhamel du Monceau, *Éléments d'agriculture* (Paris: Guérin et Delatour 1753), viii.

In this chapter, I reconstruct the web of exchanges that tied amateur naturalists in the French provinces to Duhamel du Monceau, in order to show how natural historical knowledge about insect pests was created, debated and refuted through the circulation of written observations and natural specimens between Paris and rural localities in France. I will also demonstrate how similar dynamics were at play in Duhamel du Monceau's efforts to disseminate material technologies for exterminating insect pests. By examining these associations between agricultural improvers, state officials and academic naturalists, I show how insect pests came to be configured as a highly consequential field of knowledge in the Enlightenment, and how natural history came to provide the foundation for administrative strategies of agricultural and environmental management.

The Expedition to Angoumois: Combating Pests and Provincial Prejudices

After arriving in Angoumois in July of 1760, Duhamel du Monceau and Tillet quickly identified the *chenille d'Angoumois* as a *phalena* briefly described in the second volume of René-Antoine Ferchault de Réaumur's *Mémoires pour servir à l'histoire des insectes*.⁸⁹ In order to "see more than M. Réaumur had been able to," the two naturalists travelled throughout the province, collecting specimens and conducting observations in fields and barns infested with these insects. During these expeditions, they made the home of M. Marantin, the subdelegate of the intendant of Limoges, their principal seat of residence. Marantin's house was ideally suited for the two naturalists' investigations. Situated near La Rochefoucauld, in proximity to the parishes that were hit hardest by the

⁸⁹ "Note de M. Fougereux sur le papillon d'Angoumois," 28 August 1760, 127AP/6, ANF, Paris; René Antoine Ferchault de Réaumur, *Mémoires pour servir à l'histoire des insectes*, vol. 2 (Paris: Imprimerie Royale, 1736), 490.

outbreak, it offered ready access to an inexhaustible supply of insect specimens.⁹⁰ For several weeks, the house acted as an observational and experimental laboratory. The house was equipped with microscopes which both men used to observe insects, caterpillar excrement, moth eggs and dissected grains containing live larvae. Moth specimens were kept in glasses of crystal in a darkened room in the basement, where both men were able to observe the nocturnal coupling of these insects.⁹¹ Tillet, who possessed "piercing eyesight," counted the eggs laid by the Angoumois moths to estimate their rate of reproduction.⁹² Specimens of larvae and moths were also kept with stalks of wheat in large *cabinets d'expérience*, in order to observe their growth, feeding habits and metamorphosis in controlled environments.⁹³

⁹⁰ Duhamel du Monceau, *Histoire d'un Insecte*, 291.

⁹¹ Duhamel du Monceau, *Histoire d'un Insecte*, 10, 31, 41, 48, 52.

⁹² Duhamel du Monceau and Tillet, "Observations sur les Papillons," 3 September 1760, Pochettes de Séances, AAS, Paris.

⁹³ Duhamel du Monceau, *Histoire d'un insecte*, 67.

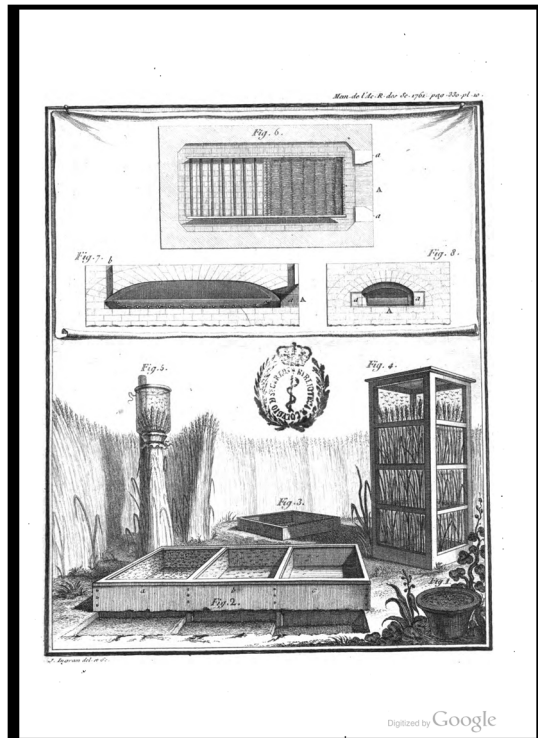


Figure 2. Duhamel du Monceau and Tillet's experimental cabinet. Source: Duhamel du Monceau and Tillet, "Sur l'insecte qui dévore les grains de l'Angoumois," 330.

The two men also paid close attention to local beliefs about the physical causes of insect generation amongst the inhabitants of the province. Duhamel du Monceau pored over a "great number of memoirs and instructive letters" made available to him by the intendant, and conversed with property owners, local officials, and peasants, finding a plethora of opinions and "contradictory observations" on the matter.⁹⁴ Of all the "foolish" ideas he surveyed, Duhamel du Monceau singled out the theory of spontaneous generation, "which had so many partisans in Angoumois," as being particularly worthy of censure.⁹⁵ He objected to the widespread belief amongst farmers in the province that the

⁹⁴ Duhamel du Monceau, *Histoire d'un Insecte*, 13, 292.

⁹⁵ Duhamel du Monceau, *Histoire d'un Insecte*, 159. [Il y a lieu d'espérer qu'après ce que nous avons dit jusqu'à présent de l'histoire de la chenille des grains, on n'insistera plus sur les productions spontanées qui avoient tant de parisans dans l'Angoumois, et qu'on prendra une idée plus juste de leur multiplication.]

larvae they found in their wheat stalks were generated from the corruption of the grain partly on philosophical grounds, noting that eggs were the "primitive principle" of all living organisms and that matter could not be generated from putrefaction.⁹⁶ Yet it was imperative that these "unfounded ideas be suppressed" primarily because they gave rise to ineffective, and even harmful techniques of pest-control.⁹⁷ The belief that the cause of the insect epidemic was a "noxious sap" in the soil of Angoumois that corrupted the grain on the stalk, for example, had led to fruitless attempts to clear "healthful soil" in which to plant wheat crops.⁹⁸ Even more damaging were attempts to obtain an ordinance to ban maize from Angoumois, on the grounds that the insects were generated from its putrefying roots and stems. This measure, Duhamel du Monceau warned, would not only fail to halt the epidemic, but it would also lead to the "total loss of Angoumois," as maize, relatively unaffected by the epidemic of caterpillars, formed the staple of the peasants' diet in the region during times of famine and shortages of wheat.⁹⁹

For Duhamel du Monceau, the "pseudo-scientific reasoning" of ignorant locals who "lacked even the first principles of natural philosophy," could not provide the grounds for practical efforts to exterminate these insects.¹⁰⁰ In order to rid the region of

⁹⁶ Duhamel du Monceau, *Histoire d'un insecte*, 152.

⁹⁷ Duhamel du Monceau, *Histoire d'un insecte*, 171.

⁹⁸ Duhamel du Monceau, *Histoire d'un insecte*, 111-112, 149-150, 160.

⁹⁹ Duhamel du Monceau, *Histoire d'un insecte*, 161.

¹⁰⁰ Duhamel du Monceau, *Histoire d'un insecte*, 148 – 149. [Ils attribuoient l'origine de cet insecte à la corruption de la substance farineuse et à la disposition que les grains avoient à se corrompre par l'intempérie de l'air et des saisons, surtout par les pluies chaudes et les brouillards ... ils terminoient leur raisonnement prétendu physique, par dire

these pests, Duhamel du Monceau quickly came to the conclusion that it was first necessary to "destroy all the ideas which have been formed in Angoumois on the efficient and distant causes of this calamity."¹⁰¹ To convince the *habitants* of Angoumois to "abandon all talk of spontaneous generation ... and form more truthful ideas of the multiplication of these insects," the two naturalists staged public displays of the insect's life cycle in Marantin's household, which Duhamel du Monceau tellingly referred to as the "theater of our experiments."¹⁰² Marantin's home was a hive of activity in the summers of 1760 and 1761, as locals eagerly came to witness the two naturalists' investigations. The observation of the process by which freshly hatched larvae burrowed themselves into stalks of grain in order to feed on the meal, for instance, attracted a great number of spectators. Even the stable boys of Marantin's household became familiar with this fact, "amusing themselves by finding stalks of wheat containing miniscule caterpillars and showing them to their friends, for whom it was a novel spectacle."¹⁰³

qu'il falloit bien qu'il y eût quelque mauvaise qualité dans la seve que la terre de l'Angoumois fournissoit aux plantes, puisque d'autres cantons ne souffroient point le sdommages causés par ces insectes.]

¹⁰¹ Duhamel du Monceau, *Histoire d'un insecte*, 146. [Maintenant que nous connoissons parfaitement l'histoire de la chenille des grains, il nous sera aisé de détruire toutes les idées qu'on s'étoit formées dans l'Angoumois sur les causes prochaines et éloignées de ce terrible fléau.]

¹⁰² Duhamel du Monceau, *Histoire d'un Insecte*, 159. [Il y a lieu d'espérer qu'après ce que nous avons dit jusqu'à présent de l'histoire de la chenille des grains, on n'insistera plus sur les productions spontanées qui avoient tant de partisans dans l'Angoumois, et qu'on prendra une idée plus juste de leur multiplication.]

¹⁰³ Duhamel du Monceau, *Histoire d'un insecte*, 35-36. [Tout le monde, chez M. Marantin et chez M. de Taponnat, s'étoit tellement familiarisé avec cette observation, que les valets de basse-cour, guidés par cette marque, venoient à bout de trouver cette petite chenille dans les grains et ils se faisoient un plaisir de la faire voir à leurs camarades pour qui c'étoit un spectacle nouveau.]

Through these acts of collective witnessing, Duhamel du Monceau and Tillet were able to turn their private observations of the various stages of the insect's life cycle, from conception to metamorphosis and reproduction, into publicly attested facts.¹⁰⁴ The presence of "so many witnesses" at these observational trials, Duhamel du Monceau wrote, had made it a "well-attested fact" [*un fait bien constaté*], one which it was "no longer possible to doubt," that the larvae found by farmers in their stalks of wheat were the progeny of the moths that periodically swarmed over their fields and in their barns.¹⁰⁵

These public demonstrations, and the widely disseminated circulars, printed publications, and engravings that verbally and visually recorded the life cycle of the Angoumois moth, formed part of a carefully elaborated mediatic strategy of rural enlightenment, aimed at reforming provincial prejudices and ill-informed agricultural practices.¹⁰⁶ Duhamel du Monceau hoped that this project would be carried on by enlightened farmers in Angoumois, whom he encouraged to publicly reproduce his observations in order to "sensibly demonstrate" the true principles of insect generation.¹⁰⁷ As Duhamel du Monceau recalled, the expedition to Angoumois had kindled great

¹⁰⁴ On collective witnessing as a crucial feature of early modern experimental science see: Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1995).

¹⁰⁵ Duhamel du Monceau, *Histoire d'un Insecte*, 28-29.

¹⁰⁶ Abridged pamphlets of the *Histoire d'un insecte* were distributed throughout the généralité of Limoges by the intendant and his subdelegates: "Expériences faites en Angoumois d'une méthode à la portée de tous les cultivateurs pour mettre les blés en état d'être bien conservés, et même pour faire périr jusqu'aux moindres insectes," 1763, AP 127/6, ANF, Paris.

¹⁰⁷ Duhamel du Monceau, *Histoire d'un insecte*, 42.

enthusiasm amongst local officials and farmers for the natural historical observation of insect pests:

Everywhere we went ... the desire to converse with us on a subject which was of such great importance to the province attracted several learned persons who brought us samples of their damaged grains, and they informed us of what they believed they had observed ... when we discovered something interesting, we informed those who were present. One can imagine that this exchange of knowledge was very useful: it excited a great deal of emulation; everyone proposed to try out more exact and decisive experiments than the vague observations that had been conducted to that point.¹⁰⁸

While Duhamel du Monceau lamented that the local enthusiasm for entomological investigations had subsided after his departure from Angoumois, he consoled himself that this "ardor" had remained alive amongst a "few zealous and enlightened citizens" like Madame de Chasseneuil, a local noblewoman who continuously sent him observations on insects "conducted ... with all the intelligence of a consummate natural philosopher."¹⁰⁹ Correspondence with these *bon citoyens*, as we will now see, would prove crucial to the generalized program of entomological observation that Duhamel du Monceau pursued in the 1760s.

¹⁰⁸ Duhamel du Monceau, *Histoire d'un insecte*, 10 [On juge combien cette communication de connoissances devoit être utile: elle excitoit une grande émulation; chacun se proposoit de faire des expériences plus exactes et plus décisives que les observations trop vagues qu'on avoit faites jusqu'alors. Nous nous attendions bien que cette ardeur se ralentiroit quand nous aurions quitté la province, et nous ne nous sommes pas trompés; cependant nous annonçons avec plaisir qu'elle a subsisté dans quelques citoyens zélés et éclairés, qui se sont fait un plaisir de correspondre à nos bonnes intentions.]

¹⁰⁹ Duhamel du Monceau, *Histoire d'un insecte*, 11, 12, 90, 117, 207.

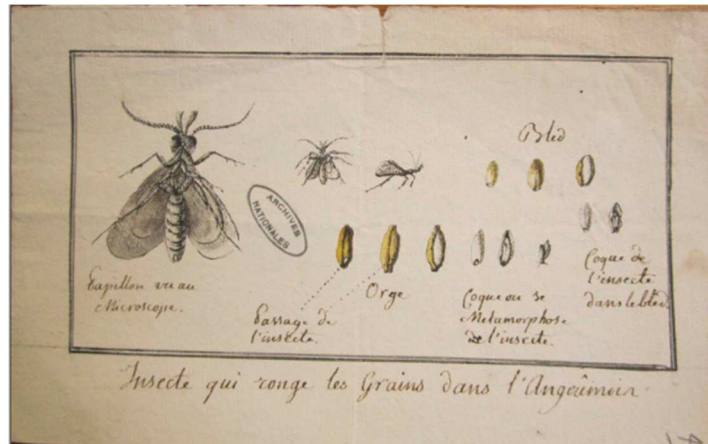


Figure 3. Duhamel's sketch of the chenille d'Angoumois Source: Henri-Louis Duhamel du Monceau, "Insecte qui ronge les grains dans l'Angoumois," AP 127/6, ANF, Paris



Figure 4. Engraving of a sketch by Duhamel du Monceau. Source: "Dessins à la main et planche gravée selon un dessin de Duhamel du Monceau," AP 127/6, ANF, Paris.

Observing Insects: Duhamel du Monceau's Entomological Network

Shortly after returning from his expedition to Angoumois, Duhamel du Monceau began to collect and compile observational and experimental reports that would allow

him to write a comprehensive natural history of crop eating insects.¹¹⁰ To this end, he corresponded with amateur naturalists and agricultural improvers throughout France who provided him with observations, insect specimens and diseased plants from fields beyond his reach. Duhamel du Monceau became the center of an expansive network of entomological observers, who acted at once as eyes with which he could see at a distance and as suppliers of materials for his own investigations.¹¹¹ These circuits of exchange were constituted and maintained through the strategic use of his printed publications. Duhamel du Monceau used his highly popular agronomic texts to mobilize entomological observers, by enticing his readers to send him specimens and observations of insects that they might find in their fields, and then by reciprocating their favors through the publication of their experimental and observational accounts in subsequent editions of his works.¹¹²

One diligent observer was Louis-François Chabot, a seigneur from Niort in the province of Poitou, who began a correspondence on insect pests with Duhamel du Monceau after having read a copy of his *Traité sur la conservation des grains*. Chabot supplied Duhamel du Monceau with "a good number of gnats," previously unidentified by naturalists, that were infesting granaries in Poitou. He also sent observations of grain-

¹¹⁰ Henri-Louis Duhamel du Monceau, *Supplément au traité de la conservation des grains, contenant plusieurs nouvelles expériences* (Paris: Guérin et Delatour, 1765), 26; "Notes sur les insectes qui dévorent les grains de froment," Papers of Henri-Louis Duhamel du Monceau, BD87 group 14, American Philosophical Society, Philadelphia.

¹¹¹ On 'seeing at a distance', the obligatory reference point is: Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge: Harvard University Press, 1987).

¹¹² A strategy that Réaumur used to great effect in writing his *Histoire des insectes*: Mary Terrall, "Following insects around," 573-588.

beetles, directly answering Duhamel du Monceau's call in the *Traité sur la conservation des grains* to provide him with materials for writing the complete history of this insect.¹¹³ Chabot kept a red colored beetle that he found lodged within a grain of wheat in a drawer in his cabinet, frequently returning over the course of several months to observe the insect's life cycle. From his observations, he was able to determine that the beetle introduced itself imperceptibly into the grain in its larval stage, and developed to maturity by feeding on the flour within, thus disproving the belief that beetles could only attack wheat kernels from outside the grain. Chabot glued the grain shut and wrapped it in a piece of paper, hoping to eventually send the specimen to Duhamel du Monceau. But the insect, he wrote, "eluded the vigilance with which I had observed it," and escaped after breaking free from its prison.¹¹⁴

Many other readers of Duhamel du Monceau's texts took up his call to send him observations of understudied or previously unidentified insect pests that they found in their granaries and fields. Toustain de Frontebosse, vicar general of the Ordre Notre-Dame-de-la-Merci, for instance, sent observations of a black fly infesting the barns of Provence, remarking that these insects had not been described in the *Traité de la Culture des Terres*.¹¹⁵ Madame de Chasseneuil, one of Duhamel du Monceau's most assiduous collaborators, began to send observations of grain-eating caterpillars after having read the

¹¹³ Chabot to Duhamel du Monceau, 21 May 1762, Papers of Henri-Louis Duhamel du Monceau, BD87 group 8, APS Philadelphia; Chabot to Duhamel du Monceau, 5 January 1763, Papers of Henri-Louis Duhamel du Monceau, BD87 group 8, APS, Philadelphia.

¹¹⁴ Chabot to Duhamel du Monceau, 5 January 1763, APS, Papers of Henri-Louis Duhamel du Monceau, BD87 group 8, APS, Philadelphia.

¹¹⁵ Toustain de Frontebosse to Duhamel du Monceau, n.d. Papers of Henri-Louis Duhamel du Monceau, BD87 group 8, APS, Philadelphia.

Traité sur la conservation des grains, several years prior to the expedition to Angoumois.¹¹⁶ Duhamel du Monceau filled his agronomic treatises with the entomological observations of his correspondents, which he observed with satisfaction in 1757, "are continuously increasing in their number and zeal."¹¹⁷ Duhamel du Monceau presented himself as an arbiter in this expanding network of "philosophe-citizens" [*philosophe-citoyen*], collecting, collating and publishing the reports that he deemed worthy of approval. This moral economy of credit, in which amateur naturalists were rewarded with public acknowledgments of their efforts through print, was the glue that held together Duhamel du Monceau's observational network and ensured the continued circulation of specimens and observations.

Some observers went beyond descriptive histories of insect pests and ventured into the territory of *physique*, or natural philosophy, by making causal claims about the physiological relationship between insects and plants. In August 1761, M. Bruté, a manufacturing inspector from Montauban, sent Duhamel du Monceau a letter in which he claimed to have proven that microscopic insects were the causes of all diseases afflicting

¹¹⁶ Duhamel du Monceau, *Traité de la Culture des Terres*, vol. 6, (Paris: Guérin et Delatour 1761), 482.

¹¹⁷ Duhamel du Monceau, *Traité de la Culture des Terres*, vol. 6, v; Duhamel du Monceau, *Traité de la Conservation des Grains* (Paris: Guérin et Delatour, 1753), 84-100; Duhamel du Monceau, *Traité de la Culture des Terres*, Volume 5, (Paris: Guérin et Delatour, 1757), 296-313; Duhamel du Monceau, *Éléments d'agriculture*, Volume 1, (Paris: Guérin et Delatour 1761), 288-302, 413-421; Duhamel du Monceau, *Supplément au Traité de la Conservation des Grains* (Paris: Guérin et Delatour 1765), 26-48; Duhamel du Monceau, *Mémoires d'agriculture adressés à M. Duhamel du Monceau, par plusieurs agriculteurs* (Paris: Guérin et Delatour, 1765), *passim*.

wheat and millet crops.¹¹⁸ Duhamel du Monceau himself had raised the possibility in the second volume of his *Traité de la Culture des Terres* (1753) that wheat rust and smut might be caused by the stings of insects. However, given the absence of conclusive evidence he left the question open to "agricultural enthusiasts" [*amateurs d'agriculture*], who might resolve the question through the "multiplication of observations and experiments."¹¹⁹ Bruté obligingly responded to the call for such experiments, examining droplets of water infused with rusted and smutted wheat under a solar microscope that revealed an innumerable quantity of imperceptible insects and insect eggs.¹²⁰ He then sent Duhamel du Monceau a descriptive account of the shape, size and movement of these insects and eggs, along with stalks of rusted and smutted wheat so that he himself might repeat these observations. For Bruté, who was preparing a manuscript on the subject of plant diseases, a correspondence with Duhamel thus provided the possibility of gaining powerful epistemic validation from an eminent naturalist whose approval could transform his private conjectures into publicly attested facts.

While Duhamel displayed a moderate skepticism towards Bruté's claims, noting that they were "conjectures deserving more observations," he could be outright dismissive of other correspondents who, in his view, proceeded according to false physical principles. Such was the case with M. Thazeau, a parish priest from the village

¹¹⁸ Bruté to Duhamel du Monceau, 3 August 1761, Papers of Henri-Louis Duhamel du Monceau, BD87 group no. 8, APS, Philadelphia; Bruté appears as "inspector de manufactures" in Montauban in *Almanach Royal* (Le Breton: Paris, 1764), 436.

¹¹⁹ Duhamel du Monceau, *Traité de la Culture des Terres*, vol. 2 (Paris: Guérin et Delatour, 1753), 176.

¹²⁰ Bruté to Duhamel du Monceau, 3 August 1761, Duhamel du Monceau Papers, group BD 87 no. 8, APS, Philadelphia.

of Solomé in Poitou and member of the Société d'Agriculture d'Angoulême, who took an active role in efforts to combat the Angoumois moth.¹²¹ Thazeau determined that the "qualities" communicated to wheat plants by the soil in which they were planted, and by the seeds from which they developed, had a determining impact on the reproductive cycles of this insect. The Angoumois moth proliferated especially on wheat planted in "warm earth" (*terre chaude*), as the "heat" of the soil caused a fermentation of the plant that accelerated the hatching of eggs laid on the stalk.¹²² The seeds of wheat planted in "cold earth" (*terre froide*) should be reserved for sowing, as they retained a freshness from the soil that prevented the mature plant from fermenting and imparting a generative heat to insect eggs. This insight, Thazeau wrote, was the "the key that opens the door to the path that leads to the annihilation of these insects," as it followed that the proper selection of soils and seeds for planting wheat would rid Angoumois of this pest.¹²³

Duhamel du Monceau categorically rejected these conclusions, remarking in a series of observations on Thazeau's manuscript that his specious distinction between warm and cold soils made clear that "the very first principles of this system are false."¹²⁴ Thazeau was distressed by this response, expressing surprise that Duhamel du Monceau could attempt, with a "single stroke of the pen," to "erase the work of a man who has

¹²¹ "Mémoire de Thazeau sur les Papillons de Blé," 1766, H/1503, ANF, Paris.

¹²² "Terre chaude" or "terre brulante" corresponded to dry, light and sandy soils while "terre froide" corresponded to heavier, humid soils like clay: Augustin-Charles Aviler, *Dictionnaire d'architecture civile et hydraulique et des arts qui en dépendent* (Paris: Jombert, 1755), 344.

¹²³ Thazeau, "Mémoire instructif pour venir à la destruction totale des insectes qui dévorent les bleds des provinces," 1766, AP 127/6, ANF, Paris.

¹²⁴ "Observations sur le mémoire de M. Thazeau," 1766, AP 127/6, ANF, Paris.

spent more than three months meditating on the means to completely destroy these moths." To convince his correspondent, Thazeau sent two packages containing seeds from wheat planted in cold and hot soil, and implored him to carry out experiments that, he was certain, would validate his purportedly "illusory system."¹²⁵ That these seeds have remained ever since in unopened packages in Duhamel du Monceau's private papers is indicative of how seriously he took Thazeau's observations. Nevertheless, the episode demonstrates that provincial naturalists and agricultural enthusiasts were not simply passive actors mobilized in the service of Duhamel du Monceau's observational program. That some of Duhamel du Monceau's correspondents pursued independent observational programs and made theoretical commitments that clashed with his own reveals how the dynamics of his network could be at once centripetal and centrifugal.



¹²⁵ Thazeau to Duhamel du Monceau, 16 April 1766, AP 127/6, ANF, Paris.



Figures 5 and 6, Package of seeds sent by Thazeau to Duhamel du Monceau. Source: Thazeau to Duhamel du Monceau, 16 April 1766, AP 127/6, ANF, Paris.

Disseminating Pest-Control Technologies

If Duhamel du Monceau's publications were partially intended to create a geographically dispersed community of observers, they were also meant to be used in the field as practical manuals for exterminating insects. These printed treatises were supposed to cultivate and satisfy the demands of provincial officials and cultivators for a body of useful knowledge that would assist them in the management of agricultural crises caused by insect pests.¹²⁶ Duhamel du Monceau's correspondents were effective proselytizers for his proposed techniques of pest-control. Chabot wrote in May 1762 to ask for a copy of the forthcoming *Histoire d'un insecte qui dévore les grains*

¹²⁶ Duhamel du Monceau tried to have four to five hundred copies of a five page pamphlet extract of this book distributed in Angoumois through the intendant. He also hoped to have a copy of the book in its entirety distributed to all the agricultural societies in France: "Conservation des Grains," 19 September 1767, Archives Nationales, H-1503, f. 17.

d'Angoumois, remarking that this book, "distributed into the hands of every farmer," would "bolster the public's confidence and encourage them to carry out your remedies in practice."¹²⁷ The following year, Chabot informed his correspondent that "the communication of your book and my exhortations," had allowed certain farmers in Niort to successfully protect their stored wheat from grain-eating caterpillars.¹²⁸ Unfortunately, the majority of cultivators in the area had refused to follow the techniques contained in this book. As we will see, it was easy enough for Duhamel du Monceau to disseminate printed instructions for controlling pests, but it proved to be much more difficult to convince farmers in rural France to adopt his proposed technological solutions when they believed them to threaten the marketability of their crops.

Insect-repelling plants, homemade chemical remedies and combustible substances had a long-established place in the canon of pre-modern techniques of agricultural pest-control.¹²⁹ In the second half of the eighteenth century, these substances received increasing public attention from French agricultural improvers, *savants* and royal administrators.¹³⁰ Recipes for insecticide liquors circulated widely in oeconomic periodicals, as agricultural improvers made the insecticidal properties of various plants

¹²⁷ Chabot to Duhamel du Monceau, 21 May 1762, Papers of Henri-Louis Duhamel du Monceau, BD87, group 8., APS, Philadelphia.

¹²⁸ Chabot to Duhamel du Monceau, 5 January 1763, Papers of Henri-Louis Duhamel du Monceau, BD87, group 8., APS, Philadelphia.

¹²⁹ Karl H. Dannenfeldt, "The Control of Vertebrate Pests in Renaissance Agriculture," *Agricultural History* 56, no. 3 (Summer 1982): 542-559; H.A. Beecham and Jonathan Brown, "Crop Pests and Diseases," in *The Agrarian History of England and Wales 1750-1850*, vol. 6 (Cambridge: Cambridge University Press, 1989)

¹³⁰ See, chapter 7.

and nostrums that they tested in their fields public. Duhamel du Monceau's correspondents did not fail to alert him to plants and simples that had proven effective in expelling insects from their granaries and fields. Toustaint de Frontebosse informed Duhamel du Monceau that the strong odor of a species of hay from Provence protected stored wheat from the mites that often infested barns in the region.¹³¹ A parish priest from Angoumois sent him a report of a remedy that he acquired from a nobleman from Poitiers, and which was claimed to completely expel mites from granaries within twenty-four hours.¹³² Chabot also reported that farmers in Niort succeeded in expelling caterpillars from infested stalks of wheat by burning sulfur and tobacco around their fields.¹³³

Duhamel du Monceau himself tested the efficacy of various fumigations and insect repellent substances, but he was highly skeptical of the value of "those many recipes that are held as infallible."¹³⁴ Other traditional conservation techniques used by farmers (constantly working the stored wheat with shovels, submerging the grain in boiling water and letting it dry in the sun) were too labor intensive and failed to effectively affect the insects lodged inside grain.¹³⁵ For Duhamel du Monceau the most

¹³¹ Toustain de Frontebosse to Duhamel du Monceau, "Moyens pour detruire les mites dans les greniers," n.d. Papers of Henri-Louis Duhamel du Monceau, BD87, group 8., APS, Philadelphia.

¹³² "Insecte du bled en Angoumois," 1766, H/1503, f.13, ANF, Paris.

¹³³ Chabot to Duhamel du Monceau, 5 January 1763, Papers of Henri-Louis Duhamel du Monceau, ANF, BD87, group 8., APS, Philadelphia.

¹³⁴ Duhamel du Monceau, *Traité de la conservation des grains*, 92; Duhamel du Monceau, *Histoire d'un Insecte*, 203-204.

¹³⁵ Duhamel du Monceau, *Histoire d'un insecte*, 184-210; For an overview of contemporary conservation techniques see: François Sigaut, *Les réserves de grains à*

economic and effective solution to the problem of wheat-pests was the *étuve*, a thermally insulated chamber connected to an oven that could be used to dry wheat and exterminate burrowed insects. The heat from the kilns would kill the eggs and larvae contained in infected grain, allowing farmers to safely preserve their crops in granaries.¹³⁶ It would also halt the metamorphosis of larvae and caterpillars into egg-laying moths, thereby preventing further outbreaks of insects in fields during harvest season. Finally, the kilns would make wheat safe for long-distance transport, ensuring that insect pests did not spread throughout the kingdom by being surreptitiously carried into neighboring provinces. The provincial administration, Duhamel du Monceau wrote, ought to enforce that all wheat shipped out of the province be processed in public *étuves*, it being the only means to "prevent the dispersal of the moths" to the rest of the country.¹³⁷ If these kilns were disseminated throughout countryside, Duhamel du Monceau hoped, it might even be possible to "annihilate this entire race of grain-eating insects."¹³⁸

The Angoumois grain moth epidemic provided Duhamel du Monceau with the ideal opportunity to promote the model-kiln that he had developed in the 1750s with his nephew Fougeroux de Bondaroy (1732-1789).¹³⁹ In this effort, he was assisted by royal

long terme. Techniques de conservation et fonctions sociales dans l'histoire. (Paris: Éditions de la MSH), 1978.

¹³⁶ Duhamel du Monceau, *Traité de la conservation des grains*, 160; *Supplément au Traité de la Conservation des Grains*, 26-48, 58-59.

¹³⁷ Duhamel du Monceau, *Histoire d'un insecte*, 299.

¹³⁸ Duhamel du Monceau, *Histoire d'un insecte*, 17, 194.

¹³⁹ Duhamel and Fougeroux spent several years making technical improvements to the instrument in order to more effectively dry out large piles of grain: "Expériences d'étuves à Pithiviers en juillet et août 1754," 127AP/6, ANF, Paris; "Expériences d'étuve à blé à

administrators, who saw the *étuve* as a valuable means of containing the spread of the insect. Circulars calling upon wealthy farmers to establish public kilns on their estates were distributed by the intendants and subdelegates in the *généralité* of Limoges.¹⁴⁰ At the insistence of the controller general Bertin, members of the Société d'Agriculture d'Angoulême built a public kiln based on Duhamel du Monceau's model.¹⁴¹ The intendant of Limoges Anne-Robert-Jacques Turgot (1727-1781) oversaw the construction of these kilns in his *généralité* and promoted its use by staging public experiments that demonstrated the instrument's utility and ease of use.¹⁴² Duhamel du Monceau praised the "tremendous patriotic zeal" of the lieutenant general of Beauvais, who had built a desiccation oven on his property that was open to all inhabitants of the town.¹⁴³ Agricultural improvers and amateur naturalists who had collaborated with Duhamel du Monceau in his study of the Angoumois grain moth were also useful allies. Montalembert de Cers, who Duhamel du Monceau described as "one of the good *physiciens* of

Corbeil," 1766, 127 AP/6, ANF, Paris. Duhamel's interest in grain conservation techniques dated back to his years as a minister of the Marine, where the question of conserving wheat for long-distance transport for the Navy was primordial: Henri Louis Duhamel du Monceau, *Supplément au Traité de la Conservation des Grains*, 2. For an overview of Duhamel du Monceau's activities as inspector of the French Marine see: Michel Allard, *Henri-Louis Duhamel du Monceau et le Ministère de la Marine* (Montreal: Lemeac, 1970); For an overview of conservation technologies in eighteenth-century France: Steven L. Kaplan, *Provisioning Paris: Merchants and Millers in the Grain and Flour Trade During the Eighteenth Century* (Ithaca: Cornell University Press, 1984), 66-79.

¹⁴⁰ "Expériences faites en Angoumois d'une méthode à la portée de tous les cultivateurs, pour mettre les blés en état d'être bien conservés, et même pour en faire périr jusqu'aux moindres insectes," 1763, H/1503, f. 21, ANF, Paris.

¹⁴¹ Bertin to Boisbedeuil, 30 July 1765, AP 127/6, ANF, Paris.

¹⁴² Duhamel du Monceau to M. Parent, 14 October 1761, H/1503, f.23, ANF, Paris.

¹⁴³ Duhamel du Monceau, *Supplément au traité sur la conservation des grains*, 136.

Angoumois," sent the royal administration several reports of experiments aimed at determining the ideal temperature at which insects burrowed in grains of wheat at different life stages could be killed in the *étuve*, without altering the taste of the flour or destroying the germinative property of the seed.¹⁴⁴

Beyond Angoumois, numerous correspondents and readers of Duhamel du Monceau's agricultural treatises installed kilns installed on their estates. Duhamel du Monceau kept a model of the instrument that he had built at Denainvilliers in his lodgings in Paris, hoping to court landowners and royal officials who resided in the capital.¹⁴⁵ When the administrators of the royal granary in the Faubourg Saint-Denis came to see the model kiln in the 1760s, they acquired the plans for this instrument from Duhamel du Monceau and had one constructed in their building. The financier and military administrator Joseph Paris du Verney (1684-1770) was likewise convinced by Duhamel du Monceau to establish a desiccating oven in the storehouses of the royal military academy in Paris.¹⁴⁶ Public demonstrations of the instrument's effectiveness in exterminating grain-eating insects were then staged at the military academy, in the presence of a number of high-ranking royal officials.¹⁴⁷ The Abbé de Monbourg, director of the Hôtel-Dieu in Paris, had an *étuve* built in the granary of the hospital after reading a

¹⁴⁴ "Mémoire de M. de Montalembert de Cers, Major de la Ville et Château d'Angouleme et Directeur du Bureau d'agriculture de la dite ville, touchant la manière de passer le froment au four pour y faire périr les papillons et chrisalydes en conservant le germe du bled," H/1503, ANF, Paris.

¹⁴⁵ Duhamel du Monceau, *Supplément au traité sur la conservation des grains*, 68.

¹⁴⁶ Duhamel du Monceau, *Supplément au traité sur la conservation des grains*, 49-50.

¹⁴⁷ Duhamel du Monceau, *Supplément au traité sur la conservation des grains*, 49-67.

copy of the *Traité sur la conservation des grains*.¹⁴⁸ Monbourg reported that he had been able to exterminate the insects that had previously infested the granaries of the hospital, and that the Archbishop and many bakers of the city had approved the bread baked from wheat passed through the *étuve*.¹⁴⁹

Such favorable testimonies, which Duhamel judiciously reprinted in successive editions of his works, were valuable for deflecting the skepticism of those who opposed the use of kilns for processing grain. Indeed, Duhamel du Monceau was to be thoroughly disappointed in his hopes that property owners and administrators would unanimously adopt the *étuve* as a technique for grain conservation. In Lyon, "entrenched prejudices" and "private interests" had led to attempts to remove Duhamel's *étuve* installed in the city's public granary at Bertin's request.¹⁵⁰ Duhamel du Monceau was troubled to hear that opposition to his kilns was mounted not only in Lyon, but also in Angoulême:

What is utterly mortifying to me, is that there are people who were present [in Angoumois] at my investigations and who cannot call into doubt the exactness and truth of the facts which I have put forward ... and who nevertheless try, in the agricultural assemblies of Angoulême, to prevent that the means that I have proposed to remedy this evil be put into practice: it is very easy to gain proselytes when one is a partisan of laziness and indolence. Nevertheless, I myself have carried out my mission as a true patriot.¹⁵¹

¹⁴⁸ Duhamel du Monceau, *Supplément au traité de la conservation des grains*, 127-128.

¹⁴⁹ Duhamel du Monceau, *Supplément au traité de la conservation des grains*, 131.

¹⁵⁰ Monlong to Duhamel du Monceau, Lyon, 6 August 1762, ANF AP 127/6; Monlong to Duhamel du Monceau, Lyon, 13 September 1764, ANF AP 127/6; Bertin to Duhamel du Monceau, Compiègne, 4 August 1765, ANF AP 127/6.

¹⁵¹ Henri-Louis Duhamel du Monceau, *Supplément au traité de la conservation des grains*, 41-42 [Ce qu'il y a de plus mortifiant pour nous, c'est de savoir qu'il y a des personnes qui ont été présentes à nos recherches, qui ne peuvent révoquer en doute l'exactitude et la vérité d'aucun des faits qui sont avancés dans notre ouvrage, et qui font cependant leurs efforts dans les assemblées d'agriculture qui se tiennent à Angoulême

Duhamel du Monceau fumed that the unfounded objections to the kiln by local noblemen like the Marquis d'Argens, "who produces no experiments, but only fine words," could only act as an encouragement to "lazy and pig-headed farmers" in Angoumois who neglected the "public good" and brought ruin to their neighbors by refusing to carry out operations necessary to prevent the spread of the epidemic.¹⁵²

On what grounds were Duhamel du Monceau's kilns opposed? The cost of the instrument and the losses in weight that the grain suffered after being passed through it were frequent objections.¹⁵³ An even more serious objection was that the flour from desiccated grain was of poor quality. Concern for the quality of wheat was fundamental for Duhamel du Monceau, as it was for most consumers and state officials in eighteenth-century France. As Steven Kaplan has shown, eighteenth-century Parisians "insisted not merely that their bread be not defective or noxious; it must be good, even delicious."¹⁵⁴ It was thus crucial that Duhamel du Monceau convince this discriminating public that the taste of wheat was unaffected by his oven. In public demonstrations of the machine in Angoumois and elsewhere, collective taste-tests by "grain connoisseurs" had been organized to attest to the ocular, gustatory and olfactory quality of the wheat passed

pour empêcher que l'on ne mette en pratique les moyens que nous proposons pour arrêter le mal: il est si aisé de se faire des prosélytes quand on se déclare partisan de l'indolence et de la paresse! Au reste nous avons rempli notre mission en véritables patriotes.]

¹⁵² "Conservation des Grains," 19 September 1762, H/1503, ANF, Paris; Duhamel du Monceau, *Histoire d'un insecte*, 297.

¹⁵³ Henri-Louis Duhamel du Monceau, *Histoire d'un insecte*, 247-251; Duhamel du Monceau, *Traité de la conservation des grains*, 139-140; Duhamel du Monceau, *Supplément au traité de la conservation des grains*, xxiv; Alexandre Ferdinand Léonce Lapostolle, *Traité de la carie ou bled noir* (Amiens: Caron 1787), 20-21.

¹⁵⁴ Kaplan, *Provisioning Paris*, 58.

through the kiln.¹⁵⁵ In Angoumois, local officials conducted collective taste-tests of bread baked from wheat passed through the ovens – which all deemed "excellent."¹⁵⁶

Nevertheless, Duhamel du Monceau found that the “prejudice” against the instrument remained strong, and was difficult to "destroy."¹⁵⁷ Chabot found a "great repugnance" for the kilns by the *petits gens* of Niort, who claimed that bread made with this wheat was "worthless."¹⁵⁸ Jacques-Donatien Leray de Chaumont (1726-1803), who had a kiln installed on his domain near Blois after reading Duhamel's *Supplément au traité de la conservation des grains*, complained that wheat passed through the kilns often yielded darkened flour.¹⁵⁹ Similar complaints about the "offensive taste" acquired by wheat passed through the kiln were reported by Montalembert de Cers, and Turgot's subdelegate in Limoges.¹⁶⁰ As Steven Kaplan has suggested, "doubts about the feel of the wheat, the color of the flour, and the taste of bread are perhaps sufficient to explain why the kiln process did not become standard practice in the eighteenth century."¹⁶¹ Thus, Duhamel du Monceau may have won the hearts and minds of improving landowners and

¹⁵⁵ Duhamel du Monceau, *Supplément au traité de la conservation des grains*, 62, 65; Duhamel du Monceau, *Histoire d'un insecte*, 266.

¹⁵⁶ Duhamel du Monceau, *Histoire d'un insecte*, 266.

¹⁵⁷ Duhamel du Monceau, *Histoire d'un insecte*, 247.

¹⁵⁸ Chabot to Duhamel du Monceau, 5 January 1763, BD87 Papers of Henri-Louis Duhamel du Monceau, group 8, APS, Philadelphia.

¹⁵⁹ "Étuve construite à Chaumont pour seicher les bleds," 127 AP/6, ANF, Paris; "Lettre de Leray de Chaumont à Duhamel du Monceau sur son nouveau traité de la conservation des grains," 127 AP/6, ANF, Paris.

¹⁶⁰ "Conservation des Grains," H/1503, f.14, f. 25, ANF, Paris.

¹⁶¹ Kaplan, *Provisioning Paris*, 75.

enlightened officials throughout France, but his inability to win the palates of consumers, grain merchants and bakers was a serious impediment to the success of his program.

Conclusion

In the 1760s, French naturalists and agricultural improvers turned in great numbers to the study of insect pests, as the tools and techniques of natural history became connected to a generalized program of patriotic agricultural improvement. Duhamel Du Monceau was a central node in the networks of entomological observation that formed across France in this period, although enthusiasm for the natural history of insect pests far exceeded his limited circle of correspondents. When the Rouergue farmer Jean Mouret kept detailed notes on the parasitic insects that attacked his wheat crops on his property in Saint-Jean-du-Bruel in the province of Languedoc in the 1760s, he submitted them not to Duhamel du Monceau, but to the naturalist Jean-Baptiste Romieu of the Académie Royale des Sciences de Montpellier.¹⁶² Nevertheless, Mouret noted in the prefatory remarks of the report read to the *Société* that it was his reading of the *Traité de la culture des terres* that had motivated him to embark on a series of agronomic experiments on his property in Saint-Jean-du-Bruel.

Duhamel du Monceau succeeded in convincing his contemporaries that a socio-epistemic alliance between administrators, scientific experts and enlightened rural elites provided the surest means to develop effective administrative and technical solutions to

¹⁶² "Expériences d'agriculture et description de plantes et d'insectes par M. Mouret correspondant de la Société Royale des Sciences à Saint-Jean-du-Burel, diocèse de Vabres en Rouergue," D 182 f. 34-35, Archives Départementales de l'Hérault (ADH), Montpellier.

the problem of insect pests and their diffusion. Administrators like the intendant Anne-Robert-Jacques Turgot used their authority to forge such alliances at the local level by sending out questionnaires and holding prize competitions on the subject of insect pests, thus encouraging provincial elites to turn their attention to the vermin that consumed their crops.¹⁶³ In this chapter, I have demonstrated how such alliances worked in practice, by reconstructing the networks in which natural knowledge and technologies of pest-control were created and debated through the circulation of observations, specimens and materials. Duhamel du Monceau occupied an important role in these scientific and administrative networks, although he often failed to obtain the unwavering cooperation that he expected from farmers in the provinces. More broadly, I have shown how attempts to regulate the natural oeconomies of rural environments and the civil realm of agricultural production and exchange became interrelated and mutually reinforcing objectives for academic naturalists like Duhamel du Monceau.

In his report to the Académie des Sciences on the Angoumois grain moth, Duhamel du Monceau noted that locusts had served in the Holy Scriptures as an instrument of "divine justice to punish the crimes of mankind."¹⁶⁴ While he remained agnostic on the final, purportedly providential, cause of the "scourge" afflicting the provinces of Western France, Duhamel du Monceau was certain that the efficient causes

¹⁶³ "Avis sur l'imposition dans la généralité de Limoges pour l'année 1762,"; "Lettre à l'Intendant de Poitiers, de Labourdonnaye, de Blossac," 115-117; "Concours Ouverts par la Société d'Agriculture," 433; in *Oeuvres de Turgot et Documents le Concernant*, ed. in Gustave Schelle, vol. 2, (Paris: Librairie Félix Alcan, 1913-1923), 115-117, 433.

¹⁶⁴ Duhamel du Monceau and Tillet, "Sur l'insecte qui dévore les grains de l'Angoumois," 66.

were thoroughly *social* in nature.¹⁶⁵ The Angoumois grain moth epidemic had exposed the biological risks associated with an intensified, but poorly regulated commercial trade in grain. As the royal administration attempted to liberalize the grain trade in the 1760s, lifting restrictions on the inter- and intra - provincial trade in wheat, it became clear to observers like Duhamel du Monceau that the increased circulation of grain might also be accompanied by the unwanted circulation of harmful crop pathogens.¹⁶⁶ Nightmares of a generalized insect epidemic across the kingdom were the reverse side of liberal reformers' euphoric visions of an agricultural sector regenerated by an unfettered trade in grain.

¹⁶⁵ This brings to mind Keith Michael Baker's argument that 'society' emerged in the eighteenth century as a conceptual replacement for an increasingly remote and transcendent deity: Keith Michael Baker, "Enlightenment and the Institution of Society: Notes for a Conceptual History," in *Main Trends in Cultural History: Ten Essays*, eds. Willem Melching and Wyger Velema (Amsterdam: Rodopi, 1994), 95-110.

¹⁶⁶ On the liberalization of the grain trade see: Steven Kaplan, *Bread, Politics and Political Economy in the Reign of Louis XV* (The Hague: Martinus Nijhoff, 1976), ch. 2-3; Antoine-Alexandre Barbier has argued that Duhamel du Monceau was the likely author of an anonymous political tract on the issue: Louis-Paul Abeille [Duhamel du Monceau], *Réflexions sur la Police des Grains en France et en Angleterre* (Paris: Regnard, 1764).

Part 1: Observing Pests: Insects and Patriotic Natural History

Chapter 2: Clergymen and Exorcisms: Disenchanted Insects?

Ariston: Et des excommunications en userez vous?

Teotime: Non, il y a des rituels où l'on excommunie les sauterelles, les sorciers et les comédiens. Je n'interdirai point l'entrée de l'église des sauterelles, attendu qu'elles n'y vont jamais.

- Voltaire, "Le Curé de Campagne," *Dictionnaire Philosophique*¹⁶⁷

The exorcisms and excommunications of invasive insects that Voltaire mocked in his *Dictionnaire Philosophique* had a well established place in the liturgical practices of the eighteenth-century Catholic Church. From the fourteenth century to the beginning of the nineteenth century, they formed part of the agrarian rites regularly used by the rural clergy to protect their parishioners from the calamitous effects of insect infestations. In the nineteenth century, antiquarians and historians unearthed insect trials, excommunications and exorcisms with curious amusement, consigning them to the distant Gothic past of the Church.¹⁶⁸ Renewed historical attention to these rites has followed from the recent interest in the cultural and intellectual history of disasters and catastrophes, although invasive insects have received far less attention than more

¹⁶⁷ François-Marie Arouet (Voltaire), *Collection complète des oeuvres de M. de Voltaire*, (Genève, 1774) 2: 347.

¹⁶⁸ For a sample, see: Léon Menabrea, *De l'origine, de la forme et de l'esprit des jugements rendus au Moyen Âge contre les animaux* (Chambéry: Puthod, 1846); M.J. Desnoyers *Recherches sur la coutume d'exorciser et d'excommunier les insectes et autres animaux nuisibles à l'agriculture* (Paris: Imprimerie Royale, 1853); Émile Agnel, *Curiosités judiciaires et historiques du Moyen Âge: Procès contre les animaux* (Paris: J. Dumoulin, 1858); Alexandre Sorel, *Procès contre des animaux et insectes suivis au moyen âge dans la Picardie et le Valois* (Compiègne: Imprimerie de H. Lefebvre, 1877).

spectacular cataclysms like avalanches, earthquakes and floods.¹⁶⁹ Religious historians have treated the subject in a cursory manner, as part of a more summary treatment of the numerous agrarian rites codified and sanctioned by the Catholic Church in the early modern period.¹⁷⁰

Voltaire was neither the first nor the last thinker of the Enlightenment to pour scorn upon the liturgical responses to catastrophes like insect infestations. Some historians have seen Enlightenment *philosophes'* skepticism about the efficacy of agrarian rites as a symptom of a general process of secularization and intellectual emancipation from providential frameworks.¹⁷¹ Yet it must be noted that the rejection of agrarian rites

¹⁶⁹ On providential readings on disasters see: Louis Secondy, "Quand L'Église faisait la pluie et le beau temps," in *Météorologie et catastrophes naturelles dans la France méridionale à l'époque moderne*, eds. Anne Blanchard, Henri Michel and Élie Pelaquier, (Montpellier: Université Paul Valéry, 1993), 101-110; Maria-Cristina Pitassi, "Je châtie tous ceux que j'aime: la providence en question," in *L'invention de la catastrophe au XVIIIe siècle. Du châtement divin au désastre naturel*, eds. Anne-Marie Mercier-Faivre and Chantal Thomas, (Paris: Droz, 2008), 63-74; François Walter, *Catastrophes: une histoire culturelle, XVIe-XXIe siècle* (Paris: Seuil, 2008).

¹⁷⁰ Nicole Lemaitre, "Prier pour les fruits de la terre. Pour une étude des bénédictions," in *Fêtes et Liturgie. Actes du Colloque tenu à Casa de Velázquez, Madrid* (Madrid: Casa de Velázquez Universidad Complutense, 1988), 103-120; Jean Delumeau, *Rassurer et protéger: le sentiment de sécurité dans l'Occident d'autrefois* (Paris: Fayard, 1989), 33-178; Jean Delumeau and Yves Lequin, *Les malheurs des temps: Histoire des fléaux et des calamités en France* (Paris: Larousse, 1998); Olivier Hubert, *Sur la terre comme au ciel: la gestion des rites par l'Église Catholique du Québec (fin XVIIe-mi-XIXe siècle)* (Québec: Presses de l'Université de Laval, 2000), 47; For specific studies on the subject see: Benjamin Arbel and Elie Barnavie, "Sauterelles et mentalités: le cas de la Chypre vénitienne," *Annales E.S.C.* 44, no. 5 (1989): 1057-1074; Catherine Chêne, *Juger les vers. Exorcismes et procès d'animaux dans le diocèse de Lausanne (XVe-XVIe siècle)* (Lausanne: Cahiers Lausannois d'histoire médiévale, 1995); Eric Baratay, "L'excommunication et l'exorcisme des animaux aux XVIIe-XVIIIe siècles, une négociation entre bêtes, fidèles et clergé," *Revue d'Histoire Ecclésiastique* 107, no. 1 (2012): 223-254.

¹⁷¹ Jean Delumeau and Yves Lequin, *Les Malheurs des Temps*, 383-410.

as "superstitions" preceded the Enlightenment and initially emerged from within the Catholic Church itself.¹⁷² In his *Histoire Critique des Pratiques Superstitieuses*, for instance, the Oratorian priest Pierre Le Brun (1661-1729) condemned the practice of excommunicating insects, remarking that the belief that insects and other "irrational creatures" could heed the "juridical sentences" of the episcopacy was a "ridiculous superstition."¹⁷³ Enlightenment-era Christian apologists like Nicolas Bergier (1718-1790), who devoted his life to combating the skepticism of the *philosophes*, noted in his *Dictionnaire de Théologie* (1788) that the excessive recourse to agrarian rites by rural clergyman had eroded the moral credibility of the Church:

In many modern works, the parish clergy are blamed for being excessively indulgent towards the superstitious ideas of their parishioners, by carrying out adjurations and exorcisms of storms, destructive insects and other harmful animals. These are, it is said, abusive and dangerously extravagant, and should no longer be permitted in an enlightened century such as our own.¹⁷⁴

¹⁷² On the origins of the term "superstition" as it was used in the Reformation and Counter-Reformation see: Jean Delumeau, "Les réformateurs et la superstition," *Bulletin de la Société de l'Histoire du Protestantisme Français* 31, no. 3 (1974): 451-487.

¹⁷³ Pierre Le Brun, *Histoire Critique des Pratiques Superstitieuses qui ont séduit les peuples et embarrassé les sçavans* (Rouen: Behourt, 1702), 358.

¹⁷⁴ Nicolas Bergier, *Dictionnaire de Théologie*, Volume 2, (Paris: Jouby et Roger, 1868), 544. [Dans plusieurs ouvrages modernes, on a blâmé les curés de campagne, qui, par un excès de complaisance pour les idées superstitieuses de leurs paroissiens, font des adjurations et des exorcismes contre les orages, contre les insectes destructeurs et les autres animaux nuisibles; c'est dit-on un abus et une extravagance dangereuse, qui ne doit plus avoir lieu dans un siècle de lumière tel que le nôtre]

Yet Bergier nevertheless defended the recourse to exorcisms because the alternative, instructing the *peuple* that all natural phenomena were the necessary results of physical causes, would necessarily lead to atheism and social anarchy.¹⁷⁵

For Bergier, it seems, the belief that natural catastrophes such as insect infestations were the visible manifestations of divine retribution was merely a useful fiction that buttressed the authority of the clergy, the guarantors of social and moral order. That the idea of an interventionist God was receding amongst orthodox clergymen of the mid to late eighteenth century like Bergier points to the affinities between Enlightenment and Christian thought.¹⁷⁶ Philosophers and theologians of the eighteenth century, as historians have shown, increasingly came to view God as a "hidden" entity, removed from the daily operations of his Creation.¹⁷⁷ The indisputable decline in the recourse to agrarian rites, processions and rituals after c. 1750, and the growing distaste of Enlightenment-era clergymen for these liturgical practices, points directly towards this phenomenon. Far from being evidence for a decline in faith or of the

¹⁷⁵ Bergier, *Dictionnaire de Théologie*, 545 [Quand [le peuple] saura que tous les phénomènes de la nature sont l'effet nécessaire des causes physiques, il en conclura, comme les incroyants, que le monde s'est fait et se gouverne tout seul, qu'il n'y a ni Dieu, ni providence : y aura-t-il beaucoup à gagner pour lui? Si les censeurs des curés connoissoient mieux le peuple, ils seroient moins prompts à les condamner]

¹⁷⁶ On the ways in which Christianity was informed by Enlightenment thought see: Bernard Plongeron, "L'Aufklärung catholique en Europe occidentale, 1770-1830," *Revue d'histoire moderne et contemporaine* 16, no. 4 (1969): 555-605; Dale Van Kley, *The Religious Origins of the French Revolution: From Calvin to the Civil Constitution, 1560-1791* (New Haven: Yale University Press, 1996); James E. Bradley and Dale K. Van Kley (eds.), *Religion and Politics in Enlightenment Europe* (Notre Dame: Notre Dame University Press, 2001).

¹⁷⁷ Dror Wharman, "God and the Enlightenment," *American Historical Review* 108 (2003): 1057-1060.

steady "disenchantment" of the world, as an older historical literature would have had it, this phenomenon points to a reworking of traditional notions of Providence that emanated largely from within the Catholic Church during the Enlightenment.¹⁷⁸

In seeking to account for the rise and fall of liturgical practices of pest-control, this chapter builds on recent scholarship that has profoundly revised our understanding of the so-called "secularization process."¹⁷⁹ It follows the process by which insects were *rescralized*, to use Charly Coleman's term, by being transformed from instruments of Providence to natural beings subject to physical forces immanent with the presence of the Divine. In turn, the study of insect pests by naturalists and clergymen became itself *sacralized*, in social and religious terms. The tools and techniques of natural history provided a way in which Enlightened men and women could enter into direct contact with Creation, immanent with God's presence, and fulfill their sacred duty towards parish and *patrie* by producing useful knowledge that contributed to the proper stewardship of agrarian resources. As this chapter (and chapter 5) will demonstrate, enlightened naturalists and clergymen-naturalists who came to study the chaos and disorder caused by

¹⁷⁸ On the 'disenchantment' narratives see, for instance: Max Weber, "Science as a Vocation," in *Max Weber: Essays in Sociology*, trans. H.H. Gerth and C. Wright Mills (New York: Oxford University Press, 1949), 129-156; Paul Hazard, *The European Mind, the Critical Years, 1680-1715*, J. Lewis May (trans.) (London: Hollis and Carter, 1953); Keith Thomas, *Religion and the Decline of Magic* (New York: Scribner, 1971).

¹⁷⁹ Jonathan Sheehan, "Enlightenment, Religion and the Enigma of Secularization: A Review Essay," *American Historical Review* 108 (2003): 1061-1080; Charly Coleman, "Resacralizing the World: the Fate of Secularization in Enlightenment Historiography," *The Journal of Modern History* 82, no. 2 (June 2010): 368-395; Charly Coleman, *The Virtues of Abandon: An Anti-Individualist History of the French Enlightenment* (Stanford: Stanford University Press, 2014); Jonathan Sheehan and Dror Wahrman, *Invisible Hands: Self-Organization and the Eighteenth Century* (Chicago: Chicago University Press, 2015).

invasive insects, paradoxically encountered the orderly workings of the Divine hand, and in the process, they sought to guarantee themselves a role as custodians of social and moral order.

Processions in the Fields: Insects and Liturgical Practice in the Archdioceses of Paris and Besançon

The Counter-Reformation can be understood a process through which the Catholic Church attempted to more rigorously manage its capital of sacrality. In the late-seventeenth century the Gallican Church strove to restrain the rural clergy's frequent recourse to processions and exorcisms during times of calamity and crisis. As the Gallican Church attempted to re-draw and stabilize the boundary between the profane and the sacred, local liturgical practices of pest-control that predated the Counter-Reformation came to be stringently regulated by episcopal authorities.

In the vineyards in the Île-de-France, parish priests had long had recourse to processions to Saint-Sacrament in order to protect vines from the attacks of insects.¹⁸⁰ In Colombes, a village to the northwest of Paris, the Eucharist was carried annually in procession through the vines on the first of May to "preserve them from worms."¹⁸¹ In nearby Sartrouville and Chanteloup, these processions occurred more exceptionally when

¹⁸⁰ Jeanne Ferté, *La vie religieuse dans les campagnes parisiennes (1622-1695)* (Paris: J. Vrin, 1962), 338; Florent Quellier, *Des fruits et des hommes: l'arboriculture fruitière en Île-de-France, vers 1600- vers 1800* (Presses Universitaires de Rennes, 2003), 211.

¹⁸¹ Abbé Lebeuf, *Histoire de la Ville et de tout le Diocèse de Paris* (Paris: Fechoz et Letouzey, 1883), 3: 67.

insects had begun to consume the grapes on the vine.¹⁸² These preventative and curative practices, part of a wider range of local and regional agrarian rites that developed in early modern France, relied on the sacred power of the Eucharist, the focal element of Catholic ritual during the Counter Reformation.¹⁸³ The seventeenth century, as Louis Châtellier has put it, was the "century of Saint-Sacrament."¹⁸⁴ Liturgical practices involving the Eucharist, and confraternities devoted to the worship of Saint-Sacrament multiplied in this period.¹⁸⁵ These devotional activities, and the numerous miracles attributed to the Eucharist in the period, were an affirmation of the Tridentine doctrine of transubstantiation.¹⁸⁶ Devotions to Saint-Sacrament also became a means of delivering rural communities from suffering caused by natural calamities: as the focus of collective

¹⁸² Lebeuf, *Histoire de la Ville*, 2: 38; Maurice Lachivier, *Livre de Raison de trois générations de vigneron de Chanteloup au XVIIIe siècle* (Pontoise: Société historique et archéologique de Pontoise, 1983), 136.

¹⁸³ See for instance, the devotion in the Brie region to Saint-Fiacre the patron saint of gardeners: Florence Collet, "Un personnage emblématique: Saint Fiacre, le jardinier légendaire," in *Le Temps des Jardins* (Fontainebleau: Conseil Général de Seine et Marne, 1992), 386-395; See also, Jean Delumeau, *Rassurer et Protéger*, 61-75; Nicole Lemaître, "Prier pour les Fruits de la Terre," *passim*.

¹⁸⁴ Louis Châtellier, "Eucharistie, spiritualité et pensée scientifique au XVIIe siècle," in *Le miracle de Faverney (1608): L'eucharistie, environnement et temps de l'histoire: actes du colloque de Faverney, 9 et 10 mai 2008*, eds. Corinne Marchal and Manuel Tramaux, (Besançon: Presses Universitaires de Besançon, 2010), 151-155; Hélène Duccini, "Les médias de la contre-réforme en France au XVIIe siècle," *Le Temps des Médias* 17, no. 2 (2011): 17-18.

¹⁸⁵ Bernard Dompnier, "Un aspect de la dévotion eucharistique dans la France du XVIIe siècle: les prières des Quarante-Heures," *Revue d'Histoire de l'Église de France* 67, no. 178 (1981): 5-31; Isabelle Brian, "Catholic Liturgies of the Eucharist in the Time of Reform," in *A Companion to the Eucharist in the Reformation*, ed. Lee Palmer Wandel (Brill: Boston, 2014), 185-204.

¹⁸⁶ Jules Corblet, *Histoire dogmatique, liturgique et archéologique du sacrement de l'eucharistie* (Paris: Société générale de la librairie catholique, 1883), 497-503.

rites of penance and the source of divine intercessional powers, the Eucharist provided a recourse for divine relief from maledictions like insect infestations.

Ecclesiastical authorities in the second half of the seventeenth-century, however, increasingly viewed such agrarian rituals involving the processional use of the Eucharist with increasing suspicion. In April 1660, the Archbishop of Paris Jean-François Paul de Gondi (1613-1679) prohibited the parish clergy in his archdiocese from carrying the Eucharist in procession into the vines afflicted by infestations of insects. Instead, priests were to perform an exorcism and return to the church where the mass *de necessitabus* would be sung with the host exposed on the altar.¹⁸⁷ This prohibition was reinforced by the synodal statutes issued by the archbishop of Paris François Harlay de Champvallon (1625-1695) in 1674, and by his successor Louis Antoine de Noailles (1651-1729) in 1697, which forbade the clergy from carrying the Eucharist in procession without prior consent from the archbishop.¹⁸⁸ These measures were part of wider rigorist efforts to stamp out liturgical practices that were deemed to profane the Eucharist.¹⁸⁹ The

¹⁸⁷ Abbé Lebeuf, *Histoire de la Ville et de tout le Diocèse de Paris*, 2: 38.

¹⁸⁸ "De l'exposition du Saint Sacrement," *Status Synodaux publiez dans le synode général tenu à Paris le Jeudy Vingt-Sixième jour de Septembre 1697*, 19-20, L 439, ANF, Paris; For a general overview of the synodal statutes issued in the diocese of Paris in this period see: Brigitte Basdevant-Gaudemet, "Les Status Synodaux Parisiens XVI-XVIIe siècles," *Conciles provinciaux et synodes diocésains du concile de Trente à la Révolution française: actes du colloque tenu à Strasbourg les 4 et 5 mai 2009*, eds. Marc Aoun and Jeanne Marie Tuffery-Andrieu (Strasbourg: Presses universitaires de Strasbourg, 2010), 143-166.

¹⁸⁹ On the regulation of rites involving the Eucharist see: Jean-Georges Vondrus-Reissner, "Présence réelle et Juridiction Ecclésiastique dans le diocèse de Paris (fin XVème-1530)," *Histoire, économie et société* 7, no. 1 (1988): 41-53; Éric Baratay, *L'Église et l'animal (France, XVIIe-XXe siècle)* (Paris: Les Éditions du Cerf, 1996), 137-140; John McManners, *Church and Society in Eighteenth Century France* (Oxford:

Tridentine Church, as Phillippe Martin has shown, proved increasingly exacting in its demands that the Eucharist remain fixed in consecrated space, and sequestered from the profane world of the "outdoors."¹⁹⁰

The efforts of ecclesiastical authorities to curtail the processional use of the Eucharist were part of a broader effort within the Counter Reformation Church to weed out liturgical practices deemed to be "superstitious," that is, alien to the true precepts of Christianity.¹⁹¹ Such pernicious practices, as the rigorist cleric Jean-Baptiste Thiers (1636-1703) wrote, could partly be attributed to the idolatrous tendencies of a half-Christianized laity, whose "superstitious" rituals gravely imperiled their souls.¹⁹² In his monumental *Traité des superstitions qui regardent les sacremens* (1679-1704), Thiers (1636-1703) judged men and women who planted their fields or gardens with the Eucharist in order to ward off insects as being worthy of divine punishment for their

Oxford University Press, 1998), 2: 41; Olivier Hubert, *Sur la Terre comme au Ciel*, 246-249, 265-271; Brian, "Catholic Liturgies," 200-203.

¹⁹⁰ Phillippe Martin, *Histoire de la Messe: Le Théâtre Divin* (Paris: CNRS, 2013), ch.4.

¹⁹¹ Jean Delumeau, "Les réformateurs et la superstition," 451-487; Bernard Dompnier, "Les hommes d'église et la superstition entre XVIIe et XVIIIe siècles," in *La superstition à l'âge des lumières*, ed. Bernard Dompnier (Paris: H. Champion, 1998), 13-47; Giorgio Caravale, *Forbidden Prayer: Church Censorship and Devotional Literature in Renaissance Italy* (Burlington: Ashgate Publishing, 2011), 191-224.

¹⁹² On Thiers and his works see: François Lebrun, "La *Traité des Superstitions* de Jean-Baptiste Thiers, contribution à l'ethnographie de la France du XVIIe siècle," *Annales de Bretagne et des Pays de l'Ouest* 83, no. 3 (1976): 443-465; Roger Chartier and Jacques Revel, "Le paysan, l'ours et Saint-Augustin," *La découverte de la France au XVIIe siècle: neuvième colloque de Marseille* (CNRS: Paris, 1980), 259-264; Bernard Dompnier, "Les hommes d'église et la superstition," 22-28.

"superstitious sacrilege."¹⁹³ Rural clergymen were also guilty of perpetuating superstition through negligence and indolence, by ignoring the liturgical protocols required by the Gallican Church in times of public calamities. In his *Traité de l'exposition du Saint Sacrement de l'autel* (1673) Thiers wrote that clergymen who carried the Eucharist in procession without episcopal authorization when their parishes were struck by insect infestations "violate the laws of the church and render themselves guilty of a very great crime."¹⁹⁴ Unless parish priests received explicit approbation from their bishops for the exorcisms, conjurations and rogations they carried out to ward off "flies, locusts, caterpillars, snakes, worms and other insects," these were deemed to be "illicit" and "superstitious."¹⁹⁵

As the arbiters of orthodoxy within the Gallican Church, episcopal authorities established the boundaries between licit and illicit liturgical practice, and made it their duty to combat "superstitious" agrarian rites in the parishes under their jurisdiction.¹⁹⁶ The archbishops had a number of administrative procedures at their disposal to regulate the devotional practices of the laity and clergy.¹⁹⁷ The archdeacons, the right-hand men of the Archbishop of Paris, conducted annual visits in the parishes of the Archdiocese to

¹⁹³ Jean-Baptiste Thiers, *Traité des superstitions qui regardent les sacremens selon l'écriture sainte, les decrets des conciles, et les sentimens des saints pères et des theologiens. Tome Second*, vol. 2, (Paris: Antoine Dezallier, 1697), 319, 336.

¹⁹⁴ Jean-Baptiste Thiers, *Traité de l'Exposition du Saint Sacrement* (Paris: Jean Dupuis, 1673), 345.

¹⁹⁵ Jean-Baptiste Thiers, *Traité des superstitions*, 457, 485-486.

¹⁹⁶ Michel de Certeau, *L'écriture de l'histoire* (Paris: Gallimard, 1975), 208-212.

¹⁹⁷ Dominique Julia, "Discipline ecclésiastique et culture paysanne aux XVIIe et XVIIIe siècle," *Actes du Colloque International sur "La Religion Populaire" Paris 17-19 Octobre 1977* (Paris: CNRS, 1979), 199-209.

ensure that the Saint-Sacrament was given proper reverence, and not defiled through profane uses.¹⁹⁸ Priests who failed to abide to the norms of liturgical worship established by their superiors were tried in ecclesiastical courts.¹⁹⁹ Archbishops also seized on the development of the printed word to impose orthodoxy within their archdiocese by disseminating printed liturgical handbooks, or, *rituels*.²⁰⁰ The publication of diocesan *rituels* was an important affirmation of episcopal authority that established the guidelines for liturgical practice within the territory administered by the archbishop.²⁰¹ The proliferation of agrarian rites and benedictions in the diocesan rituals of the seventeenth century, many of which had been eliminated by Paul V in his *Riuale Romanum* (1614), can also be seen in part as an act of Gallican opposition to the Papacy's attempts at liturgical uniformity.²⁰²

¹⁹⁸ "Visites des Archidiaconés," 1672-1673, LL 28, ANF, Paris; On the increasing frequency of *visites pastorales* after the Council of Trent: Thierry Wanegffelen, *La France et les Français, XVIe-milieu XVIIe siècles. La vie religieuse* (Gap-Paris: Ophrys, 1994).

¹⁹⁹ For earlier examples see: Jean-Georges Vondrus-Reissner, "Présence Réelle et Juridiction Ecclésiastique," 41-53.

²⁰⁰ Stanislas Breton, "Collectaire, Rituel, Processional," *Revue des sciences philosophiques et théologiques* 44 (1960): 454-464; Jean-Baptiste Molin and Annick Aussedat-Minvielle, *Répertoire des rituels et processionaux imprimés conservés en France* (Paris: CNRS, 1984), 9-19.

²⁰¹ Bernard Dompnier, "La publication d'un cérémonial diocésain, acte de l'autorité épiscopale," in *Les cérémoniaux catholiques en France à l'époque moderne. Une littérature de codification des rites liturgiques*, eds. Cécile Davy-Rigaux, Bernard Dompnier and Daniel Odon Hurel (Turnhout: Brepols, 2009), 147-164.

²⁰² Jean Delumeau, "Un dossier de bénédiction," *Fêtes et Liturgie. Actes du Colloque tenu à Casa de Velázquez, Madrid* (Madrid: Casa de Velázquez Universidad Complutense, 1988), 290-298; See also: P.M. Gy, "Les rites de benedictions dans les rituels," *Bulletin du comité des études* (Juillet-Septembre 1959): 651-659; J-B Molin, "Introduction à l'étude des rituels anciens," *Bulletin du comité des études* (Juillet-Septembre 1959): 675-692; Nicole Lemaître, "Prier pour les fruits de la terre," *Fêtes et*

In the wake the polemics ignited by the Port-Royal controversy, the Archbishops of Paris Harlay de Champvallon (1625-1695) and Louis-Antoine de Noailles (1651-1729) oversaw the publication of new breviaries, missals, processions and rituals for the archdiocese of Paris.²⁰³ The *Rituale Parisiensis* of 1646 and 1697 forbade priests from usurping the authority of the archbishop through "rashness or ignorance," by carrying out agrarian benedictions that were not contained in the ritual.²⁰⁴ Among the many liturgical procedures outlined in this text, the clergy could find the formulae for the benediction to expel "locusts, worms and other noxious animals" from fields in their parish.²⁰⁵ In the event of such a calamity, the *Rituale* instructed the clergy to bless the afflicted fields with holy water, and, at various intervals sing an antiphon, perform the signs of the cross and read the orations contained in the ritual. The priest and his parishioners were to implore the mercy of God so that they might be delivered from this affliction, "so justly deserved on account of our sins."²⁰⁶

liturgie. Actes du colloque tenu à Casa de Velázquez, Madrid (Madrid: Casa de Velázquez Universidad Complutense, 1988), 103-120.

²⁰³ Madeleine Foisil, "Lumières et institutions diocésaines à la fin de l'Ancien Régime," in *Le Diocèse de Paris: Une Histoire Religieuse des Origines à la Révolution*, ed. Bernard Plongeron (Paris: Beauchesne, 1987), 337-341.

²⁰⁴ "De Benedictionibus regulae generales," *Rituale Parisiense, ad Romani formam expressum, Auctoritate Joannis Francisci de Gondy* (Paris: Targa, 1646); "De Benedictionibus reguale generales," *Rituale Parisiense, auctoritate Ludovici Antonii de Noailles* (Paris: Josse, 1697).

²⁰⁵ "Benedictio agrorum ut ab eis locustae, bruchi, et quaevis alia animalia noxia expellantur," in *Rituale Parisiense auctoritate illustrissimi ac reverendissimi in christo patris D.D. Ludovici Antonii de Noailles* (Paris: Petrum Targa, 1646), 337-338; "Benedictio agrorum ut ab eis locustae, bruchi, et quaevis alia animalia noxia expellantur," in *Rituale Parisiense auctoritate illustrissimi ac reverendissimi in christo patris D.D. Ludovici Antonii de Noailles* (Paris: Ludovicum Josse, 1697), 408-411.

While the Parisian *rituels* of the late seventeenth century acted as a model for numerous diocesan rituals of the eighteenth century, an examination of the latter also reveals variations in liturgical practices between the archdioceses of the kingdom.²⁰⁷ In the archdiocese of Besançon, for instance, the *Rituale Bisuntinae Diocese* (1705) prescribed exorcisms, rather than benedictions, as a means of expelling insects and other harmful animals (*nocivis animalibus*).²⁰⁸ One hundred and ten requests for exorcisms, sent to the office of the Archbishop of Besançon between 1729 and 1761, are conserved in the Archives Départementales du Doubs.²⁰⁹ The majority of these petitions explicitly requested permission for the parish clergy to carry out exorcisms (63), but others asked

²⁰⁶ "Benedictio agrorum," 410.

²⁰⁷ Bernard Plongeron, "Diversité et uniformité des liturgies gallicanes au XVIIIe siècle," in *Fêtes et Liturgie. Actes du Colloque tenu à Casa de Velázquez, Madrid* (Madrid: Casa de Velázquez Universidad Complutense, 1988), 271-289.

²⁰⁸ "Exorcismus pro expellendis insectis et nocivis animalibus a territorio, virtute monitorii ab ordinario obtenti," *Rituale Bisuntinae Diocesis* (Besançon: Joseph Lugdun, 1705), 265-268; Under the episcopacy of Antoine-Pierre de Grammont (1662-1698) and Antoine-Clériadus de Choiseul-Beaupré (1707-1774) the Diocese of Besançon underwent a process of liturgical reform, marked by a more stringent control over the devotional activities of the rural clergy: Jean Courtieu, "La Renaissance Catholique au XVIIe siècle," in *Les Diocèse de Besançon et de Saint-Claude*, ed. Maurice Rey (Paris: Éditions Beauchesne, 1977), 106-119; Manuel Tramaux, "Les synodes diocésains de Besançon sous l'épiscopat du cardinal de Choiseul-Beaupré (1754-1774) L'art et la manière de s'assembler," in *Conciles provinciaux et synodes diocésains du concile de trente à la révolution française. Défis ecclésiastiques et enjeux politiques?* (Strasbourg: Presses Universitaires de Strasbourg, 2010), 335-346; Stéphane Brouillard, "Une visite pastorale au début du XVIIe siècle: un état des lieux de quelques paroisses du diocèse de Besançon," *Société d'Histoire et d'archéologie de l'arrondissement de Lure* 29 (2010): 73-110.

²⁰⁹ G 121 and G 122, Archives Départementales du Doubs (ADD), Besançon; This collection was first brought to light by Francis Bavoux, *L'exorcisme des insectes au XVIIIe siècle dans le Diocèse de Besançon* (Besançon: Imprimerie de l'Est, 1937) and more recently discussed in: Eric Baratay, "L'excommunication et l'exorcisme des animaux aux XVIIe-XVIIIe siècles," 223-254.

for the authorization to perform a "fulmination," (12) "excommunication" (19), "benediction," (3) "execration" (1) or "conjuraton" (3). Despite these linguistic variations, it is most likely all were carried out in conformity with the ceremony prescribed by the diocesan ritual. Indeed, many petitioners were keen to point out in their letters to the episcopacy that they would scrupulously follow the liturgical protocols set out in this text.²¹⁰ The Curé of Lugny, for instance, emphasized in his request for a *monitoire* from the vicar general of Besançon that his "fulmination" against the insects that besieged his parish in October 1729 would be carried out "in conformity with the *rituel* of the diocese."²¹¹ In their petitions to the archbishop, petitioners also made frequent reference to the exorcism "contra nociva animalia" contained in the diocesan ritual.²¹²

The overwhelming majority of the petitions to the Archdiocese came unsurprisingly from the rural clergy, who frequently expressed their parishioners' desire to have recourse to the "salutary remedies" offered by the Church in times of public calamities.²¹³ Laymen were also responsible for a number of requests for exorcisms sent to the Archbishop's office. Petitions submitted by the clergy were often jointly signed by the *échevins* of rural communes within the archdiocese, although a sizable number (13) of petitions came solely from lay municipal authorities or lay administrators (*fabriciens*) of

²¹⁰ Voiteur, 25 April 1756, G 121, ADD, Besançon.

²¹¹ Lugny, 18 October 1729, G 121, ADD, Besançon.

²¹² Chassey 28 October 1756, G 121, ADD, Besançon; Charicy, 3 May 1754, G 122, ADD, Besançon.; Saint-Vit 23 April 1757, G 121, ADD, Besançon. ; Servance [1761?], G 122, ADD, Besançon.; Cernans, 16 July 1762, G 122, ADD, Besançon.

²¹³ Franxault, 5 September 1753, G 121, ADD, Besançon.

the local church.²¹⁴ More rarely, farmers of large estates requested that exorcisms be carried out privately on their domains. The farmers of the domain of Vauxy and Grillard in the parish of Arbois, for instance, petitioned the Archbishop to have the local priest "damn and expel" the insects that attacked the oak trees on their property.²¹⁵ Finally, confraternities of winegrowers in the archdiocese issued requests for public processions to the Archbishop's office. Members of the confraternity of Saint-Vernier, the patron saint of viticulture in the province of Franche-Comté, issued two petitions for public prayers and processions in the 1750s, when the vines in the province were infested with worms.²¹⁶

From these petitions, the *Rituale*, and a *monitoire* conserved in the Archives Départementales du Doubs, we can reconstruct the ceremonies organized by the parish clergy to expel insects that periodically infested the vines, wheat fields, woods and kitchen gardens in the archdiocese.²¹⁷ After having received authorization from the Archbishop, on which the episcopacy levied a tax of 3 *livres* and 14 sous, the parishioners and the clergy would have assembled in front of the church to recite the *Veni Sancte Spiritus*.²¹⁸ A procession would follow, in which the congregation would sing litanies and

²¹⁴ Jouhe, 1755, G 121, ADD, Besançon.; Saint Laurent Laroche, 1755, G 121, ADD, Besançon; Chamoles [?], G 121, ADD, Besançon; Filain 1 October 1756, G 121, ADD, Besançon; Presle [?], G 121, ADD, Besançon.; Mièges [?], G 121, ADD, Besançon.

²¹⁵ Arbois, [1755?], G 121, ADD, Besançon.

²¹⁶ Besançon, [1755?]; Giverey, 26 April 1756, G 121, ADD, Besançon.

²¹⁷, "Formulare de l'officialité," [XVIIth century], G 860, ADD, Besançon.

²¹⁸ Boncourt 13 May 1756, G 121, ADD, Besançon; Serqueux 4 May 1757, G 121, ADD, Besançon; Meucourt, 23 April 1762, G 122, ADD, Besançon; Serqueux, 27 April 1762, G 122, ADD, Besançon.

invoke the mercy of God through the reading of psalms and rogations to "cleanse" (*purgare*) the parish of these "harmful animals" (*nocivis animalibus*).²¹⁹ The priest would then read the formulas of exorcisms and conjurations contained in the *Rituale*, which impelled the "unclean, pestilential, and harmful creatures" to remove themselves from the parish. In some cases, a *monitoire* was read, in which the insects were urged to leave the territory "under penalty of excommunication."²²⁰ While scrupulous attachment to the diocesan ritual was expected during insect exorcisms, the parish clergy could also make requests to include additional processions, rites or benedictions during these ceremonies.²²¹ In May 1755, for instance, the curé of Passavant asked for permission to bless the cloths that would be used during the processions to expel the insects that were devastating the orchards in his parish.²²² In Vigerey, the Curé requested the permission to perform a benediction in honor of Saint Vernier for the benefit of the wine-growers in the parish.²²³ As in the Île-de-France, public devotions to Saint-Sacrament were also requested by parishioners in the archdiocese of Besançon.²²⁴ When an outbreak of vermin threatened crops in the parish of Laviron in May 1757, the local Curé asked the

²¹⁹ "Exorcismus pro expellendis insectis et nocivis animalibus," 266-267.

²²⁰ "Formulaire de l'officialité," [XVIIth century], G 860, ADD, Besançon.

²²¹ La Planée 1755, G 121, ADD, Besançon.

²²² Passavant, 19 May 1755, G 121, ADD, Besançon.

²²³ Vigerey, 26 April 1756, G 121, ADD, Besançon.

²²⁴ Roncha, n.d, G 121, ADD, Besançon.

Archbishop for the permission to bless the altar cloth and the ciborium in which the Eucharist would be exposed during the benediction of Saint Sacrament.²²⁵

Providential understandings of catastrophe provided a common, and long-established, interpretative framework for making sense of the social and natural disorder caused by disruptive natural forces like invasive insects.²²⁶ God asserted his agency within the natural world by using his creation to punish man for his sins and to remind him of his fallen state. Thus, the Curé of Cernans saw in the "lice" that invaded the fields and meadows of his parish, "the hand of a God that strikes us because we are deserving of this affliction."²²⁷ In imploring the clemency of God in the face of the chaos caused by invasive insects, rural parishioners hoped that natural and social order could be restored through divine intervention. Collective rites of penance, as the priors of the confraternity of Saint-Vernier put it, were a means of appeasing the anger of a Deity "justly irritated" by the sins of mankind.²²⁸ By exerting increasing administrative control over these religious rituals, episcopal authorities in Counter-Reformation France asserted their position as custodians of the miraculous powers and the sacred capital of the Church. Agricultural crises thus provided the occasion for ecclesiastical authorities to affirm their position as indispensable guarantors of moral, social and natural order. Through the dispensations of the Archbishop, insect exorcisms, and the public processions that

²²⁵ Laviron, 18 May 1757, G 121, ADD, Besançon.

²²⁶ On the uses of providence for creating intellectual order out of disorder see: Jonathan Sheehan and Dror Wahrman, *Invisible Hands: Self-Organization and the Eighteenth Century* (Chicago: University of Chicago Press, 2015).

²²⁷ ADD G 122, Cernans, 16 July 1762

²²⁸ ADD G 121, Besançon, [1755?]

accompanied these rites, cleansed the religious community of its sins and of the harmful creatures that were its material manifestation.

Locusts and *Unigenitus*: From Port Royal to Lisbon

Providentialist readings of nature became highly politicized in the opening decades of the eighteenth century, profoundly marked in France by the campaign for and against Jansenism and the papal bull *Unigenitus*. Partisans and opponents of *Unigenitus* seized the occasion to denounce disorders in the natural world as providentially ordained consequences of the moral and spiritual corruption of the other camp. The *constitutionnaires* in the South of France saw the natural catastrophes that struck the region in the 1720s as God's own means of breaking the *parlement* of Provence and the dissident clergy's resistance to the papal bull *Unigenitus*.²²⁹ The virulently anti-Jansenist Bishop of Marseille François-Xavier de Belsunce (1675-1755) famously blamed the plague that killed half the inhabitants of the city between 1720 and 1722 on the "sacrileges of the *appelants*."²³⁰ In the nearby Diocese of Arles, the ultramontane bishop Jacques de Forbin-Janson (1680-1741), in the midst of a bitter struggle with the Oratorians, Benedictines, and his cousin the Bishop of Castres for their opposition to

²²⁹ For a detailed overview of this conflict, see: Paul Ardoin, *La Bulle Unigenitus dans les diocèses d'Aix, Arles, Marseille, Fréjus, Toulon (1713-1789)* (Marseille: Imprimerie Saint-Lazare, 1934).

²³⁰ M. Bernos, "Face à la peste Janséniste: Monseigneur de Belsunce et le Sacré-Coeur," *Revue Marseille* 120 (1980): 33-35; Gérard Fabre, "La peste en l'absence de Dieu? Images votives et représentations du mal lors de la peste provençale de 1720," *Archives des Sciences Sociales des Religions* 73, no. 1 (Janvier-Mars 1991): 145-146.

Unigenitus, followed suit.²³¹ In a *mandement episcopal* of October 12, 1720, he remarked that if the plague were to strike Arles, the excommunication of the *appelants* would be the surest means to protect the population from this disease.²³²

The lesser-known infestation of locusts that hit Provence and the Mediterranean littoral during the plague epidemic of 1720 provided further grist for the mill of the anti-Jansenist clergy.²³³ In a circular of May 1720, Forbin-Janson fulminated against the members of his diocese that were seduced by Jansenist doctrine, and called for their excommunication, holding these heretics accountable for the plague of locusts that was then raging in the Provençal countryside:

A lightness of spirit and a dreadful curiosity have led too many among you to pay heed to novelties and to choose false masters at the expense of the pastor that God has provided to lead you ... God, in order to punish you for the inconstancy of your faith and for your failure to submit, delivers you to these vile insects, which, by the irregularity of their movements, naturally

²³¹ On Forbin-Janson and his struggle with the Jansenists see: Michel Vovelle, "Le XVIIIe siècle," in *Le Diocèse d'Aix-en-Provence*, ed. Jean-Rémi Palanque (Paris: Beauchesne, 1975), 136-140; Jean-Maurice Rouquette, *Arles: Histoire, Territoires et Cultures* (Paris: Imprimerie Nationale: 2008), 656-657; Odile Cayleux, *Arles et la peste de 1720-1721* (Aix-en-Provence: Publications de l'Université de Provence, 2009), 161-173.

²³² M. De Lescure (ed.), *Journal et Mémoires de Mathieu Marais avocat au Parlement de Paris sur la régence et le règne de Louis XV (1715-1737)* (Paris: Firmin-Didot, 1863), 494.

²³³ The archbishop of Avignon, for his part, ordered public processions in which the Eucharist would be exposed to "render more effective the exorcisms" carried out to expel the locusts: "Ordonnance de M. l'official de Tarascon faite de l'ordre et par l'autorité de Monseigneur l'Archevêque au sujet des sauterelles qui désoloient le terroir de la dite Ville," "*Acta Ecclesiae Avenionensis Occasione Contagii Annis 1720, 1721, 1722*, f. 1-2, MS 2810, Bibliothèque Municipale d'Avignon; The locusts also caused considerable damage in Beaucaire, Bellegarde, Masillargues and Nîmes: Alexandre Eyssette, *Histoire de Beaucaire depuis le XIIIe siècle jusqu'à la révolution de 1789* (Paris: Gauguier, 1867), 138-142; "Ravages occasionés par les sauterelles dans les communes de Beaucaire et de Bellegarde, emprunt pour se débarasser de ce fléau," C/686, Archives départementales du Gard (ADG), Nîmes.

express the various changes and successive intercadences of those who let themselves be carried by every wind of doctrine.²³⁴

The Jansenist Matthieu Marais (1665-1737), a lawyer at the *Parlement de Paris*, noted with amusement in his diary that this circular contained all the "markings of provençal and molinist eloquence."²³⁵ The *parlementaires* in Aix and the Regent Phillipe Duc d'Orléans (1674-1723), who desperately tried to impose a policy of religious pacification and reconciliation by forbidding all public pronouncements on *Unigenitus* in 1719, were less amused.²³⁶ The Conseil d'État suppressed the *mandement* in December 1720, condemning it as "troublesome to the peace that has be recently been restored to the Gallican Church."²³⁷ The infestation of locusts in Provence had exposed the fragility of this peace sought by the Regent and moderates in the Gallican Church. As portents of divine wrath invested with heavy theological resonance, these insects could become highly disruptive phenomena (in political and spiritual, as well as material terms) when

²³⁴ "Ordonnance de Mgr l'archevêque d'Arles," 11 May 1720, MS 482, Bibliothèque Municipale d'Arles; Document partially reproduced in: Louis Remacle, *Ulramontains et Gallicans au XVIIIe siècle. Honoré de Quiqueran de Beaujeum évêque de Castres et Jacques de Forbin-Jansonm* (Cayer et Cie: Marseille, 1872), 113.

²³⁵ Adolphe de Lescure (ed.), *Journal et Mémoires de Mathieu Marais, avocat au Parlement de Paris sur la régence et le règne de Louis XV (1715-1737)* (Paris: Firmin-Didot, 1863), 1: 290.

²³⁶ Ardoin, *La Bulle Unigenitus, La Bulle Unigenitus dans les diocèses d'Aix, Arles, Marseille, Fréjus, Toulon (1713-1789)* (Marseille: Imprimerie Saint-Lazare, 1934), 11-69.

²³⁷ "Arrêt du Conseil d'État du Roi, qui ordonne la suppression d'un mandement donné par le Sieur Archevêque d'Arles, du 31 décembre 1720," *Pièces historiques sur la peste de Marseille et d'une partie de la Provence en 1720, 1721, et 1722*, ed. Louis-François Jauffret (Marseille: Carnaud, 1820), 162-164.

mobilized to escalate an already bitter struggle between ultramontane bishops, Jansenist clergy, *parlementaires* and the royal administration.

For Jansenists, locust plagues became a clear sign of the decadence of the Catholic Church, and a portent of the immanent Apocalypse. Prophecy became a hallmark of Jansenist opposition to the Bourbon monarchy and the Gallican Church in the decades that followed Louis XIV's destruction of Port-Royal and the publication of *Unigenitus*.²³⁸ Members of the "figurist school" that developed around the Abbé Jean-Baptiste Le Sesne d'Étemare (1682-1770) in the 1710s and 1720s used the prophecies of the Old and New Testament as a key for understanding the profane history of Christian Europe.²³⁹ Prior figurists within the Jansenist movement had opposed such uses of the Scriptures, limiting typological readings of the Old Testament to the exegesis of the New Testament.²⁴⁰ For d'Étemare and his followers, on the other hand, biblical prophecies could be used to trace the Church's historical descent into iniquity from Patristic times

²³⁸ Paul Vulliaud, *La Fin du Monde* (Payot: Paris, 1952), 157-168; Jean-Robert Armogathe, "Le Prophétisme chrétien, de l'inquiétude à la Révolution (XVe-XVIIIe siècle) in *Prophéties et Prophétismes*, ed. André Vauchez, (Paris: Éditions du Seuil, 2012), 190-198; On the prophetic tradition in the Enlightenment more generally see: Eugen Weber, *Apocalypses: prophecies, cults and millennial beliefs through the ages* (Cambridge: Harvard University Press, 1999), ch. 7; Marina Caffiero, "Millénarisme, prophétie, et politique en Europe (XVIIe-Début XIXe Siècle)," in *L'attente des temps nouveaux: eschatology et millénarismes et visions du future du moyen âge ou XXe siècle*, ed. André Vauchez, (Turnhout: Brepols, 2002), 65-73.

²³⁹ Tony Gheeraert, "Les *Gémissements* de l'abbé d'Étemare, ou la poésie des ruines," *Chroniques de Port Royal* 55 (2005): 143-168.

²⁴⁰ On the figurist tradition prior to d'Étemare see: Hervé Savon, "Le figurisme et la "Tradition des Pères" in *Le Grand Siècle et la Bible*, ed. Jean-Robert Armogathe (Paris: Beauchesne, 1989), 757-785; Catherine Maire, *De la Cause de Dieu à la Cause de la Nation: Le Jansénisme au XVIIIe siècle* (Paris: Gallimard, 1998), 163-181; Hervé Savon, "Jacques-Joseph Du Guet: des Pères de l'Église au Figurisme," *Chroniques de Port-Royal* 50 (2001): 157-175.

down to the contemporary period.²⁴¹ The search for correspondences between the "symbols" and "figures" of the Scriptures in contemporary events, personalities and in the natural world became a hallmark of Jansenist mobilization against *Unigenitus*.²⁴² D'Étemare and his followers constructed an eschatological framework based on readings of Paul's Epistle to the Romans, the Book of Malachi, and the Book of Revelations, within which their own struggles against apostasy and error within the Church figured as a precursor to the Day of Judgment. The papal bull *Unigenitus* and the persecution of Jansenists under the ministry of Cardinal Fleury became signs of the "progress of iniquity" that Saint Paul had prophesied would accompany the reign of the first Antichrist (increasingly associated with the Jesuits) in his Letter to the Thessalonians. As the remnants of the true Faith living in a time of spiritual decadence and apostasy, Jansenists were locked in the final stages of a struggle between Truth and error that would culminate in the return of the prophet Eli, the conversion of the Jews and the Second Coming of Christ.²⁴³

Jansenist millenarians understood themselves to be last remnants of the true Faith combatting apostasy and error within the Church, increasingly personified by the Jesuits and the doctrine of Molinism that affirmed the spiritual inviolability of the Papacy. The destruction of Port-Royal and the publication of *Unigenitus*, awakened a latent strand of

²⁴¹ Catherine Maire, "Le figurisme de l'abbé d'Étemare à l'abbé grégoire," *Politica Hermetica* 10 (1996): 28-51.

²⁴² Bruno Neveu, "Port-Royal à l'âge des Lumières: Les *Pensées* et les *Anecdotes* de l'abbé d'Étemare, 1682-1770," *Lias* 4, no. 4 (1977): 115-153.

²⁴³ Catherine Maire, *De la Cause de Dieu à la Cause de la Nation: Le Jansénisme au XVIIIe siècle* (Paris: Gallimard, 1998); Catherine Maire, "Les Jansenistes et le millénarisme du refus à la conversion," *Annales, Histoire, Sciences Sociales* 63, no. 1 (January-February 2008): 7-39.

apocalyptic thinking within the Jansenist movement. Typological readings of the Scriptures, and in particular of the Book of Revelations, provided Jansenists with a means of inscribing their persecution and resistance within the fold of universal history.²⁴⁴ As Catherine Maire writes, "figurism was the philosophy of history that would provide the tone of Jansenist mobilization against *Unigenitus*."²⁴⁵ As a result, contemporary natural catastrophes became portents of the immanent destruction of the Antichrist, increasingly personified by the Society of Jesus, announced by the Apostle John.²⁴⁶ The Jansenist lawyer Louis-Adrien Lepaige (1712-1802), for instance, collected relations of natural catastrophes that befell Europe in the 1740s, seeing these as "signs and rods of God's justice" that befell the European monarchies corrupted by the influence of the Jesuits.²⁴⁷

For the Jansenist scholar Laurent-Étienne Rondet (1717-1785), the role of the philologist was to establish correspondences between the Book of Nature and the scriptures. "Everything in Nature speaks to us of God," he remarked, "it suffices to read with attention and faith the Books of the Prophets to find the key to this mysterious language."²⁴⁸ In his *Réflexions sur le Désastre de Lisbonne* (1756-1757), he reminded his

²⁴⁴ André Vauchez, *Prophètes et prophétisme* (Paris: Éditions du Seuil, 2012), 190-197.

²⁴⁵ Catherine Maire, *De la Cause de Dieu à la Cause de la Nation: Le Jansénisme au XVIIIe siècle* (Paris: Gallimard, 1998), 163.

²⁴⁶ On the political readings of the Book of Revelations in the seventeenth century see: Jean-Robert Armogathe, *L'Antéchrist à l'âge classique: exégèse et politique* (Paris: Les Quarante Piliers, 2005), 153-200.

²⁴⁷ Bernard Plongeron, *Théologie et Politique au Siècle des Lumières* (Genève: Droz, 1973), 24-25.

²⁴⁸ Laurent-Etienne Rondet, *Réflexions sur le désastre de Lisbonne et sur les autres phénomènes qui ont accompagné ou suivi ce désastre*. (S.I: 1756) 1: vii.

readers that a plague of locusts had swept across Europe immediately after the foundation of the Society of Jesus in 1540.²⁴⁹ Following the destruction of Port Royal, an "army of locusts emerging from the depths of hell" had invaded the south of France, which Rondet, following John the Apostle, attributed to the "swarm of false doctors that had caused such harm to the Church since the birth of Molinism."²⁵⁰ Rondet saw the swarm of locusts that descended upon Portugal, historical fiefdom of the Society of Jesus, after the Lisbon earthquake of 1755 as a fulfillment of the prophecy of John the Apostle.

The Lisbon earthquake marked the high point of traditional Providentialist readings of natural catastrophes, but it also ushered in a new current of theological and philosophical reasoning about the limitations of man's capacity to understand the relation between Nature and Divine will. While prophetic readings of catastrophic events like locust plagues did not suddenly vanish in the second half of the eighteenth century, they became more marginal to mainstream Christianity. In rural France, the decline in the recourse to agrarian rites during times of crisis was symptomatic of this change within Enlightenment Catholicism.

Observing insects for parish and *patrie*

The sudden decline in the number of insect exorcisms and agrarian rites after 1750 requires explanation. No requests for insect exorcisms were sent to archbishop of Besançon after 1761, and this seems to have also been the case for most dioceses in the

²⁴⁹ Laurent-Étienne Rondet, *Supplément aux réflexions sur le désastre de Lisbonne. Avec un journal de phénomènes etc. depuis le 1 novembre 1755 et des remarques sur la plaie des sauterelles annoncée par S. Jean* (S.I: 1757), xlvii.

²⁵⁰ Rondet, *Supplément aux réflexions*, 116.

kingdom. This phenomenon was part of a more general decline in the recourse to public processions and to the thaumaturgic powers of saints in times of subsistence crises. In his study of the uses of Sainte-Geneviève, the patron saint of Paris, Steven Kaplan argues that the subsistence issue became simply too politically explosive in the second half of the eighteenth century for administrators to mobilize public opinion "even in the name of a politically neutral savior."²⁵¹ Indeed, royal administrators under Louis XV and Louis XVI had much to fear from providentialist readings of natural disasters at a time when the sacrality of the Bourbon monarchy was continuously brought into question.²⁵²

Yet the reasons for the decline in the recourse to such rites must also be located within a movement internal to Enlightenment Catholicism. Phillippe Goujard has written of a pronounced effort within the Catholic Church "to desacralize everyday life" in the second-half of the eighteenth century.²⁵³ This movement towards an increasingly strict delimitation between the sacred and the profane, as Alain Cabantous writes, contributed to "an evacuation of the mysterious and marvelous" from the natural world and to the "demystification" of nature, subsequently "re-sacralized" in the nineteenth century in exclusively cultural terms.²⁵⁴ The decline of agrarian rites and processions can be seen as an indication of what yet another historian, Michel Perronet, has called the

²⁵¹ Steven Kaplan, "Religion, Subsistence and Social Control: The Uses of Sainte-Geneviève," *Eighteenth-Century Studies* 13, no. 2 (1979-1980): 142-168.

²⁵² Philippe Goujard, *L'Europe catholique au XVIIIe siècle: entre intégrisme et laïcization* (Rennes: Presses Universitaires de Rennes, 2004), 250-255.

²⁵³ Philippe Goujard, *L'Europe catholique au XVIIIe siècle*, 69.

²⁵⁴ Alain Cabantous, *Entre fêtes et clochers: Profane et sacré dans l'Europe moderne, XVIe-XIXe siècle* (Paris: Fayard, 2002), 181.

"profanisation" of the natural world.²⁵⁵ For many clergymen of the Enlightenment, disorders within the natural world no longer appeared as providential instruments of Divine wrath, but as regular and apprehensible features of a material order pregnant with God's immanence.

The generalization of the seminary, the foyer of "Catholic Enlightenment" that became an obligatory site of moral and intellectual instruction for the clergy, undoubtedly contributed to the propagation of this desacralized vision of the natural world within the Church.²⁵⁶ The seminaries became powerful instruments for the interiorization of a Tridentine ideology that was increasingly exacting in its separation between the sacred and the profane.²⁵⁷ For this reason, these institutions contributed to a growing cultural and intellectual chasm between the rural clergy and their parishioners. Rural clergy formed in the seminaries came to see the benedictions and exorcisms requested by rural parishioners in times of catastrophe as "useless accessories" to the true Faith, the stuff of shamans and sorcerers rather than Enlightened men of the Church.²⁵⁸ François Pugnère and Claire Toreilles detect in the journals of the Abbé Séguier, a clergyman in the Cévennes, a mutual incomprehension between priest and parishioner, illustrated by the

²⁵⁵ Michel Peronnet, "Châtiments divins et catastrophes naturelles," in *Catastrophes naturelles dans la France méridionale à l'époque moderne*, eds. Anne Blanchard, Henri Michel and Élie Pelaquier, (Montpellier: Université Paul Valéry, 1993), 259-282.

²⁵⁶ On the seminaries and the formation of the clergy: Dominique Julia, "Le Prêtre," in *L'homme des lumières*, ed. Dominique Julia, (Paris: Seuil, 1996), 398-411; Nicole Lemaître, "Le bon pasteur," in *Histoire des curés*, ed. Nicole Lemaître (Paris: Fayard, 2002), 233-239.

²⁵⁷ Yves Krumenacker, "Du prêtre tridentin au bon prêtre," *L'image du prêtre dans la littérature classique (XVIIe-XVIIIe siècle)*, ed. Danielle Pister (Bern: P. Lang, 2001), 121-139.

²⁵⁸ Julia, "Le prêtre," 412-422.

Abbé Séguier's refusal to ring the church bells during storms to protect the parish from lightning.²⁵⁹ In the Diocese of Besançon, the Curé of Saint Vigerey showed a similar reticence to fulfill parishioners' supplications to "damn" the insects that infested their orchards through an exorcism and to give Mass in honor of Saint Vernier to protect their vines from worms. "I have not asked anything of you until now" he wrote to the Archbishop, "because I was taught that [these rites] were forbidden at the seminary."²⁶⁰ That the Curé of Saint Vigerey did nevertheless request authorization to conduct these rites points towards the pragmatic compromises that many clergymen in the second half of the eighteenth century were forced to make between the exigencies of their ecclesiastical superiors and the expectations of their parishioners.²⁶¹

The above examples nevertheless illustrate how clergymen's roles as intercessors between Heaven and Earth came to be marginalized as a more strict delimitation between "devotion" and "superstition" threw into question the orthodoxy of agrarian rites.²⁶² Nicole Lemaître has argued that the function of the Enlightenment clergy came to be re-imagined in the second half of the eighteenth century on the basis of "social utility" rather than on "mystical" grounds.²⁶³ The involvement of numerous clergymen in projects of

²⁵⁹ François Pugnère and Claire Torreilles, *Écrire en Cévennes au XVIIIe siècle: Les oeuvres de l'abbé Séguier* (Montpellier: Presses Universitaires de la Méditerranée, 2013), 21.

²⁶⁰ Vigerey, 26 Avril 1756, G 121, ADD, Besançon.

²⁶¹ Philippe Goujard, *L'Europe catholique au XVIIIe siècle*, 67-69.

²⁶² Bernard Plongeron et. al (eds.), *Les défis de la modernité: des origines à nos jours*, Histoire du Christianisme (Paris: Desclée, 1997), 10: 269.

²⁶³ Nicole Lemaître, *Histoire des Curés*, 225-260.

agricultural improvement in France is a testament to this alliance between Catholicism and the Enlightenment ethic of social utility and material improvement.²⁶⁴ Rural oeconomy became a subject of instruction in numerous seminaries in this period as clergymen were expected to become "model farmers" for their parishioners.²⁶⁵ Clergymen also took a more public role as agricultural improvers by acting as administrative relays in the dissemination of new crops, or by taking the lead in the agricultural societies that spread throughout France after 1760.²⁶⁶ Agricultural improvement provided the clergy with a means of demonstrating their "patriotism" and utility to the nation in the decades before the Revolution. Thus, a curé in the parish of Saint-Denis-sur-Sarthon in Normandy was praised as a "generous patriot" by the editors of the *Avant-Coureur* for donating a portion of his tithe (*dîme*) to the farmers who would harvest the best wheat or breed the strongest livestock.²⁶⁷

Natural history and agronomy fed into Catholic apologetics by allowing clergymen to fashion the stewardship of the material resources of their parishes as acts of patriotic and Christian benevolence. The correspondence between rural clergymen and

²⁶⁴ Florent Quellier and Georges Provost, "Introduction," in *Du ciel à la terre. Clergé et agriculture, XVIe-XIXe siècle*, eds. by Florent Quellier and Georges Provost (Rennes: Presses Universitaires de Rennes, 2008), 10.

²⁶⁵ Élisabeth Sablayrolles, "Un pasteur des Lumières: Jean-Frédéric Oberlin," *Église, éducation, lumières: histoires culturelles de la France, 1500-1830: en l'honneur de Jean Quéniart*, eds. Alain Croix, André Lespagnol et Georges Provost (Rennes: Presses Universitaires de Rennes, 1999), 187-195; Alain Contis, "Ecclésiastiques et agriculture aquitaine," *Du ciel à la terre. Clergé et agriculture, XVIe-XIXe siècle*, eds. Florent Quellier and Georges Provost (Rennes: Presses Universitaires de Rennes, 2008), 118.

²⁶⁶ Peter Jones, *Agricultural Enlightenment: Knowledge, Technology and Nature, 1750-1840* (Oxford: Oxford University Press, 2016), 74.

²⁶⁷ *L'Avant-Coureur*, 1767, 281

the Bureau of Agriculture, formed by the minister Charles Gravier de Vergennes (1717-1787) in 1785, sheds light on this pastoral or Christian ethic of social utility that emerged in the second half of the eighteenth century in France.²⁶⁸ The letters of Pressac de la Chenaye, a young clergyman from the Parish of Gaudant in the province of Poitou, are particularly illuminating in this regard. In his correspondence with the Bureau of agriculture Pressac de la Chanaye presented himself as the model *bon curé*, a source of admiration and stock character for Enlightenment philosophes like Rousseau and Voltaire.²⁶⁹ In a letter to Vergennes, he recounted how “curiosity” and “inclination” had led him to devote the past decade to the study of natural history and agriculture. Although the task of administering a congregation of ignorant rustics was a heavy burden, Pressac de la Chenaye nevertheless found the time during his hours of leisure to observe the fauna and flora in the fields and woods of his parish, “finding everywhere a common mother that refuses to fully reveal herself to me.”²⁷⁰ One detects in this clergyman’s letters a symptom of what Robert Mauzi identified as the Enlightenment reconciliation between “l’esprit chrétien” and “l’esprit du monde”: the contemplation of nature, imminent with God’s grace and presence, became a legitimate source of earthly pleasure for Christian

²⁶⁸ Dominique Julia, "Le Prêtre," 391-429; Cottret identifies this form of sociability most closely with the Jansenist clergy: Monique Cottret, *Jansénismes et lumières: pour un autre XVIIIe siècle* (Paris: Albin Michel, 1998), ch. 8;

²⁶⁹ On the trope of the *bon curé*, see: Elisabeth Crépin, "De l’image du prêtre à l’image du bon prêtre. Galerie de potraits du bas-clergé royannais aux XVIIe et XVIIIe siècles," *Terres et hommes du sud-est sous l’Ancien régime*, ed. René Favier (Grenoble: Presses Universitaires de Grenoble, 1996), 175-193; John McManners, *Church and Society*, 1: ch. 12.

²⁷⁰ Pressac de la Chenaye to Vergennes, 4 June 1786, H/1626, ANF, Paris.

men and women of the Enlightenment.²⁷¹ Nevertheless, Pressac de la Chenaye complained that his devotion to agronomy and natural history earned him continuous reprobation from his peers, for whom these activities were a distraction from the moral instruction of the congregation.²⁷²

Natural history came to be seen as a legitimate clerical pastime not only because it afforded its practitioners the means of achieving communion with God, but because it also provided the epistemological foundations for the material improvement of the parish. Rural clergymen turned in droves to the study of agriculture as the propagation of the Enlightenment sentiment of charity and *bienfaisance* gave renewed vigor to the Tridentine imperative to attend to the material and spiritual well being of the flock. Thus, when the *Société d'Agriculture de Paris* elected Pressac de la Chenaye as a correspondent, they reminded their readers that the search for means "to improve the condition and happiness of mankind through labor" was an integral part of the "functions of the ministers of the altar."²⁷³ Through continuous agronomic experiments, frequent communications to the *Société*, and, most importantly, through the "spread of useful agricultural knowledge amongst his parishioners," Pressac de la Chenaye had created a "happy alliance between the precepts of the Gospels and of rural oeconomy."²⁷⁴

²⁷¹ Robert Mauzi, *L'idée du bonheur dans la littérature et la pensée française au XVIIIe siècle* (Paris: Armand Colin, 1960), 180-215.

²⁷² "Rapport sur l'élection de Pressac de la Chaynaye," 7 May 1789, F/10/222, ANF, Paris.

²⁷³ "Rapport sur l'élection de Pressac de la Chaynaye," 7 Mai 1789, F/10/222, ANF, Paris.

²⁷⁴ "Remise de prix à la Société Royale d'Agriculture," *Mémoires de la Société Royale d'Agriculture* (Paris: Cuchet, 1788), vi.

Agricultural improvement thus provided a new basis for the social legitimacy of the clergy. Rural clergymen committed to agricultural improvement like Pressac de la Chenaye were praised as "zealous citizens," whose devotion to parish and *patrie* made them emblems for the Enlightenment ideal of utilitarian benevolence.

It was in this spirit that Pressac de la Chenaye communicated his observations of the insect pests that he found in the fields of his parish to the Bureau of Agriculture in the 1780s. Before the harvest of 1785, he collected specimens of larvae that he found lodged in stalks of wheat in the parish, and he observed their metamorphosis and life cycles in his cabinet.²⁷⁵ He also sent samples to Vergennes, hoping that the naturalists of the Bureau of agriculture could identify the insect. A year later, he sent samples of an insect that he feared to be a species of plant lice, but that Vergennes assured him to be an ichneumon, an insect that fed on the larvae of these harmful pests.²⁷⁶ Such investigations, tending to the material well being of one's parishioners, was the "duty of a curé and citizen," but Pressac de la Chenaye explained how these activities could be compromised by superstitious rustics. The appearance of grain moths in the wheat fields of his parish, he wrote to Vergennes, perpetually struck terror in the hearts of the *laboureurs*, "who have always seen the abundance of these insects as an omen [*présage*] of a greater Evil that afflicts them." Pressac de la Chenaye's investigations were cut short when a peasant from the parish, "struck and terrified by the supposed augury," broke into the clergyman's cabinet and "furiously" threw his wheat and insects into the fire.²⁷⁷ Pressac de la Chenaye

²⁷⁵ Pressac de la Chaynaye to Vergennes 23 December 1785, F/10/201, ANF, Paris.

²⁷⁶ Pressac de la Chenaye to Vergennes, 4 June 1786, H/1626, ANF, Paris.

²⁷⁷ Pressac de la Chaynaye to Vergennes 23 December 1785, F/10/201, ANF, Paris.

was more discreet in his observations of the insects that he took to be plant-lice, informing Vergennes that he had not communicated his observations to his parishioners, "who see everything through vulgar eyes," for fear of arousing fear and anguish within his community.²⁷⁸

A number of other clergymen in the final years of the ancien régime were mobilized by the Bureau of Agriculture and the *Société Royale d'Agriculture de Paris* in the search for solutions to the problem of insect pests.²⁷⁹ In 1785, the Abbé Lefebvre, administrator of the order of Sainte-Geneviève and member of the Bureau of Agriculture, used the religious order's 110 houses and 610 prieurs-curés to build a network of agricultural improvement. The entire order, Lefebvre wrote to Vergennes, was animated by a "patriotic spirit," and as such could be relied upon to assist the royal administration in the drive to perfect domestic agricultural production.²⁸⁰ A cockchafer outbreak in Normandy in 1785 caused numerous clergymen to submit their observations of the insects along with the means to exterminate them to the Bureau of Agriculture. References to insect exorcisms and other agrarian rites are noticeably absent in this correspondence, which unanimously insist on the need to find a method of exterminating these insects by the use of "human faculties alone."²⁸¹ As the case of the order of Sainte-Geneviève shows, the hierarchical structure of the Catholic Church made it perfectly

²⁷⁸ Pressac de la Chenaye to Vergennes, 4 June 1786, H/1626, ANF, Paris.

²⁷⁹ See: l'Abbé Roberjot, "Sur un moyen propre à détruire les chenilles qui ravagent la vigne," *Mémoires de la Société royale d'agriculture de Paris* (April 1787): 193.

²⁸⁰ "Circulaire de la Congrégation de France sur l'agriculture," 1787, F/10/206, ANF, Paris.

²⁸¹ "Procédés pour détruire le ver blanc des hannetons," H/1624, ANF, Paris.

adaptable for the organization of long-distance observational networks, such as those described in Chapter 1. Most importantly, this ephemeral network of clergymen-observers illustrates the amalgamation of natural history, patriotism and clerical culture in the decades preceding the French Revolution.

Conclusion: Desacralizing insects during the French Revolution

On 20 Ventôse Year 7 (10 March 1799) the Ministry of the Interior issued a circular ordering the property owners and prefects of each department to prune all the trees and shrubs on private and public land that were infested with caterpillars.²⁸² The circular advised that these operations be carried out during the winter or after cold showers, when these insects retreated and assembled in their nesting places. The circular ends by mocking the superstitious pest-control practices jointly promoted by the Catholic Church and the French monarchy in centuries prior to the Revolution:

During the *Ancien Régime*, all that was done to stop the progression of these insects were ridiculous ceremonies and exorcisms. This scourge of the fields was but fodder for priests. As ignorance recedes in the face of enlightenment, and as natural history, happily placed in the hands of the public, will become more cultivated, we shall become more cognizant of the importance and simplicity of the means by which we can successfully prevent the propagation of these harmful insects; we shall see that in this field, as in all the fields of rural oeconomy, it is not with prayers that our fields will prosper, but with hard work, vigilance and disciplined attention [*l'oeil du maître*].²⁸³

²⁸² "Circulaire sur l'echenillage," 10 March 1799, F/10/488, ANF, Paris.

²⁸³ "Circulaire sur l'echenillage," F/10/488, ANF, Paris [Ce ne sont pas, au reste, des soins minutieux, que ceux qui tendent à détruire ces races prodigieusement fécondes d'insectes destructeurs. Dans l'ancien régime, on ne savait leur opposer que des cérémonies, des exorcismes ridicules; et ce fléau des champs n'était qu'un aliment des prêtres. À mesure que l'ignorance cédera la place aux lumières, et que l'histoire naturelle, heureusement placée dans notre instruction publique, sera plus cultivée, on connaîtra mieux l'importance et la simplicité des soins par lesquels on peut attaquer avec quelque succès la propagation des insectes nuisibles; on verra qu'en ce point, comme dans toutes les parties

The *circulaire d'échenillage* drew up on a well-established, almost hackneyed de-Christianization discourse that reached its peak in Years II and III, but did not recede until the Concordat of 1801.²⁸⁴ In the 1790s, Revolutionary administrators consigned not only insect exorcisms, but also a host of other liturgical practices and devotional objects to the ludicrous superstitions of a bygone era.²⁸⁵ For Revolutionary administrators, rural oeconomy and natural history had supplanted Christianity as a body of knowledge and as a set of practices that could guarantee security and prosperity in the worldly sphere.

Revolutionary-era naturalists, concerned to justify the social utility of their pursuits within the new Republic, also came to promote this idea. In his "Mémoire sur l'utilité de l'étude des insectes, relativement à l'agriculture et aux arts," (1792) Guillaume-Antoine Olivier remarked that "mankind had received from Nature itself the faculty of imagining the means to preserve itself from all harm, and the right to make use of these."²⁸⁶ And yet for centuries, humankind had been duped by "ignorance and superstition." "How many times," Olivier wrote, "has a blind confidence in amulets, talismans and exorcisms led mankind to neglect the most effective means" for ridding itself of these nuisances? Olivier was not prepared to cast complete doubt on the

d'économie rurale, ce n'est pas avec des prières que nos champs peuvent prospérer, mais avec le travail, la vigilance et l'oeil du maître]

²⁸⁴ On de-christianization during the French Revolution see: Michel Vovelle, *Religion et révolution: la déchristianisation en l'an II* (Paris: Hachette, 1976).

²⁸⁵ Richard S. Clay, *Iconoclasm in Revolutionary Paris: The Transformation of Signs* (Oxford: Voltaire Foundation, 2012); Pierre-Yves Lacour, "Les dévotions perdues. Les objets de dévotion catholiques sous le regard des savants parisiens, 1790-1801," *Italie et Méditerranée modernes et contemporaines* 126 (2014) <https://mefrim.revues.org/2011>

²⁸⁶ Guillaume-Antoine Olivier, "Sur l'utilité de l'étude des Insectes, relativement à l'agriculture et aux arts," *Journal d'Histoire Naturelle* (1792): 49.

effectiveness of prayers addressed to the "Supreme Being [l'Être Suprême]," but he held it as a more "certain axiom" that undesirable "physical effects of nature" could only be countered by "other physical effects." It was the "sacred duty of every naturalist" to seek out those "natural causes capable of destroying supernatural natural causes which bolsters superstition and confident gullibility."²⁸⁷

For Olivier, Nature and the Supreme Being were conflated with one another, appearing as forces that invested Creation with the immanent presence of the Divine. From Thiers' *Traité sur les superstitions* to Olivier's "Mémoire sur l'utilité de l'étude des insectes," one can trace an unsteady process by which insects became de-sacralized during the eighteenth century. The disorders they caused within the socio-natural world no longer seemed to depend on the will of an active Deity, but on the immanent physical causes invested within them by a remote God. As insects became de-sacralized and liturgical practices of pest control fell into abeyance, natural history, the practice of observing the physical order of nature, itself became sacralized, in social and religious terms. This dual process of de-sacralization and re-sacralization had begun during the Ancien Régime when the clergy, increasingly active in agricultural societies and natural historical circles, created an alliance between rural oeconomy, natural history, patriotism and their pastoral duties. It would take the iconoclasm of Revolutionary-era naturalists and administrators to conceal these mutations that had occurred within Enlightenment Catholicism, and to banish liturgical practices of pest-control to the distant dark past of

²⁸⁷ Olivier, "Sur l'utilité de l'étude des Insectes," 50 [Un devoir sacré sans doute pour le Naturaliste, c'est de chercher à produire les causes naturelles capables de détruire les causes surnaturelles dont la superstition profite au dépens de la confiante crédulité]

the Ancien Régime.

Part 2: Insects and Industry Before the Synthetic Age in Lower Languedoc

Chapter 3: Patriotic Natural History and Sericulture in the French Enlightenment (1730-1780)

Introduction

"Allow me to tell you sir," the Montpellier physician François Boissier de Sauvages de Lacroix (1706-1767) wrote to the Parisian naturalist René Antoine-Ferchault de Réaumur (1683-1757) in April 1734, "that the reasons you have given for not ordering your insects according to a studied and scientific method seem very careless, and who will be able to do it if not you?" The identification and description of insect specimens was a fruitless enterprise unless they were "arranged and put in order ... few people being able to purchase large volumes of observations that do not contain a general and concise method to distinguish them."²⁸⁸ Sauvages and Réaumur's disagreement over the value of classification systems reflected a broader epistemic and institutional divide between communities of naturalists in Paris and Montpellier.²⁸⁹ Taxonomy, and Linnean typology and nomenclature in particular, took an early hold on naturalists in Montpellier at the Faculty of Medicine and the Société Royale des Sciences, partly because it provided a way to escape the intellectual stranglehold of the Parisian natural historical

²⁸⁸ François Boissier de Sauvages to Réaumur, 2 April 1734, MS 2624, Pièce 26, Bibliothèque Centrale du Muséum d'Histoire Naturelle, Paris (hereafter BCMHN), Paris; Sauvages had previously sent Réaumur a draft of his method for classifying insects: "Conspectus Insectorum," 31 July 1733, MS 2624, Pièce 25, BCMHN, Paris [Permettez moi de vous dire, Monsieur, que les raisons que vous avez pour ne pas ranger vos insectes selon une méthode étudiée et scientifique semblent bien légères et qui sera en état de le faire si vous ne le faites pas.]

²⁸⁹ Mary Terrall briefly discusses Réaumur's preference for description over classification: Terrall, *Catching Nature in the Act*, 85-86.

community.²⁹⁰ Sauvages was also an advocate of taxonomy for more utilitarian reasons. His famous classificatory system for diseases was in part an effort to facilitate the administration of medical care by providing physicians with a guide through the "labyrinth of practice."²⁹¹ Classification not only provided a way of creating intellectual order out of the bewildering variety of the nature's productions, but also made the latter appear more amenable to human control.²⁹²

In a paper he delivered on silkworms at the *Société Royale des Sciences* in May 1740, Sauvages hinted at that utility that could be derived from a greater attention to the classification of insects.²⁹³ Much had been written about "this precious insect that contributes to a greater part of the wealth of our province," but naturalists such Marcello Malpighi (1628-1694) and Réaumur had limited themselves to producing "curious" observations about these insects. Sauvages distinguished between two types of readers of natural historical texts: the "philosophical observer" and the "*économiste*, who only looks

²⁹⁰ James Livesey, "London by the Light of Montpellier: Scientific Networks Between Britain, Northern Europe and the Languedoc," in *Cultural Transfers: France and Britain in the Long Eighteenth-Century*, eds. Anne Thomson, Simon Burrows and Edmond Dziemboski, (Oxford: S.V.E.C., 2010), 85-102.

²⁹¹ Elizabeth Williams, *A Cultural History of Medical Vitalism in Enlightenment Montpellier* (Burlington: Ashgate, 2010), 90. On Sauvages' classification of diseases see: Julian Martin, "Sauvages' Nosology: Medical Enlightenment in Montpellier," in *The Medical Enlightenment of the Eighteenth-Century*, eds. Andrew Cunningham and Roger French (Cambridge: Cambridge University Press, 1990), 111-137; Volker Hess and Andrew J. Mendelsohn, "Sauvages' Paperwork: How Disease Classification Arose from Scholarly Note-Taking," *Early Science and Medicine* 19, no. 5 (2014): 471-503.

²⁹² Stephan Müller-Wille and Isabelle Charmantier, "Natural History and Information Overload: The Case of Linnaeus," *Studies in the History and Philosophy of the Biological and Biomedical Sciences* 43, no. 1 (2012): 4-25

²⁹³ François-Boissier Sauvages, "Sur les vers à soie et sur la manière la plus sûre de les élever," *Histoire de la Société Royale des Sciences de Montpellier* (Lyon: Duplain, 1778), 251-268.

upon what is useful."²⁹⁴ It was for the benefit of the *économés* of his province of Languedoc that Sauvages sought to classify the various varieties (*espèces*) of *Bombyx* (silkworms), which "not being distinguished until now, have been raised pell-mell ... their resemblance leading them to be confused with one another."²⁹⁵ On the basis of morphological differences, Sauvages distinguished five varieties, each of which produced a different color and quality of silk. Systematic classification of silkworm species could assist rural *économés* in the production of raw silk, as breeding insects of the same species would produce a higher quality silk in which "the brilliance and shine of these colors can be conserved without cost."²⁹⁶

In the past two decades, historians of science have begun to examine the ways that the taxonomic, descriptive and visual techniques of eighteenth-century natural history were mobilized by European merchants, states and empires in the pursuit of commercial profits.²⁹⁷ Curiously, insects have not figured in this growing literature on natural history and commerce despite the fact that they were a highly exploited natural resource in the period, particularly in the domain of textile production.²⁹⁸ The "tools and techniques of

²⁹⁴ Sauvages, "Sur les vers à soie," 261.

²⁹⁵ Sauvages, "Sur les vers à soie," 252. In his *Dictionnaire Universel des Sciences Morale, Économique, Politique et Diplomatique*, J-B Robinet defined the *économé* as a person who "manages and administers his property, whether his estate, goods etc. with a suitable order and intelligence": Jean-Baptiste Robinet, *Dictionnaire universel des sciences morale, économique, politique et diplomatique* (London, 1773-1783) 17: 28.

²⁹⁶ Sauvages, "Sur les Vers à Soie," 252.

²⁹⁷ Koerner, *Linnaeus: Nature and Nation*; Emma Spary, *Utopia's Garden*; Londa Schiebinger and Claudia Swan, *Colonial Botany*; Harold Cook, *Matters of Exchange*; Daniela Bleichmar, *Visible Empire*

²⁹⁸ Melilo, "Global Entomologies."

natural history" developed by academic and lay naturalists in the late seventeenth and early eighteenth centuries were increasingly deployed for the commercial exploitation of these natural beings.²⁹⁹ The case of sericulture, which the royal administration aggressively sought to promote in the south of France from the 1730s until the end of the Ancien Régime, provides a paradigmatic case with which to examine this growing truck between commerce and natural histories of insects.³⁰⁰ Rural practices of silk cultivation came under increasing scrutiny in this period from *savants*, state administrators, agricultural improvers and textile manufacturers who agreed with M. Buffel, the inspector of silk manufacturing in Languedoc, that raising silkworms required "application and knowledge that is out of the reach of the common cultivator."³⁰¹ A more intimate knowledge of the physical constitution and behavior of the notoriously fussy silkworm, which the naturalist Pierre Augustin Boissier de Sauvages (1710-1795 (the brother of François Boissier de Sauvages de Lacroix) remarked in 1749 had "not been sufficiently spied upon with attentive eyes," came to be seen as an essential precondition for the success of the French sericulture industry.³⁰² Attentive and disciplined

²⁹⁹ On the techniques of eighteenth-century natural history, see: Terrall, "Following Insects Around,"; Marc Ratcliff, *The Quest for the Invisible*; Brian Ogilvie, "Attending to Insects"; Terrall, *Catching Nature*.

³⁰⁰ Line Teisseyre-Sallmann, *L'industrie de la soie en Bas-Languedoc: XVIIe-XVIIIe siècle* (Paris: École Nationale des Chartes, 1995), 221-227.

³⁰¹ Buffel "Mémoire sur les soyes," 1768, C/11974, Archives Départementales de l'Hérault, Montpellier (ADH).

³⁰² Pierre-Augustin Boissier de Sauvages, "Projet d'un ouvrage sur la manière d'élever les vers à soye," *Assemblée publique de la Société Royale des Sciences de Montpellier* (Montpellier: Martel, 1749), 70.

observations of these insects would provide the foundation for the reform of artisanal practices of silk cultivation.

Two administrative bodies of Ancien Régime France, the Bureau de Commerce and the Intendance de Languedoc, played a particularly important institutional function in these projects of sericultural reform.³⁰³ It was to the Bureau of Commerce's office in Versailles and the intendant's office in Montpellier that lay practitioners and academic naturalists addressed their observations of silkworms and their proposals for improved sericultural techniques. Following the circulation of insect specimens, silk samples and observational and experimental reports within these administrative networks provides a way to examine several facets of the matrix of knowledge, technique and statecraft that underlay strategies of governance in Ancien Régime France.³⁰⁴ Firstly, it provides insights into the procedures of evaluation and validation developed by administrators to codify and disseminate knowledge and techniques they deemed worthy of official approval. Because manuscripts circulating within administrative channels often doubled

³⁰³ The Bureau of Commerce was a consultative body formed in 1722 and directed by the intendant of finances Daniel Charles Trudaine and his son Trudaine de Montigny from 1749 to 1776. On the Bureau of Commerce and technical innovation see: Charles Ballot, *L'introduction du machinisme dans l'industrie française* (Genève: Slatkine, 1979), ch. 9; Charles Gillispie, *Science and Polity in France: The End of the Old Regime* (Princeton: Princeton University Press, 1980), 412-420; Phillipe Minard, *La Fortune du Colbertisme: État et Industrie dans la France des Lumières* (Paris: Fayard, 1998), 219-224; Liliane Hilaire-Pérez, *L'invention technique au siècle au siècle des Lumières* (Paris: Albin Michel, 2000), 52-69; Michel Antoine, *Le coeur de l'état: surintendance, contrôle général et intendance des finances 1552-1791* (Paris: Fayard 2003), 455-458; Paula Bertucci, "Enlightened Secrets: Silk, Intelligent Travel and Industrial Espionage in Eighteenth-Century France," *Technology and Culture* 54, no. 2 (2013): 820-852; The intendant was the chief agent of royal power in the province of Languedoc.

³⁰⁴ On the matrix of science, technique and statecraft in the early modern period see: Francesca Bray, "Science, Technique, Technology: Between Matter and Knowledge in Imperial Chinese Agriculture," *British Journal for the History of Science* 41, no. 3 (2008): 319-344; Mukerji 2009.

as solicitations for patronage, they also provide a way of analyzing the strategies of self-presentation developed by petitioners in their bids to obtain favors from the royal administration. Finally, attention to the administrative paperwork generated by these appeals for patronage brings into view the mechanisms used by royal officials to nurture economic development in the form of dispensations of privileges, subsidies and offices within the state bureaucracy.³⁰⁵

Investigations of silkworms by Enlightenment *savants* and lay practitioners formed part of a wider tradition of what might be called "patriotic natural history." Silk and patriotism may seem an odd couple, given that the substance was long associated in republican moral discourse with the anti-social vice of luxury.³⁰⁶ Yet enlightened administrators, naturalists and lay practitioners whose activities were seen as fundamental to the success of the raw silk industry were routinely honored with such titles as "*citoyen zélé* and friend of humanity [*l'ami des hommes*]," as the silk entrepreneur Constant Castellet referred to the director of the Bureau of Commerce Daniel Charles Trudaine (1703-1769).³⁰⁷ As silk consumption was configured into a public good that stimulated both rural and urban productivity, patriotism in turn provided a powerful social and moral validation for the practice of scientific observation at a time when the natural history of

³⁰⁵ On privileges and technological innovation: Jeff Horn, "A Beautiful Madness: Privilege, the Machine Question and the Industrial Development in Normandy in 1789," *Past and Present* 217 (2012): 149-185.

³⁰⁶ The condemnation of silk consumption as vice and luxury also bedeviled silk producers in early America: Ben Marsh, "The Republic's New Clothes: Making Silk in the Antebellum United States," *Journal of Agricultural History* 86, no. 4 (2012): 206-234.

³⁰⁷ A reference to the Marquis de Mirabeau's highly popular *L'ami des hommes ou traité de la population* (1757), which argued that agriculture was the foundation for the power and prosperity of states; Constant Castellet to Trudaine, 1762, F/12/1432B, ANF, Paris.

insects was still widely ridiculed as an anti-social, and even dangerously obsessive, pastime for the idle and eccentric.³⁰⁸

Amidst the fears of national decline that followed from the military defeats of the War of Austrian Succession (1740-1748) and the Seven Years' War (1756-1763), French *savants* and lay practitioners came to promote their inquiries into the minute bodies of insects as a civic-minded pursuit that would provide the key for the regeneration of the *patrie*.³⁰⁹ Patriotic natural history, much like its sister-discipline political economy, was fashioned in this period as a "science for making polities materially viable in a world of ruthless competition."³¹⁰ If many continued to relegate entomology to the status of "useless and idle learning," as the naturalist Guillaume Antoine Olivier (1756-1814) complained at the end of the century, the study of insects and their productions could also be fashioned as a mark of patriotic devotion to the enhancement of domestic productivity and public welfare.³¹¹

The Political Economy of Silk Production

By the mid eighteenth century, silk textiles were no longer exclusively luxury commodities reserved for the wealthiest elite but part of a growing market of semi-luxury

³⁰⁸ Lorraine Daston, "Attention and the Values of Nature," 101-104.

³⁰⁹ Dziemboski, *Un Nouveau Patriotisme*; Bell, *Cult of the Nation*; Shovlin, *The Political Economy of Virtue*; Arnault Skornicki, *L'Économiste, la Cour et la Patrie: l'Économie Politique dans la France des Lumières* (Paris: CNRS, 2011).

³¹⁰ Sophus Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge: Harvard University Press, 2011), 349.

³¹¹ Guillaume-Antoine Olivier, "Mémoire sur l'utilité de l'étude des insectes, relativement à l'agriculture et aux arts," *Journal d'histoire naturelle, rédigé par MM. Lamarck, Bruguière, Olivier, Haüy et Pelletier* (1792), 33.

and "populuxe goods" for middle and lower-class consumers.³¹² "The luxury of silk," the manufacturing inspector Buffel reported in 1768, "has conquered all the professions and the entire country."³¹³ Silk stockings had become a "first necessity for all but countryfolk and artisans, and even the latter do not deprive themselves of them on festival days."³¹⁴ The increase in the consumption of silk, carried along partly by the rapid turnover in textile fashions (the "torrent of consumer taste" as the manufacturing inspector Imbert de Saint Paul called it), was widely praised as a social good that provided employment and sustenance to thousands of peasant households, agricultural laborers and urban artisans.³¹⁵ The humble silkworm, the abbé Soumille wrote, sustained the industry of "thousands of hands continuously occupied in the harvesting and preparation of silk and

³¹² Cissie Fairchilds, "The Production and Marketing of Populuxe Goods in Eighteenth-Century Paris," in *Consumption and the World of Goods*, eds. John Brewer and Roy Porter (London: Routledge, 1993), 228-248; Daniel Roche, *The Culture of Clothing: Dress and Fashion in the Ancien Régime* (Cambridge: Cambridge University Press, 1994), 146; Nicolas Lyon-Caen, "Les hommes du bas: fabriquer et vendre dans la bonneterie parisienne XVIIe-XVIIIe siècles," *Revue d'histoire moderne et contemporaine* 60, no. 1 (2013): 107-130.

³¹³ Buffel, "Mémoire sur les soyes," 1768, C/11974, ADH, Montpellier.

³¹⁴ Buffel, "Mémoire sur les soyes," 1768, C/ 11974, ADH, Montpellier; On the shifting boundary between luxury and necessity in eighteenth-century France see: Colin Jones and Rebecca Spang, "Sans-culottes, Sans-café, Sans-tabac: shifting realms of necessity and luxury eighteenth-century France," in *Consumers and Luxury: Consumer Culture in Europe, 1650-1850*, eds. Maxine Berg and Helen Clifford (Manchester: Manchester University Press, 1999), 37-62.

³¹⁵ Imbert de Saint Paul to Turgot, 16 July 1777, F/12/1432B, ANF, Paris; On the importance of product differentiation for the French textile industry see: Carlo Poni, "Fashion as Flexible Production: The Strategies of the Lyons Silk Merchants in the Eighteenth Century," in *World of Possibilities: Flexibility and Mass Production in Western Industrialization*, eds. Charles F. Sabel and Jonathan Zeitlin (Cambridge: Cambridge University Press, 1997), 37-64.

the making of fabric."³¹⁶ The inspector of silk manufacturing Jean-Baptiste Rodier estimated that 150,000 people in Languedoc derived a portion of their income from sericulture.³¹⁷ "Unbounded luxury" and the "extravagant tastes of the nation" had made attempts to prohibit the consumption of silk on moral and economic grounds fruitless, Buffel wrote, forcing more enlightened administrators to seek ways to turn the appetite for luxuries into a moral and social good by encouraging the domestic production of raw silk.³¹⁸

In the province of Languedoc, silk cultivation was widely promoted as a solution to the persisting problem of rural poverty and unemployment.³¹⁹ Sericulture, the silk entrepreneur Chevalier wrote, was a vital supplement to the household income of the "lesser folk," for whom the harvest of silkworm cocoons was "of the greatest commodity, providing handsome gains that are paid in cash."³²⁰ Peasant smallholders in the Cévennes and in Lower Languedoc obtained important additional revenues from their meager holdings by harvesting silk for the textile industry centered in Nîmes, often dividing the

³¹⁶ Abbé Soumille, "Lettre extraite du mercure de France du mois de Novembre 1759. Sur les Plantations de Mûriers," C/2250, ADH, Montpellier.

³¹⁷ Rodier to Joubert, 12 June 1769, C/8254, ADH, Montpellier.

³¹⁸ Buffel, "Mémoire sur les soyes," 1768, C/11974, ADH, Montpellier; On the defense of luxury consumption as a social good see: Michael Kwass, "Ordering the World of Goods: Consumer Revolution and the Classification of Objects in Eighteenth-Century France," *Representations* 82, no. 1 (2003): 87-116.

³¹⁹ Thomas McStay Adams, *Bureaucrats and Beggars: French Social Policy in the Age of the Enlightenment* (Oxford: Oxford University Press, 1990).

³²⁰ "Mémoire intéressant du Sieur Chevalier, ingénieur du roi, sur la culture du murier dans les provinces meridionales de la France," O/1/1293, ANF, Paris.

profits with merchants who provided capital inputs.³²¹ The entire peasant household was activated in the production of raw silk, with women traditionally responsible for hatching and raising silkworms, and children as early as the ages of six and seven employed in collecting mulberry leaves and unwinding the silk cocoons.³²² Migrant rural workers also found seasonal employment in sericulture workshops established by silk merchants, relieving provincial administrations and the monarchy from the burdensome costs of poor relief.³²³ Thus, sericulture could provide even "the people of the lowest order the ease of graciously earning their living."³²⁴ A reliable and plentiful domestic supply of raw silk would also shield textile manufacturers from the shortages of this material that periodically ruined them and caused mass unemployment and emigration of urban textile workers. One royal official from Languedoc predicted during a particularly acute silk shortage that unless efforts were undertaken to invigorate the domestic raw silk industry, "the most flourishing cities in France, such as Lyon, Marseille, Tours, Nimes etc will be destroyed and impoverished by the disappearance of silk manufacturing."³²⁵

Closely related to the problem of rural poverty were administrators' concerns for the fiscal solvency of the monarchy. The French monarchy's ability to service the

³²¹ Daniel Travier, "La soie dans la vie traditionnelle de la Cévenne," in *Actes du Ve colloque sur le patrimoine industriel* (Alès: CILAC, 1984), 12-25; Teisseyre-Sallmann, *L'industrie de la soie en Bas-Languedoc*.

³²² Madeleine Villard, "Travailler la soie en Languedoc sous l'Ancien Régime," *Provence Historique* 56 (2006): 439-448.

³²³ On the administrative costs of poor relief, see: Owen Hufton, *The Poor of Eighteenth-Century France 1750-1789* (Oxford: Oxford University Press, 1974), chs. 3, 6.

³²⁴ "Mémoire sur le commerce des soies," F/12/1432A, ANF, Paris.

³²⁵ "Mémoire sur le commerce des soies," F/12/1432A, ANF, Paris.

ballooning debt that resulted from royal expenditures during the War of the Spanish Succession (1701-1714), The War of the Austrian Succession and the Seven Years' War depended to a great extent on increasing the taxable revenue of peasant households.³²⁶ Only the harvest of silkworm cocoons, one official bluntly remarked, "will make it possible for peasants to pay the *taille* and the *capitation*."³²⁷ When members of the *Chambre de Commerce* of Montpellier lobbied the intendant of Languedoc to ban imports of silk cocoons from the Levant, they argued that only gains from the domestic cultivation of raw silk could provide peasants with the ability to pay their taxes.³²⁸ While some silk merchants argued that the reliance on domestically produced silk would make French textiles expensive and uncompetitive on domestic and international markets, the Intendant of Languedoc ruled that the continued importation of cheap Levantine cocoons would be "beneficial to only a few merchants and is against the good of the state." State-directed strategies of competitive amelioration prevailed against the shortsighted

³²⁶ On war debt as a major structural problem of the ancien régime see: James T. Riley, *The Seven Years' War and the Old Regime in France: The Economic and Financial Toll* (Princeton: Princeton University Press, 1986), chs. 5-6; David Bien, "Offices, corps and a system of state credit: the uses of privilege under the ancien régime," in *The French Revolution and the Creation of Modern Political Culture: The Political Culture of the Old Regime*, eds. Keith Michael Baker (Oxford: Oxford University Press, 1989), 87-114; Philip Hoffman, "Early Modern France, 1450-1700," in *Fiscal crises, liberty and representative government*, eds. Philip Hoffman and K. Norberg (Stanford: Stanford University Press, 1994), 226-252; Michael Kwass, *Privilege and the Politics of Taxation in Eighteenth-Century France* (Cambridge: Cambridge University Press, 2000).

³²⁷ "Mémoire sur le commerce des soies," F/12/1432A, ANF, Paris. The *taille*, a land tax, and the *capitation*, a universal poll tax introduced in 1695, were crucial fiscal instruments used by the monarchy to finance Louis XIV's and Louis XV's wars.

³²⁸ "Extrait des avis sur le commerce des cocons du Levant," 1768, C/2290, ADH, Montpellier; S. Reveroy to Trudaine, 3 December 1764, F/12/1432B, ANF, Paris.

demands of silk merchants and textile manufacturers, whose "knowledge," the intendant remarked, "is borne in by their desire for gain through their trade."³²⁹

State administrators and textile manufacturers also viewed domestic self-sufficiency in raw silk as vital to protecting the kingdom's political and economic sovereignty.³³⁰ French silk manufacturing, a merchant from Narbonne wrote to Trudaine, needed to have "its foundations and roots in our own soil" so that its "success would no longer depend on the political projects of neighboring nations."³³¹ French dependence on foreign raw silk, as numerous petitioners underlined, gave rival states the ability to destroy the textile industry through economic warfare and contributed to the enrichment of enemy states.³³² Prohibitions on exports of raw silk and silkworm eggs by the Spanish Crown and the Kingdom of Sardinia in the 1740s and 1750s, the intendant of Dauphiné remarked, had been undertaken to "knock down" French silk manufacturing and to "absorb the debris," by drawing unemployed textile workers into their territory.³³³ The purchase of 18 to 20 million *livres* per annum's worth of foreign raw silk, much of it imported from the kingdom of Sardinia, and from Dutch and English merchants in

³²⁹ "Extrait des avis sur le commerce des cocons du Levant," 1768, C/2290, ADH, Montpellier.

³³⁰ On competition in international trade as an issue of existential importance for early modern states see: Hont, *The Jealousy of Trade*; Reinert, *Translating Empire*; Reinert, "Greatness."

³³¹ S. Pascal, "Mémoire sur les moyens de perfectionner le filage des soies et la fabrication des organsins," F/12/1432B, ANF, Paris.

³³² "Lettre des marchands de soye de la ville de Nîmes sur la disette qu'ils éprouvent de cette matière première," 1748, F/12/1438, ANF, Paris; S. Garcin, "Mémoire sur la manière d'élever et de multiplier les mûriers," 1750, F/12/1432A, ANF, Paris.

³³³ "Sur l'avis que donne M. L'intendant du Dauphiné de la defense du roy de Sardaigne pour empêcher la sortie des soyes de ses états de Savoye," 1752, F/12/1435, ANF, Paris.

Bengal and the East Indies, a royal official remarked, had provided "our enemies with the assistance and means with which to wage war against us."³³⁴ In a world of ruthless international military and commercial competition, increasing the domestic production of raw silk became an issue not only of public welfare but also of political and military survival.

Patriotic Natural History and Strategies of Competitive Amelioration

Reversing the negative gap between annual levels of French silk consumption and domestic production, which one textile manufacturer estimated at eighteen million pounds of raw silk, was a key goal for administrators in the Bureau of Commerce.³³⁵ Yet just as important as increasing the total volume of raw silk was improving its quality.³³⁶ Ensuring that French silk could compete with the products of rival states (namely, the kingdoms of Spain, Piedmont-Sardinia, and Britain by way of its manufactures in South Asia) on domestic and international markets required a whiter and more lustrous product that could satisfy textile manufacturers and consumers.³³⁷ Administrators and silk producers identified several causes that accounted for the inferior quality of domestically produced silk. Doubts about the climatic suitability of the kingdom for silk cultivation

³³⁴ "Mémoire intéressant du Sieur Chevalier, Ingénieur du Roi, sur la culture du murier dans les provinces méridionales de Franc," O/1/1293, ANF, Paris.

³³⁵ Papion du Chateau, "Mémoire pour établir des pépinières de muriers dans toutes les généralités," 1779, F/12/1452, ANF, Paris.

³³⁶ Philippe Minard, "Réputation, normes et qualité dans l'industrie textile française au XVIIIe siècle," in *La qualité des produits en France (XVIIIe-XXe siècles)*, ed. by Alessandro Stanziani (Paris: Belin, 2003), 69-92.

³³⁷ "Mémoire intéressant du sieur chevalier, ingénieur du roi, sur la culture du murier dans les provinces méridionales de France," ANF O/1/1293, ANF, Paris.

had worried administrators from the beginning. For the manufacturing inspector Buffel, it had been a mistake to introduce such a "precarious industry" in a country where the "soil itself seems to reject the efforts of a nation which acts against its own self-interest."³³⁸

Lapenée and Raymond Dupuy, two silk merchants from Toulouse, despaired that French silk could ever equal the whiter and more lustrous *nanking silk*, because of the "privilege" of the Chinese climate: "We shall never perfectly imitate nature, it is much already to approach it."³³⁹

It was widely believed, moreover, that the species of silkworms cultivated in France had degenerated since being introduced from Asia. State administrators routinely used and elaborated upon theories of climatic degeneracy, then in vogue amongst French *savants*, as part of their assessments of the viability of the French sericulture industry.³⁴⁰ The rearing of foreign silkworms in a "climate little resembling that of their origin," the manufacturing inspector Jean-Baptiste Rodier informed the intendant Jean Emmanuel Guignard (1735-1821), had led to a natural degeneration of the original stock.³⁴¹ "All animals," another official wrote, "transplanted from their country of origin produce offspring that degenerate from their species the more the race multiplies ... silkworms are even more subject to this change in their nature because they originate from a country far

³³⁸ Buffel, "Mémoire sur les soyes," 1768, C/11974, ADH, Montpellier.

³³⁹ S. Lapenée et Raymond Dupuy to De Cotte, 1764, F/12/1432B, ANF, Paris.

³⁴⁰ Spary, *Utopia's Garden*, ch. 3.

³⁴¹ J-B. Rodier, "Mémoire sur l'éducation des vers à soie dans le Haut Languedoc," 5 July 1755, C/2280, ADH, Montpellier.

warmer than ours."³⁴² Periodic renewals of the stock of silkworms were required to replace degenerated broods of these insects.³⁴³ Royal administrators drew upon an extensive network of contacts with merchants and diplomats stationed in Spain, Italy, the Ottoman Empire, the East Indies and China to replenish the domestic stock of silkworms.³⁴⁴ These provisioning networks, however, were prone to disruption from the interference of foreign powers that saw the prospective amelioration of French silk production as a competitive threat. In 1749, a French merchant stationed in Barcelona found a case of ten bottles, each containing one hundred ounces of silkworm eggs, that he had attempted to ship to the intendant of Languedoc Jean Le Nain (1698-1750), intercepted at the border. The customs agent informed the French consul Antoine De Puyabry that "the extraction of raw silk out of Spain having been prohibited, he could not allow eggs that are used to make it to leave, and especially in such quantities."³⁴⁵ The archbishop of Rennes Louis-Guy de Guérapin de Vauréal (1687-1760), then serving as ambassador in Madrid, intervened to secure a safe passage for this shipment, pleading with the director of customs to allow the transit of these silkworm eggs to Montpellier, although these efforts appear to have been in vain.

³⁴² "Mémoire sur le commerce des soies," F/12/1432A, ANF, Paris.

³⁴³ Marsson, "Mémoire sur l'art d'élever les vers à soie," 7 February 1757, F/12/1453A, ANF, Paris.

³⁴⁴ Drapeau, "Mémoire à Monseigneur Ministre au département d'agriculture," 16 January 1781, F/12/1453A, ANF, Paris; "Lettre du S. Béranger curé de Loriol en Dauphiné à M. Le Directeur Général," 22 Avril 1780, F/12/1453A, ANF, Paris; LaSalle to Comité de Commerce, 19 June 1780, F/12/1444B, ANF, Paris; Fontanes to Le Nain, 15 December 1748, C/2253, ADH, Montpellier; Dupuyabry to Le Nain, 31 January 1749, C/5606, ADH, Montpellier.

³⁴⁵ De Puyabry to Le Nain, 2 February 1749, C/5606, ADH, Montpellier.

Pernicious practices in the raw silk trade were, above all, to blame for the poor quality of French silk. Silkworm breeders, a textile manufacturer from Nîmes wrote, corrupted the domestic stock of silkworms by continuously pawning off large quantities of degenerated and infected eggs to "merchant-traffickers."³⁴⁶ The breeding of silkworms producing heavy, but unworkable velvety silk was also encouraged by raw silk dealers because cocoons which appeared to be the most charged with silk were preferred by their ignorant clients.³⁴⁷ The Genevan *magnanier* [silk-worm rearer] Marsson blamed the inferiority of French silk on merchants and ignorant peasants who had created degenerated races of these insects by indiscriminately breeding the six "primitive and very distinct species of silkworms" that were raised in the kingdom.³⁴⁸ An official from Provence remarked that the common peasant practice of grafting mulberry trees accounted for the poor quality of silk produced in the province. Grafting created larger and more abundant mulberry leaves, but it "destroyed the always prudent oeconomy of nature," by producing indigestible nourishment that "ceases to be analogous to the temperament of silkworms and their constitution."³⁴⁹ The manufacturing inspector Buffel remarked that the "ignorance of farmers" was the "primary cause of the poor success and decay of silk cultivation." Silkworms were notoriously fussy creatures, whose fragile

³⁴⁶ "Mémoire sur les causes qui s'opposent au succès des vers à soye dans le diocèse de Nîmes depuis plusieurs années," 1785, C/5607, ADH, Montpellier.

³⁴⁷ "Mémoire sur le tirage de soyes et sur l'éducation des vers à soye," F/12/1432A, ANF, Paris.

³⁴⁸ Marsson, "Mémoire sur l'art d'élever les vers-à-soie," 7 February 1757, F/12/1453A, ANF, Paris.

³⁴⁹ Marsson "Mémoire sur l'art d'élever les vers-à-soie," 7 February 1757, F/12/1432A, ANF, Paris.

constitution required "all the care that is given to a sick man: it requires even more attention. It is subject to crises that it behooves us to examine with care. The slightest error in its regimen, the smallest negligence, inattention to the distempers in the atmosphere that are so frequent in the spring ... cause these insects to perish."³⁵⁰

The myriad techniques that constituted the rapidly expanding field of eighteenth-century natural history came to be seen at mid-century as privileged tools for harnessing the "oeconomy of nature" to the French state's project of sericultural reform.³⁵¹ Skilled artisans, amateur naturalists and agricultural improvers turned to dissection, microscopic observation, and experimental manipulation in order to develop sericultural techniques that were based on an understanding of the natural oeconomy of these insects. These socially heterogeneous actors strove to place the art of sericulture on solid foundations by combining the work of "mind" and "hand" – that is, by joining an intellectual understanding of the physical processes of insect generation and metamorphosis with

³⁵⁰ Buffel, *Mémoire sur les soyes*, 1768, C/11974, ADH, Montpellier [L'ignorance des cultivateurs est la cause ordinaire de leur mauvais succès, de leur découragement et de l'abandon de la culture des vers à soye ... le ver à soye demande les même soins qu'un malade: il exige autant d'attention. Sujet à des crises qu'il faut étudier, la moindre faute dans le regime, la plus petite negligence, l'innatention aux intemperies de l'air si fréquent dans la saison du printemps l'ignorance absolue des moyens d'y remédier, font périr les vers et leur mort déterminé par la faute d'un moment enlevé tout l'espoir d'une récolte]

³⁵¹ The "oeconomy of nature" referred to the divinely ordained processes that sustained life *within* biological entities and *between* organisms within a given environment. On the "oeconomy of nature" as a concept at the intersection of the eighteenth-century life-sciences and political economy see: Koerner, *Nature and Nation*,; Margaret Schabas, *The Natural Origins of Economics*, 2005; Lissa Roberts, "'Le Centre de Toutes Choses': Constructing and Managing Centralization on the Isle de France," *History of Science* 52, no. 3 (2014): 319-34; Etienne Stockland, "Policing the Oeconomy of Nature: The Oiseau Martin as an Instrument of Oeconomic Management in the Eighteenth-Century French Maritime World," *History and Technology* 30, no. 3 (2014): 207-231.

technical know-how.³⁵² Presenting his improved sericultural techniques to the Bureau of Commerce, Marsson emphasized that these had been developed through "laborious experiments, repeated for several years," that had allowed him to "observe the nature of this insect like a natural philosopher [*physicien*]."³⁵³ In developing such techniques, artisan-naturalists like Marsson explicitly drew on the repertoire of natural historical techniques developed by *savants* such as Marcello Malpighi and René Antoine-Ferchault de Réaumur, testing, verifying, reproducing and adding to their corpus of observations. Yet these men drew a sharp distinction between their own investigations and those of erudite naturalists whose primary purpose, they claimed, was merely to delight genteel readers with curious observations and experiments. They conducted their own investigations for the benefit of the public and the state. Motivated by the desire to contribute to the public good, these men constituted an informal community of patriotic observers whose attentive investigations of the anatomical structure and behavior of silkworms would provide the key for the reform of the French sericulture industry.

Patriotic naturalists throughout France flooded the offices of state administrators in Montpellier and Paris with useful observations of silkworms and reports of improved sericultural techniques. M. Baron, a rural physician from Luçon and a former assistant to

³⁵² On the relationship between 'theory' and 'practice' or 'making' and 'knowing' in early modern science: Paola Rossi, *Philosophy, Technology and the Arts in the Early Modern Era* (London: Harper and Row, 1970); Pamela Smith, *The Body of the Artisan*; Lissa Roberts, Simon Schaffer and Peter Dear (eds.), *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialization* (Amsterdam: Koninklijke Nederlandse Academie van Wetenschappen, 2007); Paola Bertucci and Olivier Courcelle, "Artisanal Knowledge, Expertise, and Patronage in Early Eighteenth-Century Paris: The Société des Arts (1728-36)," *Eighteenth-Century Studies* 48, no. 2 (2015): 159-179.

³⁵³ Marsson, "Mémoire sur l'art d'élever les vers-à-soie," February 7, 1757, F/12/1432A, ANF, Paris.

Antoine-Ferchault de Réaumur, to take one example, sent the intendant of Languedoc Jean Le Nain a collection of observations on silkworms in the early 1740s.³⁵⁴ Professing to possess "neither the talent nor the means" to shed new light on the natural history of silkworms, Baron held no hope to add to the "curious discoveries" made by Malpighi and Réaumur on the subject.³⁵⁵ Baron modestly limited himself to conducting useful observations that could contribute to the "good of the state," by assisting in the codification of sericultural practices that were consistent with the natural oeconomy of these insects. Baron's microscopic observations of silkworm eggs, for instance, led him to conclude that the practice whereby peasant women hatched eggs by carrying them on their bodies impeded their fertility by blocking the miniscule pores with oily skin particles. While repeating Malpighi's observations of the life cycles of silkworms, he also discovered that the molting process could be artificially assisted by using a lancet to pry open the dead skin that often trapped silkworms during metamorphosis. Baron also continued Réaumur's investigations of the intestinal liquors of silkworms. Silk, Réaumur had written, could potentially be produced in the laboratory, by extracting the nutritional substances of mulberry leaves and heating them at a temperature that matched the interior disposition of silkworms. Repeated dissections of mature silkworms, and failed attempts to extract congealed raw silk from their intestines, led Baron to conclude otherwise. The inscrutable physiology of silkworms placed limits on the ability of art to imitate nature,

³⁵⁴ René Antoine Ferchault de Réaumur, *Mémoires pour servir à l'histoire des insectes*, (Paris: Imprimerie Royale, 1734), 1: 51; Terrall, *Catching Nature*, 26-28.

³⁵⁵ "Mémoire du S. Baron sur l'élevage des vers à soye," 12 January 1743, C/2250, ADH, Montpellier.

he wrote, for these insects possessed "instruments for producing silk that are unknown to us, that the most piercing eye armed with a microscope cannot see."³⁵⁶

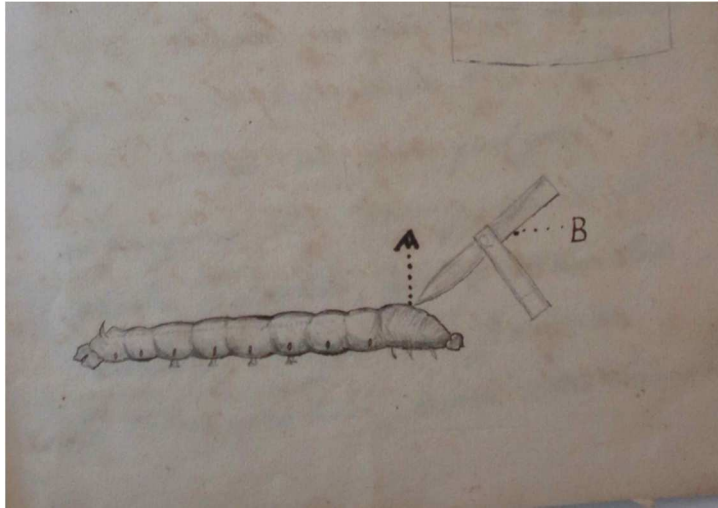


Figure 7. Sketch of silkworm by M. Baron Source: C 2550, ADH, Montpellier

Another series of observations were sent to the Bureau of Commerce in the early 1780s by the Curé Béranger, a parish priest from Loriol in the province of Dauphiné. Béranger informed the Bureau of Commerce of a technique that he had developed for producing raw silk that could rival the quality of the highly prized *nanking* silk.³⁵⁷ Béranger had read about chemical techniques for imparting a lustrous whiteness to raw silk cocoons in a copy of the *Journal de Physique* that he borrowed from one of his parishioners. Finding this method prohibitively expensive, and animated by the "desire to contribute to the prosperity of the state, and to be useful to my people," Béranger resolved to achieve this result "through the simplicity of nature itself."³⁵⁸ While observing

³⁵⁶ "Mémoire du S. Baron sur l'élevage des vers à soye," 12 January 1743, C/2250, ADH, Montpellier.

³⁵⁷ "Mémoire du S. Béranger," 10 May 1780, F/12/1453A, ANF, Paris.

³⁵⁸ "Mémoire du S. Béranger," 10 May 1780, F/12/1453A, ANF, Paris.

the coupling of silkworm moths in his workshop, Béranger found that female moths secreted various colored mucilaginous liquors during intercourse that, he surmised, were a residue of the gummy matter contained in their intestinal tracts at the worm stage. The undesirable yellowish or orange hue of poor quality silk cocoons, Béranger concurred with the "savant anatomist and naturalist Malpighi," derived from this intestinal substance that imparted colors onto raw silk threads. Repeated observations of the ejaculation of this liquor led Béranger to conclude that the highest quality cocoons were produced by silkworms whose secretions at the moth stage were of a clear whitish color. It thus was essential that *magnaniers* identify and reserve these moths for breeding in order to harvest silk of the purest color and most lustrous quality.

Useful observations of the behavior, anatomy and life cycles of silkworms, and improved sericultural techniques derived from these investigations, acted as a form of currency that amateur naturalists and sericultural improvers exchanged for patronage from the royal administration. While Baron professed to desire nothing more from his observations than to be "honored with the glorious name of *bon citoyen*," he also hoped that they might help secure his nomination as director of a royal silk manufacture that was to be established near Luçon.³⁵⁹ In the 1750s, the entrepreneur Jean-Baptiste Rodier sent the intendant of Languedoc several manuscripts on the natural history of silkworms that, along with a letter of support from the naturalist François Boissier de La Croix de Sauvages, secured his nomination to the position of inspector of silk manufacturing in the

³⁵⁹ "Mémoire du S. Baron sur l'élevage des vers à soye," 12 January 1743, C/2250, ADH, Montpellier.

province.³⁶⁰ The royal administration staffed the inspectorate with men like Rodier who combined the technical competence of an artisan with a *savant's* intellectual mastery of the natural world.³⁶¹ As enlightened propagators of new techniques in artisanal activities such as sericulture, manufacturing inspectors like Rodier played a key role in yoking the practices of natural history to the royal administration's program of sericultural reform. Rodier himself wrote that the principal duties of an inspector was to "convince the *bas peuple* through experience ... to substitute new practices for those which are incompatible with their interests."³⁶² In carrying out this mission, Rodier ran up against the suspicions of peasant communities, for whom the appearance of royal agent could only signify increased taxation.³⁶³ When he toured the villages and hamlets of Upper Languedoc, silkworm-rearers denied Rodier access to their workshops and turned him away, "a great alarm having been spread" that the peasants would be forced to pay an indemnity for his

³⁶⁰ Rodier to Le Nain, 5 October 1750, C/2255, ADH, Montpellier; Rodier to Lacroix de Sauvages, 9 November 1750, C/2255, ADH, Montpellier; Rodier, "Mémoire sur l'éducation des vers à soie dans le Haut Languedoc. Détail des soins qu'on se donne pour la perfectionner. Idées et expériences tendant à la cessation de la mortalité parmi ces chenilles," 1755, C/2280, ADH, Montpellier.

³⁶¹ On manufacturing inspectors in eighteenth century France see: Minard, *La fortune du colbertisme*, 1998; Philippe Minard, "Colbertism Continued? The Inspectorate of Manufactures and Strategies of Exchange in Eighteenth-Century France," *French Historical Studies* 23, no. 3 (2000): 477-496; The director of the bureau of commerce Daniel Trudaine introduced Rodier to Réaumur when he visited Paris in the early 1750s: Rodier, "Mémoire sur l'éducation des vers à soie dans le Haute Languedoc, 1755, C/2280, ADH, Montpellier.

³⁶² Rodier "Mémoire sur l'éducation des vers à soie dans le haut languedoc Détail des Soins qu'on se donne pour la perfectionner. Idées et expériences tendant à la cessation de la mortalité parmi ces chenilles," C/2280, ADH, Montpellier.

³⁶³ S. Rodier "Mémoire sur l'Education des vers à soie dans le Haut Languedoc," 1755, C/2280, ADH, Montpellier.

instructions. Only after he assuaged the fears of peasant women through a declaration of his intentions and "useful lessons" that he delivered in public squares did Rodier gain free access to the workshops of the local *magnaguiers*.³⁶⁴

International competition in the raw silk trade acted as leverage for petitioners with new sericultural techniques, who, in their bids to obtain various favors from royal administrators, constantly reminded the latter how many "foreign powers cherish ambitions for this branch of industry."³⁶⁵ When Marsson solicited letters patent from the Bureau of Commerce for a grant of land on which to establish a mulberry tree plantation and sericultural workshop that, he promised, would "convert into profits for the nation, sums that are now forced to pass to rival states," he slyly implied to Trudaine that he might offer his services to a rival power should his request go unfulfilled. "It is important to prevent other nations from acquiring the secret of my method," he warned, "a precaution that is all the more necessary because the queen and king of Prussia have the same views in regards to silk as the government of France."³⁶⁶ When S. Joyeuse, an commissary in the ministry of the marine from Marseille, offered to sell to the Bureau of Commerce a "discovery useful for the cultivation of silkworms" that made these insects "practically immortal" for the sum of 3600 *livres* in order to defray the costs of experiments incurred during eighteen years of natural historical observations, he strategically reminded the minister Vergennes that "many foreign powers cherish

³⁶⁴ S. Rodier "Mémoire sur l'Education des vers à soie dans le Haut Languedoc," 1755, C/2280, ADH, Montpellier.

³⁶⁵ Walsh de Valoit to Vergennes, 15 June 1785, F/12/1439, ANF, Paris.

³⁶⁶ Marsson, "Mémoire sur l'art d'élever les vers-à-soie," 7 February 1757, F/12/1453A, ANF, Paris.

ambitions for this branch of industry."³⁶⁷ The threat of expatriation could become a negotiating tool of last resort for struggling entrepreneurs like Constant Castellet, who informed Trudaine that he would be forced to take his sericultural "secrets and happy discoveries" abroad to a foreign nation unless he was given a loan by the Bureau of Commerce for his fledgling silk manufacture.³⁶⁸

“By the light of physics and natural history”: The abbé Sauvages and the Reform of the French Sericulture Industry

Academic naturalists also turned in increasing numbers towards the study of silkworms and sericulture from the 1740s onwards. Silk was a particularly privileged topic of study for *savants* in Lower Languedoc, where learned naturalists like the Nîmois Jean-François Séguier (1703-1784) took an interest in the matter.³⁶⁹ It was the naturalist Pierre-Augustin Boissier de Sauvages (1710-1795), a member of the *Société Royale des Sciences de Montpellier*, however, who left the greatest mark on the subject. The abbé Sauvages, who devoted the greater portion of his life to the study of silkworms, began his observations of these insects in the late 1730s as an assistant to his brother François Boissier de Sauvages, an important figure in the medical and natural historical community in Montpellier. He spent the next decade observing the hatching of silkworm eggs and the metamorphosis and reproductive cycles of these insects in an experimental workshop he built on his farm outside Alès, an important regional center for the raw silk

³⁶⁷ Walsh de Valois to Vergennes, 15 June 1785, F/12/1439, ANF, Paris.

³⁶⁸ Castellet to Trudaine, 27 Octobre 1762, F/12/1432B, ANF, Paris.

³⁶⁹ "Notes sur les mûriers, graines de vers à soie, filage de soie," MS 307, Recueil Séguier n°51, Bibliothèque Municipale de Nîmes, Nîmes.

trade situated at the foot of the Cévennes mountain range.³⁷⁰ Sauvages first publicly presented preliminary results of his investigations, along with his project for a broader program of sericultural reform in 1749 at the *Société Royale's* annual *assemblée publique*, held at the city hall in Montpellier in the presence of members of the Estates of Languedoc.

In the province of Languedoc, Sauvages began, the silkworm had become "the principal source of revenue for the rich and a significant resource for the artisan." A flourishing raw silk industry had developed since the beginning of the century through the encouragements of enlightened administrators, "who so wisely watch over the public good."³⁷¹ Nevertheless, this crucial industry remained on precarious ground. The costly ignorance of artisans responsible for the rearing of silkworms was a major source of lost revenue for silk producers and the provincial administration. In order to "reduce into an art that which is still today a haphazard routine subject to a thousand inconveniences," sericultural techniques would have to be based on a "method prescribed by physic and good sense, that is, through experiments [*expériences*] and observations." To serve his "*patrie* with the greatest utility," Sauvages proposed to collect observations on the subject through correspondence with "intelligent persons," by travel to sericulture workshops, and through experiments conducted on his farm.³⁷² The Estates of Languedoc, for whom

³⁷⁰ The annual value of trade in raw silk in Alès increased from 10 000 livres to 1 800 000 livres between 1720 and 1750: Sauvages 1749: 66. Roughly 15% of French raw silk was produced in the Cévennes in the eighteenth-century: Philippe Joutard, "Les Cévennes à leur apogée," in *Les Cévennes de la montagne à l'homme*, ed. Philippe Joutard (Saint-Just-la-Pendue: Chirat, 1979), 153-156.

³⁷¹ Sauvages, "Projet d'un ouvrage sur la manière d'élever les vers à soye," 66.

³⁷² Sauvages, "Projet d'un ouvrage sur la manière d'élever les vers à soye," 70.

the Société Royale had become a useful ally in projects of economic improvement since the 1720s, unanimously approved Sauvages' project.³⁷³

In 1750, the provincial administration sent Sauvages to Paris and Versailles in order to seek support from the Bureau of Commerce for his investigations of silkworms. Sauvages' connections with provincial administrators and with naturalists in Paris who had been trained at the Faculty of Medicine in Montpellier facilitated this access to courtly patronage.³⁷⁴ The naturalist and physician Louis Lavirotte (1725-1759), a former medical student at Montpellier and friend of his brother François Boissier de Sauvages, introduced Sauvages to the Comte de Buffon (1707-1788), director of the Jardin du Roi, and drew the chancellor Guillaume de Lamoignon's (1683-1772) attention to his published work on silkworms.³⁷⁵ Like many savants from Montpellier who visited the capital, Sauvages also frequented the salons of the baron d'Holbach (1723-1789), where he met Denis Diderot (1713-1784) and d'Alembert (1717-1783).³⁷⁶ Through these channels, he was enlisted in the Encyclopedic project and contributed several articles to

³⁷³ E.A. Kindleberger, *The Société Royale des Sciences de Montpellier: 1706 to 1795* (Phd thesis: Johns Hopkins University, 1979).

³⁷⁴ By mid-century, a number of physicians and naturalists from Montpellier had established themselves in the capital, providing a bridge for men like Sauvages into the Parisian natural historical community: Williams, *A Cultural History of Medical Vitalism*, ch. 4.

³⁷⁵ Georges Raféris de Broves, "L'abbé de Sauvages," *Mémoires et comptes rendus de la Société Scientifique et Littéraire d'Alais* 28 (1897): 108-109.

³⁷⁶ Jacques Proust, *L'encyclopédisme dans le Bas-Languedoc au XVIIIe siècle* (Montpellier: Faculté des Sciences et Lettres, 1968), 12-13, 43-44; Williams, *Medical Vitalism*, 120-124.

Diderot's *Encyclopédie* on topics ranging from sericulture to textile dyeing.³⁷⁷ Navigating the interlocking worlds of Parisian savants and high-level administrators, Sauvages was able to circulate his proposals within the Controller General's office and the Bureau of Commerce.³⁷⁸

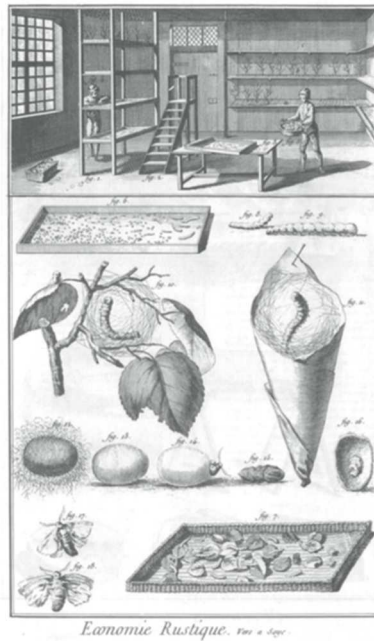


Figure 8. Engraving of a sericulture workshop from the Encyclopédie. Source: "Économie Rustique. Vers à Soie," *Encyclopédie, ou dictionnaire raisonné des sciences*, (Paris: Briasson, 1765) 8: 17.

Sauvages quickly found a willing supporter for his projects in Daniel Trudaine, the director of the Bureau of Commerce, who received him at Versailles and examined his proposals to reform French sericultural techniques.³⁷⁹ Rehearsing the plans for the

³⁷⁷ Broves, "L'abbé de Sauvages," 190-191; John Lough, *The Contributors to the Encyclopédie* (London: Grant and Cutler, 1973), 99; Frank A. Kafker and Serena L. Kafker, *The Encyclopédists as Individuals: a Biographical Dictionary of the Authors of the Encyclopédie* (Oxford: Voltaire Foundation, 1998), 355-359.

³⁷⁸ "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soie," F/12/1453B, ANF, Paris.

³⁷⁹ Sauvages to Trudaine, 24 September 1750, F/12/1453B, ANF, Paris; Sauvages to Saint-Priest, 7 September 1760, C/5606, ADH, Montpellier; Sauvages later cited

program of natural historical observation of silkworms that he had outlined at the public assembly in Montpellier, Sauvages underlined the need for naturalists to take control of sericultural production. A thriving raw silk industry would require the implementation of silkworm-rearing practices developed "by the light of physics and natural history."³⁸⁰ Such a crucial industry could not be left in the hands of "artisan-automata" who "blindly follow the same routines and errors," but needed to be based on natural knowledge that could only be gained through "the accumulation of a large number of observations that can be compared with one another and repeated experiments."³⁸¹ In the end, Trudaine proved receptive to adding Sauvages to the growing "brain trust" of *savants* attached to the Bureau of Commerce, and he arranged for a stipend of 600 livres per annum to be disbursed as an encouragement to the abbé's investigations.³⁸²

Having secured official support for his investigations, Sauvages returned to his estate near Alès in 1752 and began to conduct experiments on silkworms in his workshop. Sauvages raised several batches of silkworms in controlled environments, modifying the temperature of the workshop, the species and quantity of mulberry leaves

Trudaine as the primary supporter of his work in: Pierre-Augustin Boissier de Sauvages, *Mémoires sur l'éducation des vers à soie* (Nîmes: Gaude, 1763), ix.

³⁸⁰ Abbé Sauvages to Trudaine, 4 November 1750, F/12/1453B, ANF, Paris.

³⁸¹ Sauvages, "Projet d'un Ouvrage," 112; Sauvages, *Mémoires sur l'éducation des vers à soie*, xv; The association of artisans with automata had a well-established place in Enlightenment discourse: William Sewell, "Visions of Labor: Illustrations of the Mechanical Arts before, in and after Diderot's *Encyclopédie*," in *Work in France: Representations, Meaning, Organization and Practice*, eds. Steven Kaplan and Cynthia J. Koepp (Ithaca: Cornell University Press, 1986), 258-296; Simon Schaffer, "Enlightened Automata," in *Sciences and the Enlightened Europe*, eds. William Clark, Jan Golinski and Simon Schaffer (Chicago: Chicago University Press, 1999), 126-165.

³⁸² Minard, *La fortune du colbertisme*, 227.

fed to the insects, and the techniques used to guide silkworms to maturity, in order to determine the optimal conditions for maximizing the yield of quality raw silk.³⁸³ Repeated dissections of silkworms led him to discover that the terrible disease known as *muscardin* was a result of excessive heat that induced putrefaction of the humors in the lymphatic vessels of these insects.³⁸⁴ Sauvages examined the effects of droplets of honeydew on the tracheae and intestinal tracts of silkworms, proving that the "salts" contained in this liquid were a "deadly poison for these insects."³⁸⁵ Thermometrical experiments, which Sauvages encouraged his readers to repeat on their own, led him to determine the ideal temperature at which silkworms should be reared to prevent the fragile respiratory systems of these insects to be overcome by excessive heat or cold. Sauvages' reports to the Bureau of Commerce combined accounts of experimental manipulations of silkworms with observations of their feeding habits and life cycles, physical explanations of the causes of silkworm diseases, measurements of raw silk yields, and calculations of the profits to be derived from the adoption of his sericultural techniques.³⁸⁶ In his attempt to multiply the silk yield of these insects, prevent the outbreak of diseases that decimated silkworm broods, and artificially reduce the duration of their life-cycles, Sauvages combined the scholarly acumen of a naturalist with the labor-saving ethic of a rural *économe* determined to cut the input costs of this branch of

³⁸³ "Copie de la lettre écrite à M. de St. Priest par M. l'Abbé Sauvages," 2 January 1753, F/12/1453B, ANF, Paris.

³⁸⁴ Broves, "L'abbé Sauvages," 171.

³⁸⁵ Sauvages, *Mémoires sur l'éducation des vers à soie*, 55.

³⁸⁶ Abbé Sauvages to Trudaine, 10 June 1753, F/12/1453B, ANF, Paris; "Copie de la lettre écrite à M. De St. Priest par M. L'Abbé Sauvage," January 2 1753, F/12/1453B, ANF, Paris; Abbé Sauvages to Trudaine, 29 May 1755, F/12/1453B, ANF, Paris.

agrarian production. Examining the day-to-day practice of Sauvages' laboratory life, we see the domains of natural history, natural philosophy, artisanal production and rural *oeconomie* effectively collapsed into one another.

Administrators in the Bureau of Commerce relied on a network of Parisian *savants* and provincial officials to monitor the progress of Sauvages' investigations. Trudaine sent Sauvages' reports to the académicien Jean-Antoine Nollet (1700-1770), who judged them to be "full of observations as curious as they are useful ... naturalists will find them fruitful and those who raise silkworms will find great details with which to perfect this art."³⁸⁷ François-Emmanuel Guignard de Saint-Priest (1735-1821), intendant of Languedoc, had cocoons raised in Sauvages' workshop examined by silk connoisseurs, and reported to Trudaine that a large number of them were of poor and unworkable quality.³⁸⁸ Saint-Priest's subdelegate also secretly monitored Sauvages' operations in the workshop, and reported that his silk-rearing techniques were "not without faults and inconveniences," although he cautioned that further trials would be necessary to reach a definitive conclusion.³⁸⁹ The intendant of finances himself, Vincent de Gournay, toured Sauvages' workshop in Alès during a trip to Montpellier in 1753, and would subsequently continue to correspond with the latter on the subject of silkworms and sericultural

³⁸⁷ Nollet to Trudaine, 26 February 1757, F/12/1453B, ANF, Paris.

³⁸⁸ Saint Priest to Trudaine, 20 July 1753, F/12/1453B, ANF, Paris; Saint Priest to Trudaine, 16 August 1754, F/12/1453B, ANF, Paris.

³⁸⁹ Saint Priest to Trudaine, 20 July 1753, F/12/1453B, ANF, Paris.

techniques.³⁹⁰ By coordinating the circulation of administrative paperwork, skilled personnel, cocoons, and silk samples between Alès, Montpellier, Paris and Versailles, members of the Bureau of Commerce thus kept themselves closely informed on the progress of Sauvages' silkworm experiments, and on this basis deliberated whether to continue disbursing funds.

Sauvages also proposed to examine sericultural techniques through travel in silk growing regions in France and abroad.³⁹¹ Sauvages' published *mémoires* and his reports to the *bureau* show him to have been repeatedly travelling between his farm in Alès and workshops in Lower Languedoc, and in constant conversation with regional silk producers and "intelligent *magnaniers*."³⁹² Through his travels in his native region, Sauvages attempted to disseminate the silkworm rearing techniques that he had developed through his experiments and observations, but he was also receptive to learning from farmers, artisans and countrywomen.³⁹³ Although Sauvages often spoke harshly of artisans involved in the rearing of silkworms he was not above crediting them in print and in his reports when he found them to possess a useful observation or a valuable piece of knowledge. From a certain Pantel, a master magnanier, Sauvages learned that silkworms exposed to hot southeasterly winds perished from diseases

³⁹⁰ Trudaine to Gournay, 21 August 1753, F/12/1453B, ANF, Paris; "Note de Trudaine," F/12/1453B, ANF, Paris; Pierre-Augustin Boissier de Sauvages, *L'art d'élever les vers à soie* (Nîmes: J-J Niel, 1788), 53-54.

³⁹¹ "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," n.d., F/12/1453B, ANF, Paris.

³⁹² Abbé Sauvages to Trudaine, 29 May 1755, F/12/1453B, ANF, Paris.

³⁹³ Women played an important role in the raw silk industry in the Cévennes. For Sauvages' exchanges with women see: Sauvages, "Projet d'un Ouvrage," 83, 90.

"vulgarly known" as *jaunes* and *gras*. Sauvages confirmed this observation by repeatedly exposing his silkworms to the *vent marin*, concluding that these winds carried noxious vapours that were harmful to the constitution of silkworms.³⁹⁴ The exchange between Pantel and Sauvages reveals that a reciprocal relationship existed between the worlds of artisanal production and the experimental spaces of learned naturalists in the Languedoc region. Observations circulated between workshop and laboratory, which in turn led to the formulation of useful knowledge that could be applied to facilitate the production of commodities like raw silk.

Sauvages also solicited the Bureau of Commerce to support his travels to visit sericulture workshops beyond the frontiers of France in regions that provided stiff competition to the kingdom's nascent raw silk industry.³⁹⁵ Accumulating "facts and experiences" through travel was the only way to "acquire knowledge on this subject and to clarify a matter so obscure, uncertain and full of difficulties" as the rearing of silkworms.³⁹⁶ The workshops of Spain, Sauvages had heard from his correspondents,

³⁹⁴ Sauvages, "Projet d'un ouvrage," 79.

³⁹⁵ On this competition see: Charles Ballot, *L'Introduction du Machinisme*, 297-382; Bertucci, "Enlightened Secrets"; "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," F/12/1453B, ANF, Paris; Sauvages to Trudaine, 1 December 1751, F/12/1453B, ANF, Paris.

³⁹⁶ "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," n.d, F/12/1453B, ANF, Paris; On the importance of travel for eighteenth-century natural history: Lisbet Koerner, "Purposes of Linnaean travel: a preliminary research report," in *Visions of Empire: Voyages, Botany and Representations of Nature*, eds. David Philip Miller and Peter Hanns Reil (Cambridge: Cambridge University Press, 1996), 117-152; Marie-Nöelle Bourguet, "Landscapes with Numbers: Natural History, Travel and Instruments in the Late Eighteenth and Early Nineteenth Centuries," in *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century*, eds. Marie-Nöelle Bourguet, Christian Licoppe and H. Otto Sibum (London: Routledge, 2002), 96-125; Bertucci, "Enlightened Secrets"

were free of silkworm diseases, and thus an examination of their internal organization and of Iberian silkworm-rearing practices could provide a key to solving an intractable problem that plagued the French sericulture industry. While he doubted that much could be learned from the workshops in the Kingdom of Sicily, the "great heat and exhalations that reign there" would provide Sauvages with the opportunity to accumulate observations in order to test his theory on the atmospheric communication of silkworm diseases. Sauvages underlined that travels in Tuscany and Piedmont would be of particular strategic importance, given the high quality of raw silk produced in the workshops of those kingdoms. Sensitive to administrators' desire to collect craft secrets and useful artisanal knowledge from its competitors, and clearly aware of similar projects of industrial espionage sponsored by the royal administration, Sauvages thus made the case that his observational and experimental skills could be usefully deployed in the service of the royal administration.³⁹⁷

Yet, Sauvages continued, it was not only his skills as a naturalist, but also his standing as a member of the Société Royale des Sciences de Montpellier and as a correspondent of the Académie des Sciences that could prove to be useful to the Bureau of Commerce. As Paola Bertucci has shown, state administrators and *savants* in the eighteenth century increasingly realized that academic status could be conveniently deployed to gain access to carefully guarded craft secrets, by providing industrial spies with an "aura of gentlemanly disinterestedness."³⁹⁸ The cosmopolitanism of the Republic

³⁹⁷ On "industrial espionage" see: J.R. Harris, *Industrial Espionage and Technology Transfer: Britain and France in the Eighteenth-Century* (Aldershot: Ashgate, 1998); Bertucci, "Enlightened Secrets."

³⁹⁸ Bertucci, "Enlightened Secrets," 847.

of Letters could thus act as a useful fiction in the pursuit of national projects of economic improvement. It was precisely this strategy that Sauvages drew on when he proposed to travel under the guise of a "curious academician and naturalist, without revealing the object of my mission, so as not to render myself suspect." Stipends from the Bureau of Commerce became imperative in this respect, because Sauvages, a "simple ecclesiastic," would be required to present himself "decently" to gain "free access to men of letters and of industry."³⁹⁹

If the academic and gentlemanly culture of disinterested curiosity (which as Sauvages underlined was not without its price of entry) could guarantee relatively open access to local workshops, the more pecuniary and transactional relationships between *savants* and artisans would require more direct and straightforward expenses. It was indispensable, Sauvages noted, to have the necessary funds to offer the "liberalities" that could "untie the tongues of workmen" and "bring them to fulfill my interests."⁴⁰⁰

Wresting sericultural secrets from French competitors thus required the adoption of strategies commonly used for the transfer of craft secrets and industrial processes, tactics that ranged from the surreptitious infiltration of local networks of craftsmen and *savants* to the outright purchase of technical secrets from artisans.

³⁹⁹ "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," n.d., F/12/1453B, ANF, Paris [Outre que je ne voyagerai qu'en qualité de curieux académicien et de naturaliste, sans découvrir l'objet de ma mission pour ne pas me rendre suspect. Mais il faut être déceimment pour se présenter pour avoir un accès libre chez les gens de lettre et de manufacture]

⁴⁰⁰ "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," n.d., ANF, F/12/1453B [Il est enfin indispensable de faire quelques libéralités aux ouvriers pour leur délier la langue pour les faire entrer dans mes vues et les mettre dans mes intérêts]

The Global Itineraries of Silkworms

Sauvages' plans for a state-sponsored tour of sericulture workshops in Italy and Spain never came to fruition. When Sauvages returned to Paris in 1757 to seek financial support for a proposed tour of sericulture workshops on the Italian and Iberian peninsulas, Trudaine rebuffed him.⁴⁰¹ As a disappointed Sauvages wrote to the controller general of finances Bertin from his estate in Alès in 1760:

M. Trudaine did not want to hear a word about my proposed plans for travels, or to help me to accomplish them. I informed M. Trudaine of my work by presenting him a long memoir on the hatching of silkworm eggs, on which M. l'abbé Nollet gave the most flattering report. M. Trudaine, who, in the beginning received me with the greatest kindness and encouraged me with vivacity to put myself to work, changed his tone with me and received me drily and with utter coldness.⁴⁰²

Instead of funding Sauvages' sericultural tour of the Continent, the royal administration utilized the questionnaire as a technique for pursuing its program of competitive amelioration.⁴⁰³ Sauvages himself drew up the questionnaire that was to be disseminated not only in Languedoc and Continental Europe, but also throughout the Ottoman Empire,

⁴⁰¹ Sauvages to Trudaine, 1 December 1751, F/12/1453B, ANF, Paris; "Mémoire touchant les recherches à faire pour découvrir la cause et le remède des maladies des vers-à-soye," F/12/1453B, ANF, Paris.

⁴⁰² Sauvages to Bertin, 7 September 1760, C/5606, ADH, Montpellier.

⁴⁰³ On the questionnaire as an instrument of science and statecraft, see: Peter Burke, *A Social History of Knowledge: From Gutenberg to Diderot* (Cambridge: Cambridge University Press, 2000), ch. 6; Paul Slack, "Government and Information in Seventeenth-Century England," *Past and Present* 184 (2004): 33-68; Adam Fox, "Printed Questionnaires, Research Networks, and the Discovery of the British Isles, 1650-1800," *The Historical Journal* 53, no. 3 (September 2010): 593-621.

East Asia and the Mascarene Islands.⁴⁰⁴ It was important, for Sauvages, to distribute the questionnaire in Central and East Asia, not only because of the high quality silk produced in those regions, but also because it was the silkworm's "native country, the climate that is proper to this insect." "It is here," he wrote, "that they must be studied, in order to draw from purer source instead of the spoiled and altered creeks, so to speak, of our country."⁴⁰⁵ Using contacts with diplomats, merchants, missionaries, colonists and naturalists stationed throughout France's commercial empire, the royal administration used questionnaires to draw upon the experiential knowledge non-European silk producers and of naturalists in these foreign environments.

In the following section, I examine the case of three correspondents, a naturalist stationed in the Île de Bourbon, a travelling naturalist and spy in the Ottoman Empire and a Jesuit missionary in China, to reveal the distinctive challenges and opportunities that naturalists outside metropolitan France faced in the pursuit of economically valuable knowledge.

Jean Baptiste François De la Nux

Having lived briefly in exile in Amsterdam during the Regency period due to his association with the satiric poet François Joseph La Grange-Chancel, the nobleman Jean-Baptiste François de Lanux departed for the Île de Bourbon in 1724.⁴⁰⁶ Lanux quickly

⁴⁰⁴ "Manufactures des Soyes," no. 3463, C/2250, ADH, Montpellier; Gibertain to Le Nain, 2 Fevrier 1749, C/2253, ADH, Montpellier.

⁴⁰⁵ Sauvages, "Projet d'un Ouvrage," 75.

⁴⁰⁶ Alfred Lacroix, "Notice historique sur les membres et correspondants de l'Académie des Sciences ayant travaillé dans les colonies françaises des Mascareignes et de Madagascar au XVIIIe siècle et au début du XIXe," *Mémoires de l'Académie des*

ingratiated himself with the colonial administration and the Compagnie des Indes Orientales, which appointed him director of the slave trade on the coast of Madagascar in 1729 and a member of the *Conseil Supérieur* of the island. As resident naturalist on the island, Lanux came to play an important role in the CIO's economic projects of botanical acclimatization under the governorship of Mahé de la Bourdonnais and his successors.⁴⁰⁷ Lanux was charged by the CIO to oversee the development of the nascent sericulture industry on the Isle de Bourbon, and he was appointed as inspector of the silk weaving manufactures on the island.⁴⁰⁸ In this capacity, Lanux distributed seeds of mulberry trees shipped by the CIO from Bengal, China and Languedoc to colonists and attempted to cultivate these plants in his own garden.⁴⁰⁹ Lanux also periodically received shipments of silkworm eggs from Asia and the south of France, and he conducted experiments to determine which species would be most adaptable to the climate of the Isle de Bourbon.⁴¹⁰ Sericultural techniques also traveled across the Indian Ocean, as Lanux

Sciences (1934), 30; Philippe Bonnichon, "Autour de Pierre Poivre: Botanistes Français Des Lumières dans l'Océan Indien," *Compte Rendus Trimestriels des Séances de l'Académie des Sciences d'Outre-Mer* 64 (2004): 17-30.

⁴⁰⁷ On these projects, see: Madeleine Ly-Tio Fane, *Mauritius and the Spice Trade, The Odyssey of Pierre Poivre* (Port Louis: Esclapon Limited, 1958); Richard Grove, *Green Imperialism*; Spary, "Of Nutmegs and Botanists"; Lissa Roberts, "Le Centre de Toutes Choses."

⁴⁰⁸ As early as the 1710s, the Compagnie des Indes was recruiting artisans from the Languedoc region to establish a silk industry in the Mascarene Islands and other colonies: de Bernage à d'Argenson, 26 June 1719, C/2282, ADH, Montpellier; Lanux to Boissier de Sauvages, 29 December 1754, Dossier Lanux, f. 22, AAS, Paris.

⁴⁰⁹ Lanux to Réaumur 29 December 1754, Dossier Lanux, f.6, AAS, Paris; "Réponse aux questions de M. l'abbé Sauvages," Dossier Lanux, AAS, Paris.

⁴¹⁰ Lanux à Boissier de Sauvages, 29 December 1754, Dossier Lanux, f. 14-17, AAS, Paris.

corresponded with French silk producers in India and China on the local methods used to raise indigenous species of silkworms.⁴¹¹

For Lanux, correspondence with naturalists in metropolitan France provided both a complementary and alternative resource to the commercial knowledge networks of the CIO. Indeed, Lanux found it more expedient to rely on naturalists for samples of seeds and silkworm eggs, given their greater attention to techniques of long-distance specimen transport.⁴¹² Naturalists also proved to be more receptive patrons for Lanux' silkworm investigations than the agents of the Compagnie des Indes, who often left his appeals for assistance unanswered and his shipments of specimens to rot in warehouses.⁴¹³

Throughout his life on the island, Lanux maintained a correspondence with eminent naturalists in the capital, notably with the Comte de Buffon, Bernard de Jussieu and René Antoine Ferchault de Réaumur, who had him elected as an official correspondent of the Académie des Sciences in 1754.⁴¹⁴ Réaumur, who also served on the Bureau of Commerce, acted as the primary patron for Lanux's sericultural investigations, supplying him with instruments, specimens of mulberry trees and silkworms, and books and periodicals that kept his informant abreast of the latest sericultural techniques being

⁴¹¹ Lanux à Boissier de Sauvages, 29 December 1754, Dossier Lanux, f. 7, AAS, Paris; "Réponse aux questions de M. l'abbé Sauvages," n.d., Dossier Lanux, AAS, Paris.

⁴¹² Lanux often complained that the samples sent by the CIO had spoiled or hatched en route due to the negligence of merchant factors and ship captains. On the circulation of techniques of specimen transport see: Christopher M. Parsons and Kathleen S. Murphy, "Ecosystems under Sail: Specimen Transport in the Eighteenth-Century French and British Atlantics," *Early American Studies* 10, no. 3 (Fall 2012): 503-539.

⁴¹³ Lanux to Réaumur, 3 Septembre 1753, AAS Dossier Lanux, f.5

⁴¹⁴ Lanux also corresponded with the astronomers abbé La Caille and Alexandre Guy Pingré: Dominique Julia, *Messieurs de Sainte-Geneviève: Religieux et Curés de la Contre-Réforme à la Révolution* (Paris: Editions du Cerf, 2001), 451-454.

promoted in France.⁴¹⁵ It was also Réaumur who brokered the correspondence between Lanux and the abbé de Sauvages, by sending Sauvages' questionnaire to the Île de Bourbon, passing along excerpts of his correspondence, and establishing a direct correspondence between the two naturalists.⁴¹⁶ Silk was the thread that tied Sauvages and Lanux into a reciprocal relationship of exchange of observations, techniques and specimens between Lower Languedoc and the Île de Bourbon.

Not wanting to submit himself "slavishly and mechanically to European techniques, many of which are impractical here and others impossible," Lanux had begun to study silkworms in order to develop sericultural techniques that were adaptable to the particular climate of the Île de Bourbon.⁴¹⁷ Yet his investigations also yielded commercially useful bits of knowledge that could potentially be employed for the production of raw silk in metropolitan France. Combining thermometrical and barometrical measurements with observations of silkworm reproduction and metamorphosis over several years, Lanux attempted to determine the ideal climactic conditions for the raising of silkworms.⁴¹⁸ He sent Sauvages a recipe for a decoction he had developed to protect mulberry trees and silkworms from the depredations of ants and

⁴¹⁵ Lanux to Réaumur, 3 September 1753, Dossier Lanux, AAS, Paris; Lanux to Boissier de Sauvages, 29 December 1754, Dossier Lanux, AAS, Paris.

⁴¹⁶ Sauvages had begun a correspondence with Réaumur in the late 1730s.; Sauvages to Réaumur, 17 August 1739, Dossier Pierre Augustin Sauvages, AAS, Paris; 66/119, Fonds Réaumur, AAS, Paris.

⁴¹⁷ Lanux to Réaumur, September 3, 1753, Dossier Lanux, AAS, Paris.

⁴¹⁸ Lanux to Boissier de Sauvages, 3 September 1753, Dossier Lanux, AAS, Paris; Lanux to Boissier de Sauvages, 19 December 1754, Dossier Lanux, AAS, Paris.

other harmful insects.⁴¹⁹ Lanux also observed that the silkworm moth liberated itself from the cocoon, not by cutting through the silk threads as was commonly believed, but by discharging a liquor that loosening the gum that held the cocoon together. This observation, he wrote, could prove useful for silk producers who could collect the liquor in order to more easily unwind cocoons for spinning the threads into silk.⁴²⁰

Lanux often complained that his isolation from the natural historical community in France was a major hindrance to his investigations, but the remoteness of the Île de Bourbon from learned metropolitan communities could be overcome by turning to local resources available on the island. Lanux could rely, for instance, on the assistance of members of his household for his sericultural investigations. To test the effects of bodily heat on the hatching of silkworms, Lanux gave eggs to his children, servants and slaves to carry on their persons, in order to determine whether the difference in sex, age, temperament, and daily habits would yield varying results.⁴²¹ Local silk producers could yield valuable knowledge, as Lanux discovered when he visited the workshop of a woman who had haphazardly discovered how to prevent the eruption of silkworm disease.⁴²² Lanux also learned of a wild species of silkworms raised by indigenous inhabitants of the island of Madagascar, and he sought to raise them himself on the Île de

⁴¹⁹ Lanux to Boissier de Sauvages, 29 December 1754, Dossier Lanux, AAS, Paris.

⁴²⁰ Lanux to Boissier de Sauvages, 29 December 1754, Dossier Lanux, AAS, Paris; "Sur les Vers à soie dans l'Isle de Bourbon par M. de la Nux," n.d., Dossier Lanux, AAS, Paris.

⁴²¹ "Réponses aux questions de Monsieur l'Abbé Sauvages," nd., Dossier Lanux, AAS, Paris.

⁴²² Lanux to Boissier Sauvages 29 December 1754, Dossier Lanux, AAS, Paris.

Bourbon.⁴²³ By allowing these insects to produce silk through the natural "force of their constitution" and collecting the silk they left on trees in the forest, silk producers could thus avoid the costly and uncertain process of raising them artificially within workshops.⁴²⁴ Travellers to the island, which was a major relay point between Europe, Africa and the Indian Ocean, also brought valuable pieces of information about silk rearing techniques. From a Portuguese traveller, Lanux learned that silkworm producers in Portugal and Spain used the branches of ferns as twigs on which silkworms spun their cocoons, so as to avoid the production of double cocoons that were difficult to unwind and untangle.⁴²⁵ When the governor general of Pondichéry Charles Godeheu passed through the Île de Bourbon on his way back to France, he informed Lanux of the sericultural techniques used there by a "particular caste who make a great mystery of this know-how."⁴²⁶

Simon de Vierville

After receiving a degree from the faculty of medicine in Paris, the physician Simon de Vierville was appointed botanical demonstrator at the University of Rouen in 1747 where he proceeded to reorganize the garden according to the principles of Carl Linnaeus' taxonomic system.⁴²⁷ Vierville soon found himself under the protection of two powerful aristocratic patrons, the foreign minister Comte de Noailles and his son the duc

⁴²³ Lanux to Boissier de Sauvages. 29 December 1754, Dossier Lanux, AAS, Paris.

⁴²⁴ Lanux to Réaumur, 15 October 1756, Dossier Lanux, AAS, Paris.

⁴²⁵ Lanux to Réaumur, 15 October 1756, Dossier Lanux, AAS, Paris.

⁴²⁶ Lanux to Réaumur, 15 October 1756, Dossier Lanux, AAS, Paris.

⁴²⁷ Louis François Angier d'Angerville to Carl Linnaeus, 5 September 1747, *The Linnaean Correspondence*, linnaeus.c18.net, letter L0835 (consulted 13 July 2014)

d'Ayen, a noted collector and natural history enthusiast who was on the first Frenchmen to defend the Linnaean system of botanical classification.⁴²⁸ It was Noailles who recommended Simon to the position of travelling naturalist when the royal administration decided to send an emissary to the Levant to establish diplomatic and commercial relationships with the Persian court.⁴²⁹ For some members of the foreign ministry, like the foreign minister Louis Philogène Brûlart de Pusyieux and the ambassador Comte Dessaleur, Simon's status as a physician and naturalist, and as correspondent to the Académie des Sciences, was merely a convenient pretense under which he could pass through the Levant without raising the suspicions of rival nations who vied for influence at the Persian court:

The apparent aim of his are travels are physics and natural history ... I convinced M. Simon that the persona [*caractère*] of a physician was the most convenient for him to introduce himself without risks and to insinuate himself without pains, and to avert all suspicions.⁴³⁰

Yet for members of the scientific community in Paris, Simon's expedition to the Levant provided a rare opportunity to gain access to a region that had been inaccessible to French

⁴²⁸ Noailles to Desalleurs, 20 June 1751, SP 151, f.4, Archives Diplomatiques Centre de Nantes (ADCN); Desalleurs to Noailles, 30 November 1751, SP 151, ADCN, Nantes.

⁴²⁹ Simon was chosen over a certain Roque, an "adventurer" and interpreter for the Compagnie des Indes whom the ambassador Desalleur described as "a bit vain, licentious and talkative, but very clever and talented": Desalleurs to Rouillé, 2 September 1750, CP 123, f. 153-160, Archives Diplomatiques du Ministère des Affaires Étrangères (ADMAE), La Courneuve.

⁴³⁰ Puyieux to Desalleurs, 13 June 1751, CP 124, f. 240-241, ADMAE, La Courneuve; Desalleurs to Puyieux, 17 February 1752, SP 151, vol. 87, ADCN, Nantes; Interestingly, Dessaleur remarked that "the sciences themselves can cast suspicion on the savant," revealing the extent to which the strategies of dissimulation devised by statesmen were well-known to rival powers. [Les recherches de physique et d'histoire naturelle sont l'objet apparent de son voyage ... le caractère de médecin donneroit des facilités pour pénétrer dans le pays pour y contracter des habitudes et pour couvrir la recherche des connaissances politiques sur l'intérieur de la Turquie et de la Perse.]

naturalists since the botanist Joseph Pitton de Tournefort's (1656-1708) travels in the early eighteenth century. Natural historical investigations were, for the scientific community in Paris, far from being a mere pretext for political espionage and covert diplomatic wrangling.⁴³¹ Indeed, the imperatives of statecraft and natural history were not mutually exclusive, as Simon's instructions to send reports on commercially valuable plants, agricultural techniques and artisanal and industrial processes to Trudaine during his travels were part and parcel of the Bureau of Commerce's project of national competitive amelioration.

Multiple patrons and correspondents pressed upon Simon to take advantage of his covert diplomatic mission to gather natural historical observations and rare specimens during his travels in the Levant.⁴³² Among them was the Abbé Sauvages, who met Simon during his stay in Paris in 1750, and immediately attempted to enlist him in his program of sericultural research. Sauvages wrote to the intendant Jean Lenain to inform him of the "great advantages that many provinces, and Languedoc in particular, could draw from this expedition if M. Simon were charged to make and collect observations on silkworms in the regions where he will travel."⁴³³ Anxious that Simon would "neglect or forget entirely a commission that would come from myself alone," Sauvages asked that Le Nain

⁴³¹ This is clear from the instructions sent to Simon prior to his departure for the Levant: "Instruction donné à M. Simon allant en Perse," 19 June 1751, CP 7 f. 70-71, ADMAE, La Courneuve; Gharavi presents natural history as a mere pretext for diplomacy and espionage: Mohammad Gharavi, "Un médecin des Lumières: Simon de Vierville et son voyage en Perse," *Européens en Orient au XVIIIe siècle* (Paris: l'Harmattan, 1995), 35-155

⁴³² The duc d'Ayen, for instance, ordered Simon to collect plants and natural historical specimens for his cabinet and his botanical garden in Saint-Germain: Duc d'Ayen to Desalleurs, 2 June 1751, SP 151, ADCN, Nantes.

⁴³³ Sauvages to Le Nain, 26 May 1750, C/2235, ADH, Montpellier.

have the foreign minister Rouillé and Trudaine act as official correspondents on the subject.⁴³⁴ Simon thus became directly accountable to the Bureau of Commerce and the foreign ministry, which provided him with a questionnaire on silkworms and sericultural practices prepared by Sauvages.⁴³⁵ Simon was asked to identify and examine wild silkworms [*vers à soyes champêtres*], "submitted only to themselves and the laws of nature," and to report on the cultivation and use of wild silk by local inhabitants.⁴³⁶ He was also to examine the sericulture workshops and the silkworm rearing techniques used in the Levant, and to report on the most effective practices that could be imported in silk growing regions in France.⁴³⁷

Simon's travels through the Ottoman Empire and Persia took place within a dense network composed of French diplomats, merchants, travelling naturalists, and local notables, guides and interpreters. In Constantinople, Simon gathered news on the political situation in Persia from Armenian clergymen and local *dragomans* who also helped him improve his Turkish, and botanized with him in the surrounding countryside as recreation.⁴³⁸ In Aleppo, he bought antiquities from local merchants that he sent to the Duc d'Ayen, and he learned Arabic medical and natural historical terminology from a

⁴³⁴ Sauvages to Le Nain, 26 May 1750, C/2235, ADH, Montpellier.

⁴³⁵ Le Nain to Trudaine, 15 June 1750, F/12/1453B, ANF, Paris.

⁴³⁶ "Questions sur les vers à soye que M. Simon est prié de remplir sur les endroits de sa route où il aura occasion de voir et de connoître de près cet insecte," F/12/1453B, ANF, Paris.

⁴³⁷ "Questions sur les vers à soye que M. Simon est prié de remplir sur les endroits de sa route où il aura occasion de voir et de connoître de près cet insecte," F/12/1453B, ANF, Paris.

⁴³⁸ Simon to Desalleurs, 28 February 1752, SP 151 f. 16, ADCN, Nantes.

Turkish physician.⁴³⁹ In Smyrna, he visited the cabinet of the late Swedish naturalist Fredrik Hasselqvist, and was permitted by the keeper of the collection to send packets of seeds to the minister Comte d'Argenson.⁴⁴⁰ Simon also remained attentive to gathering useful knowledge about commercial crops and artisanal techniques for the Bureau of Commerce. In Bursa, Simon cured a local notable and his family of a sickness, and the latter thanked him by giving him a tour of apothecaries' shops and teaching him the method for making painted linens. The French diplomat Pesyonnell arranged for him to visit the estate of member of the Karasmanoglu family, a powerful landowning dynasty of the region, who instructed him on techniques of cotton cultivation and silkworm rearing.⁴⁴¹

Yet Simon ultimately proved to be a notoriously unreliable informant for the French administration. Desalleurs complained that he was wasting valuable resources buying antiquities for his patrons, and sternly reminded him of his obligations towards the Crown.⁴⁴² His increasingly erratic behavior began to worry the French administration by the beginning of 1753. After a fever-induced suicide attempt, several unauthorized transits into the interior provinces of the Ottoman Empire and a public conversion to Islam during an apparent fit of madness that nearly caused a riot outside the French Embassy, the French administration was ready to pull the plug on Simon's diplomatic mission. Yet Simon beat them to the punch by fleeing to Persia, abandoning his

⁴³⁹ Simon to Desalleurs, 6 October 1752, SP 151, f. 58, ADCN, Nantes.

⁴⁴⁰ Simon to Desalleurs, 12 April 1752, SP 151, f. 29-30, ADCN, Nantes.

⁴⁴¹ Simon to Desalleurs, 12 April 1752, SP 151, f. 29-30, ADCN, Nantes.

⁴⁴² Desalleur to Simon, n.d., SP 151 f. 109, ADCN, Nantes.

diplomatic contacts and leaving behind a host of unpaid creditors. It is unclear what became of Simon's sericultural investigations. At Desalleur's encouragement, he had begun to prepare a memoir on cotton cultivation and sericulture, although he himself deemed these to be "superfluous."⁴⁴³ Increasingly frustrated and overweighed by obligations towards his patrons, Simon instead chose to take up a position as a court physician in Persia, where he could dedicate himself entirely to medical practice and botanical research.

Père d'Incarville

China was the source of the most highly prized silk for textile manufacturers and consumers in the eighteenth century. French administrators and silk producers struggled for half a century to create an imitation *nanking silk* that could match the lustrous whiteness of the material produced in China. Attempts to naturalize Chinese silkworms in the south of France and to discover the secrets of Chinese sericulture were an integral part of the policy of import substitution and competitive amelioration pursued by the Bureau of Commerce and the intendancy of Languedoc in the second half of the eighteenth century.⁴⁴⁴ The Jesuit missionary-naturalist Pierre Nicolas Chéron d'Incarville (1706-

⁴⁴³ Simon to Desalleurs, 24 July 1752, SP 151, f. 49, ADCN, Nantes.

⁴⁴⁴ "Soyes de Nankin," 1764, F/12/1432B, ANF, Paris; "Lettres de M. Les Intendants des Provinces du Midi, de quelques inspecteurs de manufactures de soies et de plusieurs entrepreneurs de tirages et moulinsages de soies sur un projet de séparer les cocons blancs et de faire féconder la graine par des papillons blancs pour tirer de la soie blanche façon de nanquin," 1761-1783, F/12/1432B, ANF, Paris; "Inventaire des pièces du dossier concernant les essais de la soie blanche imitant la soie de Nankin," 1773-1777 F/12/1432B, ANF, Paris; "Le S. Béranger curé de Loriol en Dauphiné rend compte des expériences qu'il a faites de l'éducation des vers à soie dont la graine a été apportée de la Chine," 1780, F/12/1453A, ANF, Paris; Towards the end of the eighteenth century, chemists gradually replaced naturalists as advisors in state-directed attempts to produce imitation nanking silk: Pierre Poivre, "Procédé pour tirer la soie blanche à l'imitation de

1757), stationed in China from 1740 to 1757, became a regular correspondent of the Bureau of Commerce and the Académie des Sciences, sending reports to Trudaine and Bernard de Jussieu on local species of silkworms and on Chinese sericultural techniques.⁴⁴⁵ Incarville published little during his lifetime, and the bulk of the work he had prepared on Chinese sericulture was lost or dispersed following his premature death in 1757.⁴⁴⁶ Nevertheless, his correspondence and the manuscripts that he prepared for his patrons continued to circulate among savants well after his death.⁴⁴⁷ Sauvages himself does not seem to have corresponded directly with Incarville, but was able to consult the Jesuit's correspondence with Trudaine and with the *académiciens* Jean-Jacques d'Ourtau de Mairan and Bernard de Jussieu before the preparation of his treatise on sericulture.⁴⁴⁸

While in Canton, Incarville found his investigations obstructed by local authorities who restricted the travel of foreigners within the city and in the surrounding

celle de Nankin," 1766, F/12/1432B, ANF, Paris; "Rapport du S. Macquer sur le procédé de S. Villard pour le blanchiment," 29 September 1780, F/12/1453B, ANF, Paris.

⁴⁴⁵ "Catalogue alphabétique fait par le P. d'Incarville, Jésuite de plantes et drogues simples qu'il a vues en Chine, avec quelques observations qu'il a fait pendant 15 ans de séjour dans ce pays," MS Brequigny 2, f. 155, 162, 167, BnF, Paris.

⁴⁴⁶ See, however, a published letter sent from Incarville to the Royal Society of London, describing the use of wild silkworms - *kien tchou* - in Chinese silk production: Father d'Incarville "A Letter from Father d'Incarville, of the Society of Jesus, at Peking in China to the late Cromwell Mortimer," *Philosophical Transactions* 48 (1753-1754): 257-258.

⁴⁴⁷ Incarville's manuscripts and letters on silk were used, for instance, in the preparation of the *Mémoires concernant l'Histoire, Les sciences, les arts, les moeurs, les usages et des Chinois pars les Missionnaires de Peking*.

⁴⁴⁸ Abbé Boissier de Sauvages, *L'art D'élever Les Vers à Soie* (Nimes, 1788), 47-48; During his stay in Paris Sauvages also read the natural histories of Chinese silkworms compiled by Jesuit missionaries at the Bibliothèque Royale: Abbé Sauvages to Trudaine, 8 September 1750, F/12/1453B, ANF, Paris.

region, and by the local antipathy towards foreign missionaries.⁴⁴⁹ In Canton, Incarville wrote to Bernard de Jussieu, he had been forced to disguise himself as a layman in order to gain the trust of local authorities, seed-merchants and horticulturalists.⁴⁵⁰ Peking proved to be a less hostile environment, and Incarville was able to botanize in the mountains around the city and to develop contacts with local medical practitioners who acted as guides during these expeditions.⁴⁵¹ His grander strategy for tapping into the botanical wealth of the Qing Empire was to cultivate a personal relationship with the botanophile Qianlong emperor through gifts of plants collected from the Jardin des Plantes in Paris. Incarville outlined this plan to Jussieu in November of 1742:

If you can send me some seeds, onions etc. that we can present to the emperor, I will be able to make myself known as a *curieux des fleurs* and eventually as a botanist, this may give me the chance to see many plants that I will otherwise never be able to see ... the emperor only needs to give the word and in the same year every mandarin in the different provinces will send with great care all that his province yields.⁴⁵²

Incarville's strategy paid off, as he reported to Jussieu in October 1753 that the gifts of seeds and plants that had been sent from Paris to Peking for nearly a decade had built him a reputation as a *curieux de fleurs* at court and provided him with "free access to the

⁴⁴⁹ In 1724, Catholicism was proscribed in China, although Jesuit missionaries continued to find a place at Court. On the anti-missionary policies under the Qianlog Emperor: John W. Witek, "Catholic Missions and the Expansion of Christianity 1644-1800," *China and Maritime Europe, 1500-1800: Trade, Settlement, Diplomacy, and Missions*, ed. John E. Wills (Cambridge: Cambridge University Press, 2011), 172-177.

⁴⁵⁰ Incarville to Jussieu, 15 January 1741, Dossier Incarville, AAS, Paris.

⁴⁵¹ Incarville to Jussieu, 10 October 1743, Dossier Incarville, AAS, Paris.

⁴⁵² Incarville to Jussieu 17 November 1742, Dossier Incarville, AAS, Paris [Si vous pouviez m'envoyer quelques graines, oignons etc. que l'on pu présenter à l'empereur par là je pourrai me faire connaitre, du moins comme curieux de fleurs, et ensuite pour botaniste ce qui me donnerait peut être occasion de voir bien des plantes que je ne verrai]

emperor's gardens."⁴⁵³ Yet Incarville hoped that by continuing to build his standing at court he would become known as a botanist, rather than a mere *curioso*. Such a standing, he wrote to Jussieu, would give him the opportunity to botanize with court naturalists in the interior provinces and to discover plants that were not kept in the emperor's gardens.⁴⁵⁴

Among the many plant specimens that Incarville acquired for his garden in Peking were the *kien tchou*, *tcheou tchun*, *po lo chu* and the *fagava*, mulberry trees which Chinese farmers used to feed a species of wild silkworms. These plants may have come from the intendants and horticulturalists of the emperor's gardens, with whom Incarville maintained an increasingly close relationship as he established his position at court.⁴⁵⁵ Or, he may have simply acquired them from the local seed dealers whose shops he frequented or from peasants he encountered during his expeditions into the countryside. Incarville raised wild silkworms in his garden on each of these plant species in an attempt to determine which produced the highest quality silk, and he dutifully passed on his reports and samples of silk cocoons he raised to his correspondents in the Bureau of Commerce and at the Académie des Sciences.⁴⁵⁶ Incarville believed that the naturalization of Chinese species of wild silkworms and mulberry trees would revitalize the languishing silk French

⁴⁵³ Incarville to Jussieu, 26 October 1753, Dossier Incarville, AAS, Paris; On the role of Jesuit missionaries as courtiers in Peking, and the strategies used to integrate themselves at court see: Florence Hsia, *Sojourners in a Strange Land: Jesuits and their Scientific Missions in Late Imperial China* (Chicago: Chicago University Press, 2009); Bernard Brizay, *La France en Chine: Du XVIIe siècle à nos jours* (Paris: Perrin, 2013), ch. 4.

⁴⁵⁴ Incarville to Jussieu, 27 August 1753, Dossier Incarville, AAS, Paris.

⁴⁵⁵ Incarville to Jussieu, 27 August 1753, Dossier Incarville, AAS, Paris.

⁴⁵⁶ Incarville to Jussieu, 2 November 1750, Dossier Incarville, AAS, Paris.

silk industry, for as he wrote, "the printing of books on this matter increases every day, without increasing our production of cloth."⁴⁵⁷ To this end, he acted as a vital link in a global sericultural network that linked his garden in Peking, to administrative and scientific institutions in Paris, and ultimately to the estates of farmers in the Languedoc region. The seeds of the mulberry plants and the eggs of wild silkworms that he and other Jesuit missionaries in China sent to the *Jardins des Plantes* and the Bureau of Commerce would ultimately pass through the intendants office in Montpellier, to be distributed throughout the countryside in Languedoc.

Conclusion

Although enthusiasm for his sericultural research program had cooled considerably within the Bureau of Commerce by the end of the 1750s, Sauvages did not allow the vicissitudes of royal patronage to dampen his enthusiasm for sericulture. In the 1760s, he travelled to Italy, keeping detailed records of Florentine sericultural practices, and identifying a new variety of silkworm, the *tres volta*, that spun its cocoons ten days sooner than the *Bombyx mori*.⁴⁵⁸ While Sauvages' relations with royal officials seem to have deteriorated, he remained a public authority on sericultural matters within circles of agricultural improvers. In the late 1760s, when seigneurs in the province of Limousin

⁴⁵⁷ Incarville to Jussieu, 3 November 1751, Dossier Incarville, AAS, Paris.

⁴⁵⁸ Pierre Augustin Boissier de Sauvages to François Boissier de la Croix de Sauvages, 30 December 1763, NAF 18312, BnF, Paris.

looked to establish sericulture workshops on their domains, it was Sauvages that they called upon to assist them in their endeavours.⁴⁵⁹

In 1763, Sauvages published his *Mémoires sur l'Éducation des Vers à Soie*, a book that was intended to assist property owners and "intelligent amateurs" in the management of their sericulture workshops.⁴⁶⁰ The fruit of several decades of observations in "physics and natural history," this compilation of sericultural techniques would give landowners the power to better direct artisans under their employment, whose "laziness, vanity and pigheadedness" came at a great cost to men of property. Natural history, Sauvages reminded his readers, provided the foundation for the oeconomic management of rural estates. An enlightened understanding of the oeconomy of nature was fundamental for the proper stewardship of manorial resources. Sauvages repeatedly encouraged his readers to repeat his experiments, "worthy of the attention and zeal of every good patriot."⁴⁶¹

To reduce the craft of sericulture, shrouded in the secretive routines of *magnaniers*, into a collectively accessible science, "by the light of natural history." Such was the ambition of Sauvages' *Mémoires* and the dozens of books and articles published on the subject in France during the eighteenth-century.⁴⁶² As this chapter has demonstrated, natural history was envisioned by its practitioners not only as vital to the oeconomic management of private wealth but to the management of state resources. Natural history provided the backbone for patriotic projects of enlightened sericultural

⁴⁵⁹ Rodier to Joubert, 12 June 1769, C/8254, ADH, Montpellier.

⁴⁶⁰ Sauvages, *Mémoires*, xvi.

⁴⁶¹ Sauvages, *Mémoires*, 20.

⁴⁶² Bourde, *Agronomie et Agronomes*, vol. 1, 704-711.

reform, as the prudent management of the kingdom's resources came to be seen as inextricable from the careful scrutiny of the natural world. The inspector Buffel could dismiss sericultural improvers' "ostentatious patriotism" as self-serving attempts to garner favors and privileges from the royal administration, but "patriotism" was a powerful idiom that allowed practitioners of natural history to insert their activities within a broader field of civic-minded pursuits.⁴⁶³

Sericultural knowledge and natural specimens circulated, as we have seen, within an expansive communication network consisting of socially heterogeneous actors that connected silk-growing regions and administrative bodies in metropolitan France to far-flung localities in France's global commercial empire. International competition in the silk trade pushed naturalists, agricultural improvers, skilled artisans, state and colonial administrators, diplomats, and missionaries to invest significant time and resources into the study of silkworms. Their belief that a robust French sericulture industry could only be built on 'secrets' wrenched from careful observations of the natural oeconomy of these insects cemented the alliance between natural history, commerce and statecraft.

⁴⁶³ Buffel to Joubert, 17 January 1762, C/8248, ADH, Montpellier.

Part 2: Insects and Industry Before the Synthetic Age in Lower Languedoc

Chapter 4: Kermes Insects and the Rural Oeconomy of Languedoc

Introduction

Kermes oak (*quercus coccifera*), a prickly plant that takes the form of a small shrub or tree is regarded by plant geographers as typical vegetation of the chalky plateaus and hillsides known as *garrigues* in the South of France.⁴⁶⁴ A hardy plant that sprouts rapidly and in dense clusters, kermes oak proliferated in the Mediterranean scrublands as a result of the frequent pastoral fires that aided their reproduction.⁴⁶⁵ These plants derive their vernacular name from the parasitic scale insect that feeds on their sap - *kermes vermillio*.⁴⁶⁶ The adult females of these insects, which can contain up to 6500 eggs, fix themselves on the branches of the oak trees in the early spring and release their larvae between mid-May and mid-June.⁴⁶⁷ When the female insects are killed and dried before reproduction, their eggs and husks, known respectively as *pulpe de kermès* and *graine*

⁴⁶⁴ On the vegetation of the Languedocian garrigues see: Alfred Thomas Grove and Oliver Rackham, *The Nature of Mediterranean Europe: An Ecological History* (New Haven: Yale University Press, 2003), 48-56

⁴⁶⁵ Clément Martin, *La Garrigue et ses hommes: une société traditionnelle* (Montpellier: Espaces Sud, 1996). On the importance of fires to the management of pastoral spaces in the garrigues of Languedoc see: Le Collectif des Garrigues, *Atlas des garrigues regards croisés* (Prades-le-Lez: Éditions Écologistes de l'Euzière, 2013), 124-150.

⁴⁶⁶ A-S Balachowsky, "Le kermes des chênes en Europe et dans le bassin Méditerranéen," *Proceedings of the Eighth International Congress of Entomology* (Stockholm: Axel B. Elfstroms Boktryckeri ab, 1950): 739-754.

⁴⁶⁷ André Ucken and Jan Wouters, "The Coccid Insect Dyes: Historical, Geographical and Technical Data," *Bulletin de l'Institut Royal du Patrimoine Artistique* 22 (1988/1989): 212.

d'écarlate, yield a red substance that has been used as a source of natural crimson since classical Antiquity.⁴⁶⁸

The extensive use of kermes for dyeing silk and wool in Western Europe, can be dated back to the later Middle Ages, when crimson replaced purple as a sartorial signifier of power and elegance amongst the nobility and the clergy.⁴⁶⁹ In the medieval and early modern periods, kermes became a vital primary material for the textile industries in Provence, Languedoc and Catalonia. An enormous number of the insects were needed to dye cloth: between 1 million and 2 million were typically used to dye 25 kilograms of wool. As a result of the great value of these insects for the peasant household economy and for the textile industry, much effort was made by local and regional authorities to protect these insect populations from depletion by strictly regulating their collection and protecting their habitats. As Dominique Cardon has shown for the case of medieval Spain, municipalities in Valencia began to manage the long-term growth of kermes insect populations by regulating their collection in the *garrigues* in the thirteenth century.⁴⁷⁰ Although Mexican cochineal had largely supplanted kermes in the Spanish textile industry by the end of the seventeenth century, it remained an important natural resource

⁴⁶⁸ Bozena Lagowska and Katarzyna Golan, "Scale Insects/Hemiptera, Coccoidea/ as a Source of Natural Dye and Other Useful Substances," *Aphids and other Hemipterous insects* 15 (2011), 155.

⁴⁶⁹ John H. Munro, "The Medieval Scarlet and the Economics of Sartorial Splendor," in *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E.M. Carus-Wilson*, eds. N.B. Harte and K.G. Ponting (London: Heinemann, 1983), 13-70; Dominique Cardon, *Teintures précieuses de la Méditerranée* (Carcassonne: Musée des Beaux-Arts de Carcassonne, 1999), 30.

⁴⁷⁰ Dominique Cardon, "La garrigue le monde de l'écarlate," *Études Rurales* 151/152 (July-December 1999): 33-42.

in the south of France, one that rural communities and the royal administration sought to manage with great care well into the eighteenth century.

State-directed efforts to manage populations of kermes insects and their habitats in Languedoc can be dated back to the late seventeenth century, when fiscal-hungry administrators first began to note the insect's value in their surveys of the wealth of the province.⁴⁷¹ In his *Mémoires pour servir à l'histoire de Languedoc* (1696-1697), a report on the state of the province ordered by Louis XIV that circulated widely in manuscript form until its publication in 1734, the intendant Nicolas Lamoignon de Basville (1648-1724) underlined the importance of kermes insects to the textile industry in the province, while also taking note of the important annual revenues (50, 000 *livres* per annum) generated by the exports of a medicinal syrup, *sirop d'alkermes*, that apothecaries in Montpellier concocted with this insect.⁴⁷²

When the Regent Phillipe d'Orléans (1674-1723) launched a survey of the natural wealth of the kingdom in 1716, in an attempt to redress the lamentable state of royal finances bequeathed by Louis XIV and over two decades of uninterrupted warfare, Basville sent him samples of the insect while informing him of the seasonal periodicity of their reproduction and the locations of the most abundant harvests.⁴⁷³ Two apothecaries

⁴⁷¹ On the *enquêtes* of the late seventeenth and eighteenth century, see: Bertrand Gille, *Les sources statistiques de l'histoire de France: des enquêtes du XVIIe siècle à 1870* (Geneva: Droz, 1964), ch.1.

⁴⁷² Nicolas de Lamoignon de Basville, *Mémoires pour servir à l'histoire du Languedoc*. Edited by Françoise Moreil (Paris: CTHS, 1985), 253.

⁴⁷³ Basville to Phillipe d'Orléans, 27 August 1717, 16/9/m, AAS, Paris; On the regency survey, see the introduction in: Christiane Demeulenaere-Douyère and David J. Sturdy (eds) *L'Enquête du Régent, 1716-1718: Sciences, techniques et politique dans la France pré-industrielle* (Turnhout: Brepols, 2008).

from Montpellier also informed the Regent of the climactic factors affecting the reproduction of kermes insects, the average yields of kermes extracted from the *garrigues* of Languedoc, and the techniques used by peasants to collect and process the insects.⁴⁷⁴ Solicited by the Controller General Philibert Orry (1689-1747), administrators, dyers and apothecaries in Languedoc in the 1730s sent information about the annual prices and yields of kermes harvested in the province, as well as samples of the dried insects to Versailles. In turn, Orry had dyers at the Gobelins Manufactory conduct experiments with the insects to evaluate their tinctorial properties.⁴⁷⁵

Kermes insects also captivated the attention of academic naturalists in the opening decades of the eighteenth century: uncertainty about its vegetable or animal nature animated debates within the European natural historical community.⁴⁷⁶ At the Société Royale des Sciences de Montpellier, the naturalists Guillaume Nissole (1647-1734) and Antoine Gauteron (1660-1737) confirmed the findings of the Italian naturalists Antonio Vallisneri (1661-1730) and Giacinto Cestoni (1637-1718) that the organism was in fact an insect and not a seed or vegetative growth, through microscopic observation and chemical analysis.⁴⁷⁷ Naturalists were also drawn to the study of kermes insects as part of

⁴⁷⁴ "Mémoire du S. Durand," s.d [1717?], 16/10/d/iv, AAS, Paris; "Mémoire du frère Charles, capucin," s.d [1717?], 16/10/d/iii, AAS, Paris.

⁴⁷⁵ "Imbert à Fagon," 30 April 1731, C/5393, ADH, Montpellier; "Orry à Saint-Maurice," 14 October 1737, C/5393, ADH, Montpellier.

⁴⁷⁶ On these debates, see: Marc Ratcliff, *The Quest for the Invisible: Microscopy in the Enlightenment* (Burlington: Ashgate, 2009), 57-68.

⁴⁷⁷ Guillaume Nissole, "Dissertation botanique sur l'origine et la nature du kermes," *Mémoires de l'Académie des Sciences de Paris* (Paris: Imprimerie Royale, 1717), D 161, ADH, Montpellier; "Discours sur la nature du kermès, lu par M. Gauteron le 8 avril 1734," f. 98-107, D 161, ADH Montpellier; See also letters on the subject in "Recueil de

their efforts to assist state administrators in the territorial management of natural resources. For the Regency survey, René-Antoine Ferchault de Réaumur (1683-1757) and Jean-Paul Bignon (1662-1743) of the Académie des Sciences Royales de Paris prepared and annotated the questionnaires sent to correspondents in Languedoc about kermes insects, and observed samples of oak branches and insects sent to the Academy.⁴⁷⁸ Naturalists at the *Société Royale des Sciences de Montpellier* in the 1720s similarly called on its members to gather information on the geographical distribution, reproductive patterns and commercial uses of this valuable insect. In his proposals for a natural history of the province of Languedoc, a project supported by the Estates of Languedoc, the physician-naturalist Jean Astruc (1684-1766) called on the inhabitants of the province to provide "exact descriptions" of kermes and other insects that similarly yielded "substances useful to medicine and industry."⁴⁷⁹

lettres adressées à l'ancienne Société Royale de Montpellier et conserves par elle," no 8-10, MS 52, Bibliothèque Municipale de Montpellier.

⁴⁷⁸ "Extraits du mémoire sur le Languedoc rédigé par Lamoignon de Basville établis par Réaumur," 17/18/c, AAS, Paris; "Mémoire sur le kermès [de la main de Bignon]," "Demandes de renseignements par Réaumur," 18/15/d, AAS, Paris.

⁴⁷⁹ Jean Astruc, *Mémoire de la Société Royale des Sciences de Montpellier au sujet de l'Histoire naturelle de la province de Languedoc* (Montpellier: Jean Martel, 1737).

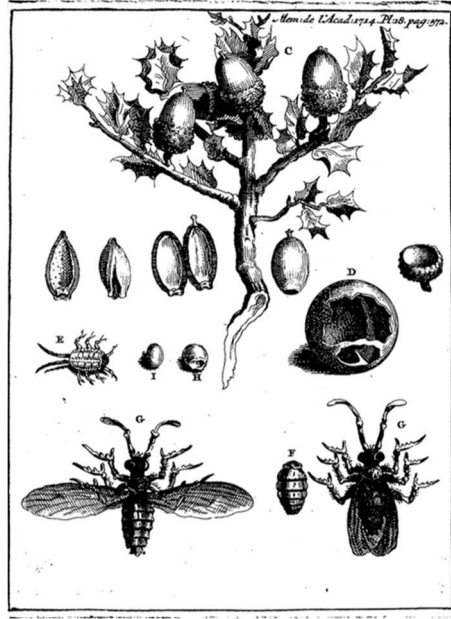


Figure 9. Engraving of kermes insects and kermes oak. Source: Guillaume Nissole, "Dissertation botanique sur l'origine et la nature du kermes," *Histoire de l'académie royale des sciences* (Amsterdam: Pierre de Coup, 1719), 572.

Observations of the lifecycles and reproductive patterns of kermes insects was not, however, exclusively the business of naturalists in scientific academies. Local officials in the province of Languedoc and the merchants, artisans and peasants who derived a portion of their livelihood from these insects, were keenly perceptive of the interactive relationships between these organisms and the socio-material environments of the *garrigues*. Indeed, it was through these actors that the royal administration first became conscious of the depletion of populations of kermes insects in Languedoc in the 1730s. The testimonies gathered by the intendant and his subdelegates on the growing scarcity of these insects invariably associated the decline of their reproductive rates with anthropogenic change in the *garrigues*. As historians have noted, the vegetation of these large swaths of uncultivated land, held for the most part in Languedoc by rural communities, and by the nobility that leased collective use rights to peasant communities, faced significant pressures from intensified human activity and animal grazing in the

eighteenth century.⁴⁸⁰ Kermes insects were particularly susceptible to increased anthropogenic pressure placed on the *garrigues*, as their host plant (kermes oak) was highly sought after as a source of fuel and by tanners for its tannin-rich bark and roots. Kermes insects became a casualty of the vegetative degradation that affected the *garrigues* of Languedoc in the eighteenth and nineteenth centuries, eventually disappearing completely from these environments.⁴⁸¹

This chapter examines the attempts of rural communities and the provincial administration of Languedoc to manage populations of kermes insects by enforcing a "sustainable" exploitation of the natural resources of the *garrigues*.⁴⁸² In a province of scarce arable land dominated by *petite culture*, the collection of spontaneous productions from the *garrigues* formed an important part of the subsistence strategies and market-oriented economic activities of the peasantry.⁴⁸³ Balancing competing demands to the

⁴⁸⁰ See: Peter McPhee, *Revolution and Environment in Southern France: Peasants, Lords and Murder in the Corbières, 1780-1830* (Oxford: Oxford University Press, 1999), ch. 1; Noëlle Plack, *Common Land, Wine and the French Revolution: Rural Society and Economy in Southern France, c. 1789-1820* (Farnham: Ashgate, 2009), ch.1; Sylvain Olivier, "Peasant property, common land and environment in the *garrigues* of the Languedoc from the seventeenth to the twenty-first centuries," in *Rural Societies and Environments at Risk. Ecology, Property Rights and Social Organisation in Fragile Areas*, edited by Bas van Bavel and Erik Thoen (*Middle Ages- Twentieth Century*) (Turnhout: Brepols, 2013), 85-110.

⁴⁸¹ On the extinction of insects species through the destruction of their habitats by human activity in the early modern period see: Paul C. Buckland and Pat E. Wagner, "Is there an insect signal for the 'Little Ice Age'?" *Climatic Change* 48 (2001): 137-149.

⁴⁸² On the early modern origins of the idea of "sustainability" see: Paul Warde, "The Invention of Sustainability," *Modern Intellectual History* 8, no. 1 (2011): 153-170.

⁴⁸³ André Fel, "Petite Culture 1750-1850," in *Themes in the Historical Geography of France*, ed. Hugh D. Clout (London: Academic Press, 1977), 215-245; Sylvain Olivier, "Rural Commons in Mediterranean France from the seventeenth to the twentieth centuries," *Jahrbuch für Geschichte des ländlichen Raumes* 12 (2015): 45-54; *Atlas des*

natural resources of the *garrigues* became fundamental to prevent the exhaustion of organisms like kermes insects that were integral to both the peasant household economy and the textile industries of Languedoc. Yet because the uses of kermes oak were so various – it was at once a source of fuel for households, bakers and workshops, a source of tannin for the leather industry, a nesting place for the partridges hunted by the nobility and the clergy, fodder for grazing animals at the sprouting stage, and, of course, a host-organism for kermes insects –regulating the use of this resource was bound to be fraught with complications.

The site of multiple and complex entanglements between humans, plants, animals and insects, the *garrigues* of Languedoc were perhaps unsurprisingly sites of significant social and ecological stress. The provincial administration's efforts to conserve kermes oak and its parasites can be seen as an attempt to engineer a stable balance between these social and material elements. In this chapter, I examine the shifting strategies of environmental management related to kermes insects and their host plants across the long eighteenth century (1670-1815) in southeastern France.⁴⁸⁴ Charting changing attitudes towards these organisms against a backdrop of mounting ecological pressures, global economic conjunctures, and contingent political events, I will show how the value, in economic and ecological terms, of this insect ebbed and flowed across this period.

Garrigues, 226-235; For the medieval period see: Aline Durand, *Les paysages médiévaux du Languedoc (Xe-XIIIe siècles)* (Toulouse: Presses universitaires du Mirail, 2003), 381-388.

⁴⁸⁴ On the environmental management of rural spaces in the South of France, see: Patrick Fournier, "Pour une histoire de l'aménagement des espaces ruraux." *Annales du Midi* 122, no. 2 (2010): 469-476.

"Un bénéfice que la providence leur envoi comme une manne": Kermes and the Rural Oeconomy of Languedoc

Peasant smallholders responded to the growing demand for kermes insects from apothecaries and textile producers in Languedoc and more distant markets by devoting an increasing proportion of their household labor to the collection and retailing of these precious insects.⁴⁸⁵ An important ancillary economic activity for rural families of meager means, the collection of kermes punctuated the seasonal rhythms of the agricultural calendar, typically occurring before the harvest in the late spring when the bodies of these parasitic insects had reached maturity.⁴⁸⁶ The seasonal harvest of kermes formed part of a broader range of peasant activities that utilized the labor of the family unit to ensure its reproduction and survival, and also to seize market opportunities for the enrichment of the household.⁴⁸⁷ Throughout the months of April and May, peasant women, accompanied by their children, made their way to the *garrigues* at dawn when the thorny leaves of kermes oak were softened with morning dew and could thus be handled with

⁴⁸⁵ On the market-oriented activities of peasant smallholders in the South of France see: P.M Jones, *Politics and Rural Society in the Southern Massif Central c. 1750-1880* (Cambridge: Cambridge University Press, 1983), 55-61; Stephen J. Miller, "The Economy of France in the Eighteenth and Nineteenth Centuries: Market Opportunity and Labour Productivity in Languedoc," *Rural History* 20, no. 1 (2009): 1-30; James Livesey, "Les Réseaux de Crédit en Languedoc au XVIIIe siècle," *Annales Historiques de la Révolution Française* 359, no. 1 (Janvier-Mars 2010): 29-51.

⁴⁸⁶ "Mémoire de Durand, sd [fin xvii]" in *L'enquête du Régent 1716-1718: Sciences, Techniques et Politique dans la France Pré-Industrielle*, eds. Christinae Demeulenaere-Douyère et David J. Sturdy (Turnhout: Brepols, 2008), 504.

⁴⁸⁷ On rural labor and the family unit during the ancient régime, see: Fabrice Boudrjaara (ed.) *Le travail et la famille en milieu rural XVIe-XXIe siècle* (Rennes: Presses Universitaires de Rennes, 2014).

greater ease.⁴⁸⁸ They then set to work filling wicker baskets or clay pots with the insects that they detached from the leaves of the shrub, using their fingernails that they expressly grew out for the purpose.⁴⁸⁹ The insects were then soaked in vinegar and set out dry in the sun, in order to prevent the hatching of the eggs contained in their bodies.

The harvest of kermes insects in Lower Languedoc was concentrated in the *garrigues* situated in proximity to the primary textile centers of the province: Carcassonne, Clermont-Lodève, Nîmes and Montpellier. A highly variable and complex set of juridical arrangements governed peasants' access to this resource. In the simplest cases, peasants possessed collective access rights to the *garrigues* that were under full possession of the community of their residence. In Gignac, where the harvest of kermes supplied the textile workshops of nearby Clermont-Lodève, peasant women collected the insect from communally owned hillsides covered in kermes-oak.⁴⁹⁰ Many rural communities, however, also possessed rights to collect kermes-insects and other products from the *garrigues* held by the nobility or clergy, in exchange for a payment of *redevance*. In Beauvoisin, south of Nîmes, and in Minerve, where one observer remarked that in the summer months, "the women spend all day gathering these insects for merchants in Béziers," the communities paid annual rents of 300 and 100 *livres* respectively to the local seigneur for the rights to collect products from the *garrigues*

⁴⁸⁸ Joseph Garidel, *Histoire des Plantes qui Naissent aux Environs d'Aix et dans plusieurs autres endroits de la province* (Aix: Joseph David, 1715), 249; Gustave Planchon, *Le kermès du chêne, aux points de vue zoologique, commercial et pharmaceutique* (Paris: Savy, 1864), ch. 2.

⁴⁸⁹ Garidel, *Histoire des Plantes*, 254.

⁴⁹⁰ "Mémoire sur la garouille," C/1995, ADH, Montpellier; "Visite et montrée du bois dont la coupe a été promise," 18 January 1745, Archives communales de Gignac, 114 EDT 192, ADH, Montpellier.

under his possession.⁴⁹¹ These collective use rights known as *droits de ceuillette*, often dated back to the later Middle Ages when the *castrum* of Lower Languedoc had been in a position of strength vis-à-vis seigneurs, and were jealously reaffirmed against seigniorial encroachment from the end of the seventeenth century onwards.⁴⁹²

The retailing of kermes insects occurred through a variety of different commercial arrangements. Apothecaries and textile producers could obtain their provisions directly at the source, paying peasant women for their yields at a set price per pound. In the commune of Gignac, for instance, women contracted with the director of a silk manufacture in the nearby town of Clermont-Lodève to sell their harvests of kermes at fifteen *sous* per pound.⁴⁹³ During the harvest months, women could be found selling their yields in the marketplaces of Nîmes, Narbonne, Montpellier and Béziers.⁴⁹⁴ Apothecaries and merchant druggists also carried on a second-hand trade in the substance, selling the refuse collected from the preparation of *sirap d'alkermes* to textile merchants and dyers.

A more elaborate system of retailing was developed by merchants in Béziers,

⁴⁹¹ De Murat à Bernage de Saint Maurice, Carcassone, 23 June 1731, C/5393, ADH, Montpellier; "Dénombrement des biens de la communauté de Beauvoisin," C/2983, f. 65-67, ADH, Montpellier; "Dénombrement des biens de la communauté de Minèrve," C/2987, f. 44-49, ADH, Montpellier.

⁴⁹² Anne Blanchard et Élie Pélaquier, "Biens communaux et droits de communautés de Languedoc dans le dénombrement de 1687," in *Libertés locales et vie municipale en Rouergue, Languedoc et Roussillon* (Montpellier: Maury, 1988), 159-168; Jean-François Lalanne, "Le droit au bois," in *Bois et forêts de l'Hérault* (Montpellier: Archives départementales de l'Hérault 1998): 69-72.

⁴⁹³ S. Bastizat, "Mémoire sur la garouille," 1744, C/11995, ADH, Montpellier.

⁴⁹⁴ "Mémoire de Durand," *L'enquête du Régent 1716-1718*, 504. Pierre Pomet, *Histoire générale des drogues traitant des plantes, des animaux, et des minéraux* (Paris: Loyson et Pillon, 1694), 37-38; "Mémoire du frère Charles, capucin," s.d. [1717?], *L'enquête du Régent 1716-1718*, 506-508; De Murat to Fagon, 23 Juin 1731, C/5393, ADH, Montpellier.

Carcassonne, Nîmes and Montpellier, who relied on commercial agents stationed in villages throughout the province to acquire large provisions of these insects, in order to retail the powder extracted from the husks on domestic and international markets, notably through the *foire de Beaucaire*, the great clearinghouse for Languedocian commercial products that connected the province to northwestern Europe and the Mediterranean.⁴⁹⁵

For provincial administrators, the harvest and trade of kermes was an important activity that stimulated both rural and urban productivity, allowing them to fulfill the interdependent political objectives of maintaining public welfare, increasing fiscal revenues and encouraging commercial prosperity. Administrators in Languedoc recognized that kermes insects were a vital source of subsistence for the rural poor and peasant smallholders. M. Tricon, a manufacturing inspector from Clermont-Lodève estimated that as much as 50 *livres* of supplemental income per family could be obtained from the sale of kermes in years where climatic conditions had been favorable to the proliferation of insects.⁴⁹⁶ The household revenue generated by this resource was a "great relief" to peasant households, "as much for the payment of their dues as for the purchase of *petites provisions* that they may lack."⁴⁹⁷ In the textile trade, kermes was an important

⁴⁹⁵ "Observations sur l'état des fabriques du Languedoc," 1732, C 5517, f. 23-24, ADH, Montpellier; De Murat à Bernage de Saint Maurice, Carcassonne 23 June 1731, C/5393, ADH, Montpellier; S. Bastizat, "Mémoire sur la garouille," 1744, C/11995, ADH, Montpellier; On the Beaucaire fairs see: Pierre Léon, "Vie et mort d'un grand marché international. La foire de Beaucaire (XVIIIe-XIXe siècles)," *Revue de géographie de Lyon* 28, no. 4 (1953): 309-328.

⁴⁹⁶ "Copie de la lettre écrite par M. Tricon à M. le Contrôleur Général," 2 September 1742, C/2229, ADH, Montpellier.

⁴⁹⁷ "Copie de la lettre écrite par M. Tricon à M. le Contrôleur Général," 2 September 1742, C/2229, ADH, Montpellier. [Ils vendent cette graine depuis 8 jusqu'à 18 s la livre ainsi quand la récolte est abondante ils gagnent 30, 40, jusqu'à 50 livres chacun. Ce petit

indigenous substitute for Spanish cochineal, a domesticated red dye producing parasitic insect that was harvested from cacti in Mexico and South America.⁴⁹⁸ Tricon informed the Controller General of Finances that the *graine de vermillion*, as kermes insects were known, allowed textile manufacturers in Languedoc to produce high quality crimson cloth that was cheaper and therefore more competitive on domestic and international markets than textiles dyed with cochineal.⁴⁹⁹

A key resource in the interdependent agrarian and manufacturing sectors of the Languedoc, kermes also became a source of conflict between various social groups within the province.⁵⁰⁰ Peasants faced obstructions from seigneurs who sought to limit communal access to the kermes oak trees on their property.⁵⁰¹ The manufacturing

bénéfice leur est d'une très grand soulagement tant pour payer les charges ordinaires que pour acheter les petites provisions qui leur manquent]

⁴⁹⁸ For an introduction to the abundant literature on the global trade in cochineal see: Raymond L. Lee, "American Cochineal in European Commerce," *Journal of Modern History* 23, no. 3 (September 1951): 205-224; Tarantola Giulia, "Cochenille et Indigo en Meso-Amérique," *Études Rurales* 151/152 (2000): 43-49; Jordan Kellman, "Nature, Networks and Testimony in the Colonial Atlantic: The Case of Cochineal," *Atlantic Studies* 7, no. 4 (2010): 373-395.

⁴⁹⁹ Tricon à M. le Controlleur général, 2 Septembre 1742, ADH, C/2229.

⁵⁰⁰ Conflicts emanating from rural communes' claims to access the forests on the lands of large landowners, seigneurs and religious communities were legion in the province of Languedoc: Gérard Gangneux, "Conflits pour les bois entre la commanderie de Montsaunes (Ordre de Malte) et les communautés d'habitants au XVIIIe siècle," in *La Forêt et l'Homme en Languedoc-Roussillon de l'Antiquité à nos jours* (Montpellier: Fédération historique du Languedoc méditerranéen et du Roussillon, 1984), 57-62; Yves Pourcher, "La forêt: espace global et espace conflictuel. La Lozère aux XVIIIe et XIXe siècles," in *La Forêt et l'Homme*, 96-106.

⁵⁰¹ Other important and contentious use-rights over privately owned land in the ancien régime included gleaning of grain and grapes and the pasture of cattle after the harvest (*vaine pâture* and *parcours*): Gérard Béaur, *Histoire agraire de la France: inerties et changements dans les campagnes françaises entre 1715 et 1815* (Paris: SEDES, 2000), ch. 3; Nadine Vivier, "The management and use of the commons in France in the

inspector Tricon complained in September 1742 that there was a shortage of kermes in Montpellier, because seigneurs in the region surrounding the city were prohibiting peasants from collecting these insects on their property. Under the "frivolous pretext" that this rural activity spoiled the hunt by destroying partridge nests, seigneurs deprived the poor of a "benefice that providence sends like manna."⁵⁰² The shortages that resulted from these prohibitions, moreover, caused "disturbances and considerable losses" to commerce and manufacturing in the province, as they forced textile producers to import kermes at great expense from Spain and the Barbary Coast.⁵⁰³ After receiving complaints from peasants in communities in the Diocese of Montpellier, the subdelegate Baudouin provided the intendant with the names of seigneurs who habitually used their *garde-chasses* to expel peasants who came to collect kermes on their property. Baudouin conceded that partridges, which laid their eggs at precisely the same time as the harvest of kermes, were "at the mercy of those who pick this grain."⁵⁰⁴ Yet he underlined that "the interest of seigneurs must not prevail over commercial interests," and advised the

eighteenth and nineteenth centuries," in *The Management of Common Lands in Northwestern Europe, 1500-1850*, eds. Martina de Moor and Leigh Shaw-Taylor (Turnhout: Brepols, 2002), 143-172. Jean-Marc Moriceau, "L'accès à l'herbe sous l'Ancien Régime: des compromis pastoraux impossibles," in *Temps et espaces des crises de l'environnement*, eds. Corinne Beck, Yves Luginbühi and Tatiana Muxart (Versailles: Quae, 2006), 37-56.

⁵⁰² "Copie de la lettre écrite par M. Tricon à M. le Controlleur Général," 2 September 1742, C/2229, ADH, Montpellier.

⁵⁰³ "Copie de la lettre écrite par M. Tricon à M. le Controlleur Général," 2 September 1742, C/2229, ADH, Montpellier.

⁵⁰⁴ Baudouin to Jean LeNain, 26 November 1742, C/2229, ADH, Montpellier.

intendant to draft an ordinance securing peasants right to access to private domains for the collection of kermes.⁵⁰⁵

Under pressure from rural communities, textile manufacturers and provincial subdelegates to curb the abusive exercise of seigniorial authority that was deemed contrary to the "*bien du commerce*," the intendant Jean Le Nain issued an ordinance in March 1744 that prohibited seigneurs from using their *garde-terres* and *garde-chasses* to obstruct the harvest of kermes under penalty of a fine of one hundred *livres*.⁵⁰⁶ The ordinance effectively formalized the legal status of kermes as a usufruct good, giving legal force to peasants' right to collect this insect on private domains adjacent to their commune of residence. Significantly, it gave individual peasants and rural communes recourse to the legal prosecution of seigneurs who obstructed the harvest of kermes.⁵⁰⁷ In one notable case, twelve women from the commune of Beauvoisin in the Diocese of Nîmes sought to bring a Cistercian monk from the abbey of Franquevaux to justice in the royal courts for having brutally expelled them from the domain while they were collecting kermes in the *bruyères* and *garrigues* on the monastery's property on tMay 25, 1750.⁵⁰⁸ The prior of the abbey, M. Bégiot, and his *garde-chasses* had violently struck the

⁵⁰⁵ Baudoin to Jean LeNain, 26 November 1742, C/2229, ADH, Montpellier. [La recherche de cette graine se fait précisément dans le temps de la ponte de perdrix. On comprend assez que les nids sont à la mercie de ceux qui ceillent cette graine. Mais l'intérêt des seigneurs ne doit pas prévaloir à l'utilité du commerce.]

⁵⁰⁶ "Ordonnance qui fait défenses aux garde-terres, garde-chasses et à tous autres d'empêcher les habitants des communautés de Languedoc de ramasser de la graine de vermillon sous peine de cent livres d'amende," 1744, C/2228, ADH, Montpellier.

⁵⁰⁷ "Ordonnance du 6 Mars 1744," C/11995, ADH, Montpellier.

⁵⁰⁸ The abbey of Franquevaux held property in the *costières* de Nîmes. In the Middle Ages, the rights to collect kermes insects were leased to apothecaries and druggists from Montpellier: "Privilèges accordés par Guillaume Belliard, abbaye de Franquevaux à des

women with their fists and the butts of their firearms, confiscated their baskets filled with kermes insects and their belongings, and detained them in the abbey before driving them off the property.⁵⁰⁹ In their *requête* to the intendant, the women called for Bégiot and his vassals to be punished for both violating the ordinance that granted peasants the right to collect *vermillon* in the *garrigue* of the abbey's domain, and for having used excessive force that had left several of them "bruised and bloodied."⁵¹⁰

Questioned by the subdelegate Timpié, Bégiot professed ignorance of the ordinance, claiming that by virtue of the abbey's legal privileges he believed it was within his right to prevent any individual outside the monastic community from entering the domain.⁵¹¹ To the intendant Imbert de Saint Paul, Bégiot explained that he had expelled the women because he believed they were responsible for the "continual degradation of the woods" and the "great destruction of the nests of partridges" on the property.⁵¹² As for his violent actions, Bégiot contended that they had been necessary to "intimidate" the mob of nearly two hundred "insolent" women who began to hurl insults and threatened to "throw themselves" upon him when he asked them to leave the

épiciers de Montpellier, d'acheter toute la graine de vermillon qui se recueille dans le monastère," 1280, H/36, Archives départementales du Gard (ADG), Nîmes; "Supplication à Monsieur Le Nain, Conseiller d'État Intendant en la province de Languedoc," 1750, C/2229, ADH, Montpellier.

⁵⁰⁹ "Supplication à Monsieur Le Nain, Conseiller d'État Intendant en la province de Languedoc," 1750, C/2229, ADH, Montpellier.

⁵¹⁰ "Supplication à Monsieur Le Nain, Conseiller d'État Intendant en la province de Languedoc," 1750. C/2229, ADH, Montpellier.

⁵¹¹ In canon law, an *exemption* established the independence of a religious community and its possessions from the neighboring diocese; Timpé to Imbert, 17 June 1750, C/2229, ADH, Montpellier.

⁵¹² S. Bégiot to Imbert de Saint Paul, 22 June 1750, C/2229, ADH, Montpellier.

property.⁵¹³ Imbert de Saint Paul ultimately spared Bégiot from legal prosecution, but warned him that he would not be as lenient if similar complaints were brought to his attention in the future.⁵¹⁴ The ordinance of March 1744, he reminded Bégiot, overrode the legal privileges of the monastic community: "No person can evade its execution."⁵¹⁵

The above case demonstrates the limits that the intendants of the Ancien Régime were willing to place on private land ownership and the legal system of privileges when the exercise of seigniorial authority was seen to infringe upon the collective welfare of the peasantry and the commercial prosperity of the province.⁵¹⁶ By attempting to secure peasants' usage rights over private domains for the collection of kermes, the royal administration also established stronger administrative control over the province and secured taxable revenue from the peasantry.⁵¹⁷ The intendants of Languedoc would face another challenge in attempting to regulate the collective exploitation of kermes oak in the *garrigues* held in common by peasant communities. Kermes oak became increasingly scarce in the first half of the eighteenth century, as the intensive economic exploitation of the *garrigues* caused a general degradation of the biodiversity of these environments.⁵¹⁸ Beginning in the 1740s, the provincial administration launched an effort to conserve

⁵¹³ S. Bégiot to Imbert de Saint Paul, 22 June 1750, C/2229, ADH, Montpellier.

⁵¹⁴ Imbert de Saint Paul to Bégiot, 22 June 1750, C/2229, ADH, Montpellier.

⁵¹⁵ Timpié to Imbert de Saint Paul, 17 June 1750. C/2229, ADH, Montpellier.

⁵¹⁶ Nadine Vivier, *Propriété collective et identité communale: les biens communaux en France, 1750-1914* (Paris: Publications de la Sorbonne, 1998), 25-29.

⁵¹⁷ Stephen Miller, "Lords, Peasant Communities and the State in Eighteenth-Century Languedoc," *French Historical Studies* 26, no. 1 (Winter 2003): 55-85.

⁵¹⁸ Sylvain Olivier, "Peasant Property, Common Land and Environment in the Garrigues of the Languedoc," 85-110.

kermes oak, as manufacturing inspectors and provincial subdelegates attributed increasing shortages of the vital insect to the progressive eradication of the shrub in the *garrigues* of Languedoc.

Kermes Oak: From Conservation to Clearance

A more intensive exploitation of wood resources in Languedoc followed from the rapid demographic growth of the first half of the eighteenth century in the province.⁵¹⁹ Deforestation was a source of concern for apothecaries and dyers who attributed the increasing scarcity of kermes insects to the excessive felling of kermes oak trees in the *garrigues* of Languedoc. M. Reboul, an apothecary from Carcassone, for instance, complained in the early 1740s that the "great destruction of the shrubs that produce the *graine de vermillon* in the *garrigues*" had made it impossible to obtain these insects for the preparation of the *opiate d'alkermes*.⁵²⁰ For many communities of Languedoc, kermes oak was an important available source of fuel for domestic and artisanal purposes, and the increase in the number of hearths and fuel-intensive metal and glass workshops in the province contributed to the growing scarcity of these trees.⁵²¹ The Montpellier physician

⁵¹⁹ Historians estimate an increase in population in the province from 1 200 000 to 1 700 000 between 1715 and 1789: Louis Dermigny, "De la Révocation à la Révolution," in *Histoire du Languedoc*, ed. Philippe Wolf (Toulouse: Privat, 1967), 355-436.

⁵²⁰ "Mémoire pour répondre aux difficultés qu'on peut faire à l'exécution de l'ordonnance portant défense de couper l'arbrisseau qui produit le vermillon," 1744, C/11995, ADH, Montpellier [J'ai demandé à M. Reboul, apothicaire de cette ville [Carcassone] dont il tirait le vermillon pour faire l'opiate d'alkermes. Il m'a répondu quatre fois. On lui apportait de La Grasse ou des environs de la graine de vermillon pour composer le remède qu'on ne voit pas depuis longtemps parce qu'on détruit depuis quelques années toutes ces garrigues ou sont les arbrisseaux qui la produisent.]

⁵²¹ M. Le Nain to Joubert, 14 June 1744, C/11995, ADH, Montpellier; Edward Allen, "Deforestation and Fuel Crisis in Pre-Revolutionary Languedoc, 1720-1789," *French*

Paul-Joseph Barthès (1734-1806) remarked that the demand for wood-fuel was continuously increasing, "by virtue of our luxury and *délicatesse*," leaving hillsides that were previously covered with kermes oak and other shrubbery bare of vegetation.⁵²² An intensification in pastoral uses of the *garrigues* also contributed to an important destruction of this valuable resource. Large quantities of kermes oak were destroyed when shepherds routinely set fire to the vegetation of the *garrigues* in order to clear pasture for their herds, a practice that proved difficult for the provincial administration to extinguish despite vigorous efforts to proscribe it.⁵²³ Goats were particularly destructive in this respect, preventing the regeneration of these plants after burning, by intensively feeding on the oaks at the sprouting stage.

Historical Studies 13, no. 4 (Fall 1984): 455-473; Michel Noël, *L'homme et la forêt en Languedoc Roussillon* (Perpignan: Presses Universitaires de Perpignan), 168-197; In the *Cahiers de Doléances* (see below) the proliferation of forges in the countryside was often singled out as a major cause of deforestation: Gilbert Larguier (ed.), *Cahiers de doléances Audois*. (Carcassonne: Association des amis des Archives de l'Aude, 1989), 209, 212, 214, 215.

⁵²² Barthès, "Mémoire sur le moyen d'augmenter la richesse réelles de l'état et en particulier celles de la province de Languedoc," f. 99-175, Recueil Poitevin, H 681, Bibliothèque Interuniversitaire de Médecine, Montpellier. [Combien ne devraient pas s'alarmer les méridionales, surtout la côte des provinces de Provence, de Languedoc et du Roussillon, en considérant que toutes trois n'ont que des clairières de bois de chauffage de chêne vert, de loin en loin sur quelques collines et vallées, la plupart affreuses dont les arbres sont rabougris, et que le besoin oblige chaque jour d'arracher et dont la consommation augmente en raison de notre luxe et de notre délicatesse.]

⁵²³ "Mémoire sur la Garouille," C/11195, ADH, Montpellier; "Défense de mettre le feu aux chaumes, haies, landes, buissons, bruyères, et garrigues à peine de punition corporelle," C/555, ADG, Nîmes; "Procès contre les incendiaires des garrigues de Nîmes." ADG, C/561; "Arrêt du Conseil interdisant les incendies des bruyères, landes et garrigues," 27 September 1756, C/5403, ADH, Montpellier.

Kermes oak was also heavily prized for its tannin-rich bark and roots that were essential for the preparation of leather hides.⁵²⁴ In the second half of the seventeenth century, the monarchy sold privileges granting monopoly rights on kermes oak bark (*rusques*) to merchants in the province of Languedoc. The merchant Jean de Brus, "bourgeois de Béziers," for instance, held exclusive commercial rights to the bark collected by peasants from kermes oak in the *garrigues* of the Diocese of Narbonne, and he used the royal courts to enforce his monopoly on this material.⁵²⁵ In 1670, however, Louis XIV, under the advice of Jean-Baptiste Colbert, revoked all existing monopolies on the bark in the provinces of Languedoc and Roussillon.⁵²⁶ These privileges were deemed to be a "considerable prejudice" to the poor of the province, as it forced them to sell the bark they collected in the *garrigues* at the exceedingly low prices set by monopoly-holders. The elimination of monopolies, which allowed all inhabitants of the province to engage in trade of the material, evidently stimulated an aggressive exploitation of the bark in Languedoc. By the 1720s, tanners in the province were facing a scarcity of the substance.⁵²⁷ Merchants in the commune of Lagrasse, as the wife of a tanner from

⁵²⁴ J.E. Bertrand, *Description des Arts et Métiers faites ou approuvées par messieurs de l'Académie des Sciences de Paris* (Neufchâtel: Imprimerie de la Société Typographique, 1775), 3: 33; "Exploitation des bois," *Bois et forêts de l'Hérault*, 47.

⁵²⁵ "Privilege exclusif accordé par le diocèse à Jean de Brus, bourgeois de Bezier d'acheter l'écorce de chêne qui sera enlevée dans les garrigues du diocèse," C/2324, Archives départementales de l'Aude (ADA), Carcassonne.

⁵²⁶ "Arrest du Conseil qui revoke la permission accordée au S. Pelaché de vendre luy seul des rusques et garouilles dans le Languedoc et Roussillon, 18 Décembre 1670," A/55, ADH, Montpellier.

⁵²⁷ "Arrest du Conseil d'Estat du Roy, portant défense de faire sortir du royaume des écorces d'arbres servant à faire le tan pour l'apprest des cuirs," 13 June 1720, A/192, ADH, Montpellier.

Carcassonne remarked to the manufacturing inspector M. Batizat in 1744, had grown wealthy stockpiling enormous quantities of kermes oak, and in the process had stripped the neighboring *garrigues* of this vegetation, to the point that there was now a "risk of destroying the species."⁵²⁸

Efforts to conserve kermes oak were underway in the 1730s, as seigneurs and rural communes sought to enforce a more prudent exploitation of collective resources in the *garrigues*. Seigneurs in the communes of Pradelles and Mèze, near Narbonne and Montpellier respectively, prohibited peasants from felling kermes oak and from tearing the bark and roots, fearing that the oak trees were "on the verge of being completely destroyed."⁵²⁹ In the 1740s, a number of alarming reports on the degradation of the vegetation in the *garrigues* convinced the Intendant of Languedoc Jean Le Nain that kermes oak needed royal protection from the inhabitants of the province, which had hitherto felled these trees "indiscriminately and without prudent management [*ménagement*]."⁵³⁰

In September 1744, an ordinance was issued that prohibited the felling, sale and storage of kermes oak, and made such acts punishable by fine, despite protests from

⁵²⁸ "Mémoire pour répondre aux difficultés qu'on peut faire à l'exécution de l'ordonnance portant deffences de couper l'arbrisseau qui produit le vermillion," 1744, C/11995, ADH, Montpellier [Cette demoiselle ne m'avait pas laissé ignorer qu'au sujet de cette écorce on détruisait les garrigues qui produit le vermillon et qu'on risquait d'en détruire l'espèce]

⁵²⁹ "Mémoire pour répondre aux difficultés qu'on peut faire à l'exécution de l'ordonnance portant deffences de couper l'arbrisseau qui produit le vermillion," 1744, C/11995, ADH, Montpellier.

⁵³⁰ Joubert à Le Nain, 10 Juin 1744, C/1195, ADH, Montpellier; Le Nain à Joubert, 14 Juin 1744, C/11195, ADH, Montpellier.

tanners that the law would be of great detriment to their trade.⁵³¹ The royal administration made this ordinance applicable to kermes oak on private land, fearing that seigneurs would simply uproot the trees on their property in order to deter peasants from trespassing on their estates.⁵³² Violations of the ordinance were to be punished by a fine of 25 *livres* (50 *livres* in case of second offences), half of which was to be redistributed to the poor. To encourage denunciations, the other portion of the fine was to be granted as a reward to individuals who provided information leading to convictions of delinquents. Finally, the consuls of villages responsible for the administration of adjacent *garrigues* were given the authority to search the shops of bakers, pottery-makers and other artisans suspected of purchasing and storing kermes oak as fuel for their ovens and kilns.⁵³³

These conservation efforts seem to have been partially informed by the existing work of academic naturalists on kermes insects. The intendant of Languedoc, for instance, had relevant excerpts from natural historical texts and papers read at the Société Royale de Montpellier copied out on slips of paper for his consultation.⁵³⁴ When a provincial subdelegate advised the intendant that, in order to prevent the decline of

⁵³¹ "Ordonnance qui fait défense à toutes personnes de couper à l'avenir aucun des arbrisseaux appelez vulgairement garouille, sous peine de ving-cinq livres d'amende," C/11995, ADH, Montpellier; Jean Le Nain, "Projet d'ordonnance concernant la graine de vermillon," C/1195, ADH, Montpellier

⁵³² "Mémoire sur la garouille," 1744, ADH C/11995. [Il n'est pas douteux que les seigneurs qui ont des garigues à eux et qui craignent que ceux qui vont ramasser la ditte graine ne gâtent les oeufs de perdrix ne manqueront pas de faire couper leurs garrigues pour prévenir cette crainte]

⁵³³ Jean Le Nain, "Projet d'ordonnance concernant la graine de vermillon," C/11995, ADH, Montpellier; In the south of France, *consul* was the name given to the elected member of a village responsible for the management of the commune.

⁵³⁴ "Kermes," nd. C/2229, ADH, Montpellier.

kermes insect populations, it ought to be only permissible to fell kermes oak trees that were over six years old, because the hardened bark of older trees could not be penetrated by the stingers of the insects that laid their eggs inside the branches, he cited the naturalist Guillaume Nissole's report in the *Académie Royal des Sciences* in support of his claim.⁵³⁵ This example points to the fact that an understanding the reproductive cycles of insects came to be seen by state administrators as vitally important for the proper management of the natural resources of the province.

The enforcement of the 1744 ordinance was left in the hands of the *maitres des eaux et forêts*, representatives of royal authority whose courts provided the first recourse for the adjudication of civil or criminal disputes relating to the use of forest resources on private domains or in the commons.⁵³⁶ The consuls of rural communities used these royal courts to enforce a proper management of the *garrigues* over which they held rights and, as in the case of kermes oak, to protect resources that were vital to the peasant economy from overexploitation and potential extinction.⁵³⁷ The records of these courts reveals a

⁵³⁵ "Mémoire pour répondre aux difficultés qu'on peut faire à l'exécution de l'ordonnance que Monseigneur l'Intendant a rendu le 18 Novembre 1744," C/11995, ADH, Montpellier [Il y aurait des tempéraments à prendre pour l'usage de la garouille, qui serait de couper que les arbrisseaux qui ont passé six ans qui, pour lors ne produisent point de vermillon à cause que l'insecte ou papillon qui le produit par sa pique ne peut pas pénétrer l'écorce de ces vieilles branches et si on voulait s'instruire de la façon que cela se produit M. Le Bon Pere PP a un recueil de discours de l'académie royale de l'année 1714 où l'on trouvera la dissertation que M. Nisolle en a donné, on verra par cette dissertation les avantages qui peuvent en revenir si on avait soin de bien conserver cet arbrisseau]

⁵³⁶ On the *maitres des eaux et forêts* in the diocese of Montpellier see: Anabelle Bestion, *Les Eaux et les Forêts: La Jurisprudence de la maîtrise particulière de Montpellier (1700-1729)* mémoire de DEA d'histoire du droit et des faits économiques, université de Montpellier I, 1997.

⁵³⁷ On the workings of municipal self-government in the Lower Languedoc see: George Fournier, *Démocratie et Vie Municipale en Languedoc du milieu du XVIIIe au début du XIXe siècle* (Toulouse: Les Amis des Archives de la Haute Garonne, 1994).

systematic pattern in the illicit trade of kermes oak in the years following the 1744 ordinance. In most cases, the guilty parties were landless laborers hired by artisans or merchants to surreptitiously procure this wood from communal forests.⁵³⁸ In June 1746, for instance, Antoine Peysson and Guillaume Saigné, two *journaliers* from the commune of Aniane, were interrogated by François Fabre, lieutenant of the *maitrise des eaux et forêts de Montpellier*, after a *garde des bois* had surprised them tearing the bark from kermes oak in a forest belonging to the commune.⁵³⁹ The interrogation revealed the complicity of Antoine Bonniol, a merchant-tanner from Aniane, who hired the two men, and a number of other landless laborers, to procure him the bark his tannery for 3 *sols* per day.⁵⁴⁰ Similarly, the 1747 prosecution of Guillaume Roucairol, a landless laborer from the commune of Gigean who was brought to trial for pilfering the woods of the commune, revealed that he was under the employment of a certain M. Vidal, a local baker.⁵⁴¹ Vidal admitted to regularly hiring *journaliers* to procure wood from the *garrigue* in Gignac, and a search of his bakery revealed a stockpile of fuel that included

⁵³⁸ The two examples cited below are drawn from a much wider sample of cases examined in the Archives départementales de l'Hérault and the Archives départementales de l'Aude: 5B/61-5B/76, 1746-1755, ADH, Montpellier; 63C/19, "Procès verbaux d'enregistrement." 1755-1774, ADA, Carcassonne.

⁵³⁹ "Requête et plainte pour le Sieur Plagnol contre Bonniol et autres," 29 June 1746. 5B 66/1747, ADH, Montpellier.

⁵⁴⁰ "Information faite pardevant nous François Fabre Lieutenant en la maitrise particulière des eaux et forêts de Montpellier," 5B 66/1747, ADH, Montpellier.

⁵⁴¹ "Claude Carenet contre Roucairol," 17 August 1754, 5B 75, 1754, ADH, Montpellier.

several bundles of kermes oak ("garouille") which, the consul noted in his report to the *maitre des eaux et forêts*, it was expressly prohibited to use as fuel in the province.⁵⁴²

The extensive deforestation and clearance of the commons that the royal administration sponsored in Languedoc beginning in the 1770s placed additional pressures on the wood resources of the *garrigues*.⁵⁴³ The land clearance edicts registered by the *Parlement* of Toulouse in September of 1770 granted fifteen-year tax exemptions to individuals who cleared uncultivated land in the province.⁵⁴⁴ Uncultivated land, or land that had been left uncultivated for forty years, was subject to appropriation and seizure by individuals who had their claims registered by the authorities.⁵⁴⁵ These edicts incentivized not only rich *laboureurs*, but also middling and poorer peasants, to clear and plant the *garrigues* with vines and wheat.⁵⁴⁶ In total, nearly 120,000 acres of common land in the province were authorized for clearance in the period between 1771 and 1787.⁵⁴⁷ The clearance of the *garrigues* Languedoc was part of a more general effort by the royal administration in the final decades of the Ancien Régime to enclose and

⁵⁴² "Rapport des Sieurs Palairac et Cambalerez pour la communauté de Gigean," 21 August 1754, 5B/75, ADH, Montpellier.

⁵⁴³ McPhee, *Revolution and Environment*, 21-24.

⁵⁴⁴ Émile Appolis, "Les biens communaux en Languedoc à la fin du XVIIIe siècle," in *Commission de recherche et de publication des documents relatifs à la vie économique de la Révolution française*, vol. 2 (Paris: Tepac, 1945), 371-397.

⁵⁴⁵ Déclaration du Roi concernant le défrichement en Languedoc 5 Juillet 1770," C/5403, ADH, Montpellier.

⁵⁴⁶ Noëlle Plack, "Agrarian Reform and Ecological Change during the Ancien Régime: Land Clearance, Peasants and Viticulture in the Province of Languedoc," *French Historical Studies* 19, no. 2 (2005): 189-210.

⁵⁴⁷ Peter McPhee, *Revolution and Environment*, 23; Plack, "Agrarian Reform," 198-199.

improve commonly held wasteland throughout the kingdom.⁵⁴⁸ Beginning in the 1760s, proponents of the "new agriculture" had launched an ideological assault, which found a receptive audience amongst reforming administrators, on all forms of collective property and collective use-rights.⁵⁴⁹

Yet the enclosure and clearance of the common wasteland did not go unopposed within the province of Languedoc. In a memorandum read at the *Société Royale des Sciences* in December 1777, the textile merchant Jacques-Antoine Mourgue deplored the neglect of the wooded resources in the *garrigues* of the province had left these spaces in a state of "abandon and decline."⁵⁵⁰ The *garrigues* were a potential source of "inexhaustible and always regenerating wealth," that, properly managed, could yield resources vital to "our daily needs, the sustenance of our industries and provide a considerable boon to

⁵⁴⁸ Henri Sée, "La mise en valeur des terres incultes. défrichements et dessèchements à la fin de l'ancien régime," *Revue d'Histoire Économique et Sociale* 11, no. 1 (1923): 62-81; Keith Sutton, "Reclamation of Wasteland During the Eighteenth and Nineteenth Centuries," in *Themes in the Historical Geography of France*, ed. Hugh Clout (London: Academic Press, 1977), 255-259.

⁵⁴⁹ March Bloch, "La lutte pour l'individualisme agraire dans la France du XVIIIe siècle," *Annales d'Histoire Économique et Sociale* 2, no. 7 (1930): 329-383; André Bourde, *Agronomie et Agronomes*, 557-573; P.M. Jones, *The Peasantry in the French Revolution* (Cambridge: Cambridge University Press, 1988), 17-19; Jean Gay, "Les physiocrates et les communes en France. Doctrines et projections administratives entre 1750 et 1789," *Il Pensiero Politico* 21, no. 2 (May 1988), 218-228; Nadine Vivier, *Propriété Collective*, 23-55;

⁵⁵⁰ Jacques-Antoine Mourgue, "Mémoire sur l'emploi utile des communaux," 1777, Recueil Poitevin, H 681, f. 470-478, Bibliothèque Interuniversitaire de Médecine, Montpellier [Tel est l'objet de ce mémoire où après avoir succinctement indiqué combien peu sont considérable le produit et l'usage de ces communaux, je me propose de démontrer combien il serait facile de les convertir en une source inépuisable de richesses toujours renaissante et qui, loin de diminuer nos autres revenus, ni de nuire aux autres objets de culture, seraient d'un secours naturel et inévitable pour l'augmentation des uns et des autres]

public and private revenues."⁵⁵¹ To this end, Mourgue called for a moratorium on the planting of vines in the *garrigues* and for one tenth of each plot of commonly held wasteland to be replanted with kermes oak, evergreen oak (*quercus ilex*), prized for its tannin-rich bark by tanners in Montpellier, and white oaks (*quercus robur*), whose solidity made it the wood of choice in the region for carpentry.⁵⁵²

In the 1780s, the subdelegates of the Intendant expressed repeated concern over the "fury" with which the inhabitants of the province were carrying out clearances in the commons.⁵⁵³ The subdelegate of Nîmes, M. Phéline, reminded the Intendant that the wood resources of the *garrigues* were "infinitely more precious" than the vines that had been planted in the hillsides around the city.⁵⁵⁴ What was worse, the "tremendous" wood-clearances carried out for the purpose of viticulture exposed these hills to severe soil erosion and sterility as rain carried the topsoil and left behind bare limestone. Phéline also blamed the depletion of wood resources on "greedy" peasants and woodsmen who tore out the shrubbery from the *garrigues* with billhooks in order to sell the roots to tanners. This vicious practice threatened to turn the *garrigues* into "useless and arid wastelands," and to deprive local artisans of a crucial source of fuel and vegetative materials for industrial processes. Municipal authorities in Portail-de-Corbières feared in turn that it

⁵⁵¹ Mourgue, "Mémoire sur l'emploi utile des communaux," f. 470.

⁵⁵² See another proposal for wood plantations proposed by Barthès at the Société Royale: Barthès, "Mémoire sur le moyen d'augmenter la richesse réelle," f. 99-175, Recueil Poitevin, H 681, Bibliothèque Interuniversitaire de Médecine, Montpellier.

⁵⁵³ Vital to Saint Priest, Mende, 24 Avril 1784. C/2838, ADH, Montpellier.

⁵⁵⁴ Phéline, "Mémoire sur les défrichements dans le diocèse de Nîmes," 1786. ADH C 2840.

would lead to the extinction of bees in the *garrigues* belonging to the community, as the shrubbery was deemed to be essential for the production of their "delicious and precious honey."⁵⁵⁵

Similar concerns about deforestation in Lower Languedoc were voiced in the *cahiers de doléances*, the list of grievances drawn up by members of the three Estates on the eve of the French Revolution.⁵⁵⁶ For many rural communities, the ineffectiveness of the royal system of forestry conservation was to blame.⁵⁵⁷ The inhabitants of Bézouze, near Nîmes, complained that their efforts to protect the evergreen oaks from pilferers in the *garrigue* belonging to the community were hampered by the "obstacles erected by the administration."⁵⁵⁸ Many pleaded for a stricter enforcement of conservation ordinances and an increase in personnel to that end.⁵⁵⁹ The consuls of Lédignan and Savignargues urged the royal administration to assign *gardes-forêts* to their community in order to prevent the habitual "pillage of the fruits and wood" in their *garrigues*.⁵⁶⁰ The overwhelming majority of rural communities in Lower Languedoc also called for a

⁵⁵⁵ Gilbert Larguier, *Cahiers de doléances audois*, 182

⁵⁵⁶ Michel Noël, *L'Homme et la forêt en Languedoc-Roussillon: histoire et économie des espaces boisés* (Perpignan: Presses universitaires de Perpignan, 1994), ch. 3

⁵⁵⁷ Édouard Bondurand (ed.) *Les cahiers de doléances de la sénéchaussée de Nîmes pour les États généraux de 1789: Département du Gard* (Nîmes: A. Chastanier, 1908-1909), 1: 268, 374-375; Jean-Pierre Donnadiou (ed.), *Cahiers de doléances des sénéchaussées de Béziers et Montpellier: procès-verbaux et cahiers de doléances* (Montpellier: Archives départementales de l'Hérault, 1989), 472.

⁵⁵⁸ *Les cahiers de doléances de la sénéchaussée de Nîmes pour les États Généraux de 1789* (Nîmes: A. Chastanier, 1908), 1: 127.

⁵⁵⁹ *Les cahiers de doléances de la sénéchaussée de Nîmes*, 1: 361-362, 436, 441, 455; 2: 277.

⁵⁶⁰ *Les cahiers de doléances de la sénéchaussée de Nîmes*, 1: 424; 2: 373.

revocation of the land-clearance edicts of 1770.⁵⁶¹ The clergy of Limoux spoke for many when they wrote that the "inconveniences caused by the clearances are much greater than its advantages."⁵⁶² Several municipalities echoed Mourges' earlier proposal in urging the royal administration to assist in the reconversion of deforested wasteland into wood-plantations.⁵⁶³

Kermes during the Revolutionary and Napoleonic periods

Despite mounting concerns about the depletion of the vegetation along the Mediterranean littoral, the progressive eradication of populations of kermes insects from the *garrigues* in Lower Languedoc elicited far less alarm in the final decades of the *ancien régime* than it had in the first half of the eighteenth century. In fact, kermes lost its crucial importance in the Languedoc textile industry over the course of the century, as Mexican cochineal progressively replaced it as the preferred source of red dye amongst textile producers.⁵⁶⁴ The royal administration encouraged the turn towards cochineal

⁵⁶¹ *Les cahiers de doléances de la sénéchaussée de Nîmes*, 1: 268, 455, 521; 2: 90, 210, 265, 342, 361-362, 598; *Cahiers de doléances des sénéchaussées de Béziers et Montpellier*, 248; Gilbert Larguier, *Cahiers de doléances Audois* 69, 167, 338.

⁵⁶² *Les cahiers de doléances audois*, 338.

⁵⁶³ *Les cahiers de doléances audois*, 18, 205.

⁵⁶⁴ For the early history of the cochineal trade see: Raymond Lee, "American Cochineal in European Commerce 1526-1625"; On the basis of chemical analyses of medieval and early modern dyed textiles, Judith Hofenk-Degraaf makes the rather exaggerated claim that "Mexican cochineal within fifty years of its introduction into Europe (c. 1520-1530) fully displaced kermes in scarlet textile dyeing." In the South of France, this does not seem to have occurred until the second half of the eighteenth-century: Judith Hofenk-Degraaf, "The Chemistry of Red Dye-Substances in Medieval and Early Modern Europe," in *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E.M. Carus-Wilson*, eds. N.B. Harte and K.G. Ponting (London: Heinemann, 1983), 75.

beginning in 1712, granting textile manufacturers who produced red cloth for the Levant an exemption from the *droits d'entrée* levied on imports of the insect.⁵⁶⁵ This measure was part of a broader effort to ensure the competitiveness of French cloth with Dutch and English exports in Levantine markets by guaranteeing superior quality.⁵⁶⁶ Textile manufactures acclaimed the insect for the unrivaled durability and depth of its colors. Widely reputed as a substance that yielded, as a manufacturing inspector in Languedoc put it, "the most handsome and striking color of all dyes," cochineal progressively supplanted kermes in the production of *écarlate* - the striking bright red cloth that was particularly sought after in the Levant.⁵⁶⁷ At the beginning of the nineteenth century, a member of the *Athénée des Arts, Sciences, Belles-Lettres et Industrie de Paris* reported

⁵⁶⁵ On the trade in textiles between Languedoc and the Levant see: Jean-Michel Minovez, *La Puissance du Midi: Drapiers et Draperies de Colbert à la Révolution* (Rennes: Presses Universitaires de Rennes, 2012), 115-117.

⁵⁶⁶ "Arrest du Conseil du Roy du troisième Decembre 1712, qui accord aux marchands fabriquans de draps destinez pour le Levant, la franchise des droits d'entrée qui se levent sur la cochenille, à concurrence de deux cens dix quintaux poids de marc," C/2228, ADH, Montpellier; On the administrative mechanisms for quality control of red cloth destined for the Levant see: Gilbert Buti, "Des goûts et des couleurs. Draps du Languedoc pour clientele Levantine au XVIIIe siècle," *Rives méditerranéennes* 29 (2008): 125-140.

⁵⁶⁷ "Mémoire sur les laines, sur la fabrication des draps et autres étoffes de Laine," 1775, C/5519, ADH, Montpellier [On ne s'en sert que très rarement dans ce pays, depuis qu'on a découvert la cochenille qui donne une écarlate plus vive et plus éclatante que celle que donne le kermès qui est plus foncé, et qui approche plus de la pourpe romaine] On the trade in cochineal and dyed cloth between Spanish America, Southern France and the Levant see: Gilbert Buti, "Marseille, la peninsule ibérique et les empires Américains (1659-1793): le soleil des profits se lève aussi à l'ouest," *Revue d'histoire maritime* 13 (2011): 211-232.

that kermes insects, previously employed for *écarlate* were now only employed in the production of *cramoisi* (dark crimson).⁵⁶⁸

Market incentives also pushed textile producers to turn towards cochineal. The efficient system of cochineal production put in place by the Spanish Crown in the Oaxaca region of Mexico from the sixteenth century to the end of the colonial regime made the insect a highly competitive alternative to European sources of red dye. At the onset of Spanish colonization, large numbers of Oaxaca peasants came to specialize in the cultivation of this indigenous domesticated insect on the Nopal cactus, allowing for an adaptive response to the sharp increase in international demand for red dyes in the eighteenth century.⁵⁶⁹ This labor-intensive system of cochineal cultivation, financed by Mexican merchants and encouraged by the Spanish monarchy, yielded ever-increasing quantities of cochineal at a cost that steadily declined throughout the century.⁵⁷⁰ In comparison, the supply of kermes insects spontaneously gathered by peasants in Mediterranean Europe, prone to disruption by climatic fluctuations, was irregular and costly. The naturalist Louis-Augustin Bosc d'Antic (1759-1828) remarked in the *Nouveau Cours Complet d'Agriculture* (1809) that kermes had been replaced by cochineal in the

⁵⁶⁸ "Rapport sur les expériences faites à Paris par M. Bressley relativement à la possibilité de la culture du Nopal et de l'éducation de la cochenille en France," F/10/209/B, ANF, Paris.

⁵⁶⁹ Carlos Marichal, "Mexican Cochineal and the European Demand for American Dyes, 1550-1850," in *Latin American Commodity Chains and the Building of the World Economy, 1500-2000*, ed. Steven Topik (Durham: Duke University Press, 2006), 76-92.

⁵⁷⁰ Louisa Schell Hoberman, *Mexico's Merchant Elite, 1590-1660: Silver, State and Society* (Durham: Duke University Press, 1991), 118-127; Jeremy Baskes, *Indians, Merchants and Markets: A Reinterpretation of the Repartimiento and Spanish-Indian Economic Relations in Colonial Oaxaca, 1750-1821* (Stanford: Stanford University Press, 2000), ch.2.

textile industry, because the harvest of this insect was "too difficult, or too long, and as a result too costly."⁵⁷¹ In Spain, Bosc d'Antic saw enormous quantities of kermes in the *garrigues* that went uncollected because the high-labor costs required for their harvest made them uncompetitive with Mexican cochineal.

The fact that textile manufacturers and dyers abandoned kermes insects in favor of Spanish cochineal elicited numerous complaints from 'patriotic' commentators, who feared that this dangerously exacerbated France's already worrisome commercial dependence on rival nations. In his *Essai sur l'art de la teinture et sur les moyens de la perfectionner* (1770), a work explicitly designed to "revive the use of indigenous productions in the dying industry," Placide Auguste Le Pileur d'Alpigny (?-1820) deplored that a frivolous "love of novelties" had given cochineal precedence in the textile trade.⁵⁷² The dependence on imports of cochineal had made France "tributary to the Spanish," and d'Alpigny urged the "patriots of Languedoc and Provence" to restore the indigenous kermes insect to its rightful place in the Southern textile industry.⁵⁷³

Efforts to naturalize cochineal and the Nopal cactus in France and its colonies in the final decades of the eighteenth century were also presented as an alternative solution

⁵⁷¹ Louis-Augustin Bosc d'Antic, "Cochenille," *Nouveau Cours Complet d'Agriculture Théorique et Pratique* (Paris: Déterville, 1809), 136-141.

⁵⁷² Pileur d'Alpigny, *Essai sur l'art de la teinture, et sur les moyens de la perfectionner. Avec des observations sur quelques matières qui y sont propres* (Paris: Costard 1774), 50-51 [La conquête de l'Amérique nous en a fait connaître deux [nouvelles substances à la teinture, la cochenille et l'indigo. L'amour de la nouveauté n'a pas manqué de leur faire donner la préférence sur le pastel, la garance et le chermès ... mon objet est donc de réveiller mes compatriotes sur l'emploi des substances indigènes propres à la teinture.]

⁵⁷³ Pileur d'Alpigny, *Essai sur l'art de la teinture*, 50, 117.

to the problem of commercial dependence. The naturalist and spy Thierry de Ménonville (1739-1780) famously smuggled samples of the insect from Mexico to Saint-Domingue in the 1770s with the intention of establishing cochineal plantations on the island, a project pursued by planters after his death in 1780.⁵⁷⁴ Agricultural improvers in the 1780s and 1790s also attempted to naturalize the Nopal cactus in Provence and Languedoc. A Provençal nobleman sought support from the *Bureau de Commerce* to establish a *nopalerie* on his estate, using contacts with merchants in Mexico and Cadiz to surreptitiously introduce the insect into the south of France.⁵⁷⁵ In Year II, a physician from Nîmes presented his plans to naturalize cochineal, (along with a number of other colonial products) in the "meridian soil of the Republic" to the Revolutionary *Commission d'Agriculture et des Arts*.⁵⁷⁶ In spite of these efforts to establish cochineal production on French soil, all of which seem to have failed, Spain was able to maintain its monopoly on cochineal production until Mexican independence in 1821.

The renewed interest in kermes insects reached its peak during the Napoleonic Wars, when Britain's maritime blockade (1806-1813) cut off French textile

⁵⁷⁴ Thierry de Ménonville, *Traité de la culture du nopal et de l'éducation de la cochenille dans les colonies françaises de l'Amérique, précédé d'un voyage à Guaxaca* (Cap-Français: Vve Herbault, 1786); "Rapport sur les expériences faites à Paris par M. Bressley relativement à la possibilité de la culture du nopal et de l'éducation de la cochenille en France," F/10/209/B, ANF, Paris.

⁵⁷⁵ "Le Sieur Conte, propose d'établir dans la partie méridionale de la Provence la cochenille et la plante qui le nourrit," 1779, F/10/258, ANF, Paris.

⁵⁷⁶ "Rapports et mémoires relatifs à l'agriculture adressés à la commission de l'agriculture des arts," 12 Nivose An II, L/1244, ADH, Montpellier

manufacturers from supplies of American cochineal.⁵⁷⁷ Naval warfare had periodically interrupted the cochineal trade between Spain and France during the eighteenth century. During the War of Austrian Succession (1740-1748) the British blockade of French ports had briefly forced merchants to use an overland route from Bayonne to supply textile manufacturers with cochineal.⁵⁷⁸ Yet the scale and length of the British blockade during the Napoleonic Wars, combined with Spanish colonists' siding with Britain against Napoleon during the Iberian insurrections in 1808, created an unprecedented shortage of the insect in France and Continental Europe. The loss of France's colonial empire during the French Revolution and the British blockade made the search for indigenous substitutes to colonial products a general matter of urgency for Napoleonic administrators, as Emma Spary has shown for the case of coffee and sugar.⁵⁷⁹ As an indigenous substitute for Spanish cochineal that had fallen into disuse, kermes insects gained new life as a substance that could shield textile manufacturers in Napoleonic France from ruin at the hands of its enemies and contribute to the construction of a vigorous and self-sufficient land-based empire.

⁵⁷⁷ On the economic consequences of the blockade see: François Crouzet, "Wars, Blockade and Economic Change in Europe, 1792-1815," *The Journal of Economic History* 24, no. 4 (December 1964): 567-588; Louis Bergeron, "Problèmes économiques de la France napoléonienne," *Revue d'histoire moderne et contemporaine* 17, no. 3 (Jul-Sept 1970): 468-505; Martin Lyons, *Napoleon Bonaparte and the Legacy of the French Revolution* (New York: St. Martin's Press, 1994), 265-270.

⁵⁷⁸ "Arrêt du Conseil d'etat du Roy du 26 Mars 1749, qui en révoquant l'arrêt du conseil du 19 Janvier 1745, ordonne qu'à l'avenir la cochenille qui viendra de Bayonne par terre, sera sujette à tous les droits dûs sur la route, comme avant le dit arrêt," 26 March 1749, C/2228, ADH, Montpellier.

⁵⁷⁹ Spary, *Feeding France*, ch. 8.

The Ministry of the Interior launched a campaign to promote the cultivation of kermes-insects in 1808, disseminating a circular authored by the naturalists Bosc d'Antic, Guillaume Antoine Olivier (1756-1814) and Henri-Alexandre Tessier (1741-1837) of the Société d'agriculture du département de la Seine.⁵⁸⁰ Noting that cochineal was becoming "rarer by the day through the effects of the maritime war," the three naturalists underlined the need to "recover from oblivion" a substance that could be gathered "spontaneously and without cultivation" in Languedoc, Provence, Roussillon and in the annexed Spanish, Italian and Greek territories of the Empire.⁵⁸¹ Cochineal's reputation as a dye of superior quality was ill founded, they wrote, as the red obtained from kermes was in reality more striking and brilliant than its American counterpart. The preference that textile manufacturers gave to cochineal was a result of its cheapness and abundance, not of its intrinsic properties. Unfortunately, the enormous quantities of cochineal dumped on European markets had made kermes a commodity of "extreme rarity"; peasants who had no longer been able to find ready buyers for these insects had long ceased to collect them. By disseminating instructions for the harvest of this insect to the *préfets* and mayors of communes in the south of France, the Société d'Agriculture hoped to regenerate trade in a substance that could become "as fertile a source of wealth as it was once." It was also

⁵⁸⁰ Reprinted in: Bosc d'Antic, "Note sur le kermès et instruction sur sa récolte. Rédigées d'après le vœux de la Société d'Agriculture du Département de la Seine, remises à S.E. le Ministre de l'intérieur et publiées par son ordre," *Annales de l'agriculture française* 34 (Paris: Huzard, 1808), 231-234; Olivier had previously deplored the neglect of kermes in the textile industry, and called for naturalists to identify other species of the same genus that might be usefully employed as dyes or medicine: Olivier, "Kermes," *Encyclopédie Méthodique. Histoire Naturelle des Insectes* (Paris: Baudoin 1801-1802), 418-436.

⁵⁸¹ "Note sur le kermès," 233. [Il est temps de retirer de l'oubli une substance qui vient spontanément et sans culture dans tout le midi de l'Europe, et qui peut être pour le Roussillon, le Languedoc, la Provence, l'Espagne, l'Italie, la Grèce, une source aussi féconde de richesses qu'elle l'a été autrefois.]

hoped that textile manufacturers would be motivated "by true patriotism" (if not by their own self-interest) to permanently replace cochineal with kermes in the production of red cloth.⁵⁸²

Agricultural improvers in the South of France also sought to regenerate trade in kermes insects. "There is no good Frenchman who must not seize every occasion to thwart the monopoly of the tyrant of the seas," the Arlesian cultivator Michel Truchet began his *Traité complet sur le kermes* (1811), "and to do so each must use the resources of our own soil in order substitute indigenous productions to those of America."⁵⁸³ In Provence, kermes had ceased to be employed in the textile industry not because its intrinsic qualities made it an inferior dye to cochineal, but because it could no longer satisfy commercial needs, having become a scarce commodity. Truchet attributed the scarcity of this insect to the failure of successive administrations to protect the wooded resources of the *garrigues* of southern Provence. In the Crau valley, kermes oak had nearly completely succumbed to the pastoral fires of "greedy and imprudent arsonists" who, after having cleared the vegetation from the *garrigues*, tore out the roots of these shrubs to sell to tanners.⁵⁸⁴ Truchet was appalled to see that this practice continued

⁵⁸² "Note sur le kermès," 233-234. [Il faut espérer aussi que nos fabricans, mûs autant par leur intérêt que par un vrai patriotisme, trouveront dorénavant dans le kermès une couleur pour le moins aussi belle et aussi durable que celle qu'il retiroient de la cochenille.]

⁵⁸³ Michel Truchet, *Traité complet du kermes, considéré sous un rapport nouveau relativement aux circonstances de sa vie et à sa propagation, à sa conservation et aux moyens de la rendre propre à remplacer la cochenille des îles* (Paris: Bertrand, 1811), 1. [Il n'est pas de bon Français qui ne doive saisir avec empressement toutes les occasions qui peuvent déjouer le monopole du tyran des mers.]

⁵⁸⁴ Truchet, *Traité Complet*, 87. [Croirait-on que malgré la nécessité bien reconnue de conserver les bois, on a vu, vers ces derniers temps, d'avidés et imprudents incendiaires, après avoir mis le feu aux touffes de chênes, sur pied, pour brûler les feuilles ou piquants, en arracher jusqu'aux racines qu'ils avaient l'impudence de venir vendre à la ville]

despite the fact kermes had become "invaluable since the maritime wars and the general blockade."⁵⁸⁵ By attributing the collapse of the trade in kermes insects to the depletion of the wood resources of the *garrigues* in Provence, Truchet underlined the environmental and social costs of decades of poor forestry management. The eradication of kermes oak and kermes insects from the *garrigues* of the Midi had forced the French textile industry to form dangerous ties of commercial dependence with rival nations that the blockade had thrown in sharp relief. While cochineal imports enriched enemy nations, women and children in the south of France were deprived of an activity that had previously provided a much-needed revenue to peasant households.

A more rigorous forestry administration, combined with a state-sponsored effort to repopulate the *garrigues* with kermes oak, provided a way out of this miserable situation. Truchet proposed that the state provide *gratifications* to cultivators in the Midi and in other departments of the Empire who planted kermes oak, as had been done for mulberry trees in the first half of the eighteenth century. Truchet also argued that a more intimate knowledge of the physiological processes underlying the reproduction and of kermes insects was necessary for re-launching trade in this commodity. The *Traité complet sur les kermes* provided a detailed set of instructions for cultivating kermes oak and for harvesting kermes insects, techniques that were based on Truchet's natural historical observations of these insects and on botanical experiments with kermes oak that he conducted on his property. The domestication of kermes insects was necessary for successfully re-populating the wooded environments of the Empire climatically susceptible to the harvest of this insect:

⁵⁸⁵ Truchet, "Notes relatives aux améliorations qui sont survenues en agriculture dans le territoire d'Arles," *Annales d'agriculture française*, 39 (1809), 234-273.

In the simple state of nature kermes insects find themselves exposed to all the vicissitudes of the seasons ... if man wants to overcome these limits, if he wants to multiply them according to the proportion of the needs of luxury, he must necessarily have recourse to industry to accomplish artificially what nature alone cannot.⁵⁸⁶

Just as Oaxaca peasants had domesticated cochineal centuries prior to the arrival of the Spanish, Truchet called upon *savants* and agricultural improvers to reclaim kermes insects from the spontaneous state of nature in order to lay the foundations of an indigenous supply of red dye that could break the monopoly of the "tyrant of the seas."⁵⁸⁷

Conclusion

Surveying the history of the trade in kermes-insects that had animated the Languedocian countryside in prior centuries, the Montpellier physician Gustave Planchon (1833-1900) marveled at the enormous quantities of kermes that were gathered every year in the *garrigues* of the south of France before the nineteenth century:

It is difficult to believe today that such abundant harvests ever occurred. In the areas previously known in particular for their abundance, Frontignan and Mireval, I only found small samples scattered here and there on the numerous *garouilles* of this warm region. It appears that these insects have diminished considerably in number although it is impossible to determine the cause.⁵⁸⁸

⁵⁸⁶ Truchet, *Traité sur le kermès*, 60-61. [Comme, dans l'état de simple nature, le kermès se trouve exposé à toutes les intempéries des saisons ... mais si l'homme veut outre-passer ces bornes, s'il veut le multiplier dans la proportion des besoins du luxe, il doit nécessairement recourir à l'industrie pour faire artificiellement ce que la nature n'a pas fait.]

⁵⁸⁷ Olivier, "Cochenille," 85-88.

⁵⁸⁸ Gustave Planchon, *Le kermès du chêne aux points de vue zoologique, commercial et pharmaceutique* (Paris: Savy), 1864, 34. [De nos jours, il paraît difficile qu'on ait jamais pu réaliser de pareilles récoltes. Dans les endroits particulièrement cités pour leur abondance, Frontignan et Mireval, je n'ai trouvé que des échantillons disséminés ça et là sur les nombreuses garouilles de cette chaude région. On dirait donc que l'insecte a diminué depuis le siècle dernier, sans qu'on puisse s'en expliquer la cause.]

Over a century later, in the spring of 1986, the Belgian entomologist André Verhecken scoured the *garrigues* of Catalonia and Southern France for samples of kermes insects, guided in his search by the historical literature. Several weeks of searching only yielded ninety specimens, in areas where "old texts state that one person could collect up to one kilogram per day."⁵⁸⁹

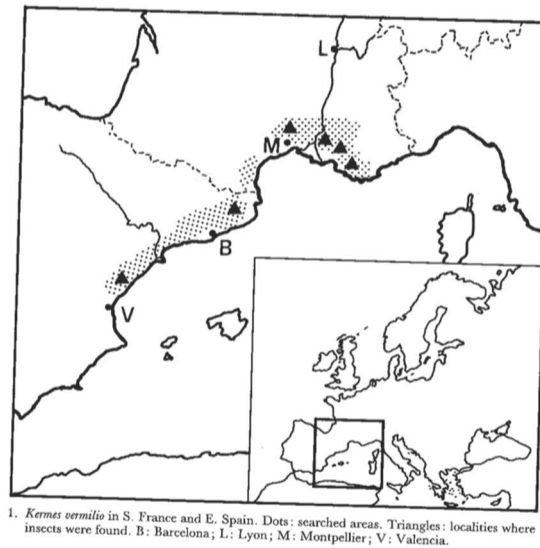


Figure 10. *Kermes Vermilio* in Southern France and Eastern Spain. Source: André Verhecken and Jan Wouters, "The Coccid Insect Dyes: Historical, Geographical and Technical Data," *Bulletin de l'Institut Royal du Patrimoine Artistique* 22 (1988/1989), 219

Why did populations of kermes insects in the Languedocian countryside enter a period of terminal decline from the end of the nineteenth century onwards? Verhecken suggests that air pollution, the great expansion of cultivated land since the Middle Ages, and the related increase in the frequency of summer bushfires in the *garrigues*, may have all contributed to the current scarcity of the species. This process of extinction must also be understood in relation to the complete displacement of kermes insects, first by

⁵⁸⁹ Verhecken, "Coccid Dyes," 218.

cochineal, and later by chemical dyes, in the textile industry. Kermes-oak, the host plant of these insects, far from being regarded as a valuable resource, as it was in the eighteenth century, is feared as parasitic vegetation that threatens biodiversity and the economic potential of the *garrigues*. At the beginning of the twentieth century the botanist Charles Flahaut singled out kermes-oak as "a great barrier and danger" to the prosperity of the Hérault department, as this *broussaille* [brush] competed with more valuable wood species that could be cultivated in the *garrigues*, and was a chief culprit in the extension of brush fires.⁵⁹⁰ From an object of state-sponsored conservation to an enemy of agricultural improvers, the value of kermes oak and its parasites, in economic and ecological terms, had declined precipitously between 1740 and 1920. Kermes insects were casualties of the profound changes in regional and global economic modes of productions that shaped the Languedocian countryside across this period.

⁵⁹⁰ Charles Flahaut, "La Mise en Valeur des Terres Pauvres par le Boisement," (1920), 7 M 232, ADH, Montpellier.

Part 3: Insect Pathogens in the Age of Global Commerce

Chapter 5: Policing the Oeconomy of Nature: The *oiseau martin* as an Instrument of Oeconomic Management in the French Maritime World

Introduction

Shortly after his arrival on the Isle de France (as the island of Mauritius was then called) in July of 1767, the newly appointed intendant Pierre Poivre (1719-1786) addressed a crowd of colonists gathered to meet him at the Hôtel du Gouvernement in Port Louis. While announcing his plans of administrative and agrarian reform for the colony, Poivre lamented that the productive potential of the island had been squandered through the mismanagement of his predecessors and the corrupt mores of the colonists that stood before him. The lure of the metropole, which had prevented colonists from adopting the island as their *patrie*, had led them to view it merely as a transitory passage point from which they could derive a quick fortune before returning to their homeland. Yet the promise of leisured retreat in the metropole was a chimera, Poivre informed the colonists, for property-holders in France – unlike those in the Isle de France - were besieged by a multitude of "impositions and onerous duties," continually harassed by "a horde of men more terrible in the countryside *than all the insects* which even in France are nearly as numerous as those of which you complain here."⁵⁹¹

For Poivre, tax collectors and insect pests were evidently contiguous phenomena, as both acted as a drain on the natural wealth that property owners derived from the fruits of the earth. Practitioners of the eighteenth-century art of resource management– or *oeconomie* – dealt not only in moral and political issues, as the above quotation suggests,

⁵⁹¹ Pierre Poivre, "Discours prononcé par P. Poivre, à son arrivée à l'Isle de France, aux habitants de la colonie assemblés au gouvernement," in *Les Oeuvres Complètes de Poivre* (Paris, 1797), 205, 207.

but also in matters of natural knowledge, all three of which were directed toward the mutually beneficial stewardship of both material and social resources. As the Swedish naturalist Carl Linneaus remarked, the "two pivots" on which the "science of oeconomy" turned were the knowledge of nature and the human-directed capacity to engineer its various elements towards a desired end.⁵⁹² The invasive insects that besieged the colonists of the Isle de France and its sister-colony the Isle de Bourbon (Réunion), and to which Poivre referred, were the target of a broad project of oeconomic reform pursued by administrators during the period of French colonial rule on the islands. This essay examines one component of that project, the introduction of the common mynah bird (*acridotheres tristis*) in the Isle de France and Isle de Bourbon as an oeconomic agent of biological pest control.

Native to India, China and Southeast Asia, the common mynah is a predatory insectivorous bird that has long played an important role in the protection of agriculture from insect pests in the region.⁵⁹³ In the middle of the eighteenth century the mynah bird followed the fate of a number of other plant and animal species that were spread across

⁵⁹² Carl Von Linné, "Principes de l'Oeconomie fondés sur la science naturelle et sur la physique," *Journal Oeconomique* 2 (May 1752), 40.

⁵⁹³ S. Thirumurthi, "Insectivorous Birds Associated with the Rice Ecosystem at Madurai India," *Journal of the Bombay Natural History Society* 78 (1981): 603-605; O.P. Singh and S.V. Dhamdhare, "Bird as enemies of rice grasshopper, Hieroglyphus banian Fabricius in Madhya Pradesh," *Bulletin of Entomology* 27 (1986): 185-186; G.V. Rao Ranga, V. Wightman, Rameshwar Rao, "Birds as Insect Control Agents in the Groundnut Crop," in *Symposium on Birds in Agricultural Ecosystems* (Rajendranagar: Society for Applied Ornithology, 1998), 79-84; Chris Feare and Adrian Craig, *Starlings and Mynahs* (Christopher Helm, London, 2010), 157-161; S.B. Shivankar, et al. "Role of Avian Community in Reduction of Spodoptera pest population in sugar beet at Pune," *Our Nature* 6 (2008): 19-25.

the globe during the age of European imperialism.⁵⁹⁴ Beginning in the 1750s, hundreds of mynah birds began to be shipped from French outposts in India and South East Asia to the Mascarene Islands in order to assist planters besieged by infestations of locusts. The locust itself had apparently been accidentally introduced in the 1740s, arriving aboard a shipment of food supplies sent by the Compagnie des Indes Orientales (CIO) for settlers of the islands. Like many other territories settled by Europeans in the eighteenth century, the environments of the Isle de France and Bourbon were profoundly shaped by the accidental and deliberate introduction of foreign biota.

The introduction of the mynah bird (or the *oiseau martin* as the French called it) to the Mascarene Islands was first proposed by Pierre Poivre himself, a former missionary, naturalist, CIO agent, and later, colonial administrator who travelled across the Indian Ocean in the 1740s and 1750s. Poivre is principally known by historians for his role in breaking the Dutch East India Company's monopoly on the spice trade through the transplantation of nutmeg and clove plants in the Isle de France.⁵⁹⁵ Far less attention has been given to other kinds of natural specimens – subsistence crops, domesticated and undomesticated animals – that Poivre introduced and naturalized in the Mascarene

⁵⁹⁴ Jacques Berlioz, *Oiseaux de la Réunion* (Paris: Larose, 1946); Raymond Decary, "Sur des Introductions Imprudentes d'Animaux aux Mascareignes et à Madagascar," *Bulletin du Muséum d'Histoire Naturelle d'Histoire Naturelle* 34 (1962): 404-407.

⁵⁹⁵ Madeleine Ly-Tio-Fane, *Mauritius and the Spice Trade: The Odyssey of Pierre Poivre*. (Port-Louis: Esclapon Limited, 1958); Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press, 1995), ch. 5; Emma Spary, "Of Nutmegs and Botanists: The Colonial Cultivation of Botanical Identity," in *Colonial Botany: Science, Commerce and Politics in the Early Modern World*, eds. Londa Shiebinger and Claudia Swan (Philadelphia: University of Pennsylvania Press, 2005), 196-201; Lissa Roberts, "'Le Centre de Tout les Choses': Constructing and Managing Centralization on the Isle de France," *History of Science* 52, no. 3 (2014): 319-342.

Islands during his residency as a CIO agent in the 1750s and during the period of his intendency from 1767 to 1772. Utilizing an intra-imperial network of actors positioned around the Indian Ocean – agents of the CIO, ship captains, colonial officials and itinerant naturalists – Poivre sought to reshape the natural oeconomies of the Mascarene Islands through the domestication of foreign fauna and flora. In part, these introductions were intended to address ecological disturbances, caused by global commerce, colonial expansion and settlement, which undermined the agricultural sustainability of the islands.⁵⁹⁶

Controlling insect invasions required that Poivre deploy his skills as a naturalist-administrator to restore equilibrium within the natural oeconomies of the islands. In his effort to rid the islands of locusts, Poivre mobilized a range of human and non-human actors to disrupt the reproductive cycles of these invasive insects, and he used his legislative powers as head of the "police" of the islands to engineer a stable ecological order in the colonies.⁵⁹⁷ The war on locusts that Poivre launched during his intendency

⁵⁹⁶ Here, I follow Fredrik Albritton Jonsson in using the word "ecology" and its cognates as a shorthand for eighteenth-century terms like "balance of nature" and "oeconomy of nature": see Frederik Albritton Jonsson, *Enlightenment's Frontier: The Scottish Highlands and the Origins of Environmentalism* (New Haven: Yale University Press, 2013), 300, footnote 9.

⁵⁹⁷ In eighteenth-century Europe the term "police" referred broadly to the maintenance of order and the proper functioning of the state. The objectives of the "bureau of police" thus extended well beyond the punishment of crimes, to include such tasks as the management of natural resources and subsistence. See: Kaplan, *Bread, Politics and Political Economy*; Marc Raeff, *The Well-Ordered Police State: Social and Institutional Change Through Law in the Germanies and Russia, 1600-1800* (New Haven: Yale University Press, 1983); Bernard Durand, "La Notion de Police en France du XVIe au XVIII siècle," in *Policey im Europa der Frühen Nuzeit*, ed. M Stolleis (Frankfurt am Main: Klostermann, 1996), 163-211; Andre Wakefield, *The Disordered Police State: German Cameralism as Science and Practice* (Chicago: Chicago University Press, 2009); Vincent Denis, "La circulation des savoirs policiers en Europe dans la seconde moitié du

formed part of a broader project of political oeconomic reform that was intended to transform the settlers of the islands from selfish, short-term profit seekers to patriotic colonist-citizens dedicated to the production of food crops; crop and moral growth would feed off each other in this productive cycle of oeconomic management. Attempts to reshape the physical order of the islands were continuous with attempts to refashion the moral and political order of the colonies, following the CIO's retrocession of the islands to the crown in the mid-1760s.

This chapter attempts to develop a historicized sense of the term "oeconomy" by demonstrating how Poivre and his contemporaries used interventions in the oeconomy of nature as a strategy for the oeconomic management of the islands' material and social resources. The reproductive cycles of insects, the feeding habits of exotic birds, agricultural yields and the moral constitution of human populations were all subjects that fell under the province of oeconomic practice in the eighteenth-century. As an instrument of oeconomic management, the *oiseau martin* became part of the socio-natural infrastructure of the islands built by the CIO and the colonial administration in the second half of the eighteenth-century. Like "oeconomy" itself, the *oiseau martin* served a dual purpose: to build and manage a socio-material environment organized to produce virtuous citizen-colonists and maximal yields of subsistence crops.

XVIIIe siècle" in *Les Circulations Internationales en Europe années 1680-années 1780*, eds. Pierre Yves Beaurepaire and Pierrick Pourchasse (Rennes: Presses Universitaires de Rennes, 2010), 213-224.

To speak of an insectivorous bird in such instrumentalized terms is to blur the boundary that is habitually erected between "nature" and "technology."⁵⁹⁸ Environmental historians and scholars in the field of Science and Technology Studies (STS), however, have recently argued that nature must be seen as a component of socio-technological systems.⁵⁹⁹ In this chapter, I view the introduction of the *oiseau martin* as part of the broader "infrastructural work" carried out by colonial administrators and CIO agents to increase agricultural production and to eliminate disruptive bits of nature that threatened the moral and material foundations of the colonies in the Mascarene Islands.⁶⁰⁰

Coordinating these hybrid infrastructural systems became a central concern for eighteenth-century naturalists like Pierre Poivre, whose self-fashioning as authoritative managers of the natural resources of expanding empires became an intrinsic element of their position as colonial administrators.⁶⁰¹ As they contended with a range of material and social factors that threatened the productivity of agrarian environments, naturalists'

⁵⁹⁸ Reuss and Cutcliffe (eds.) *The Illusory Boundary: Environment and Technology in History* (Charlottesville: University of Virginia Press, 2010); Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge: Harvard University Press, 2011).

⁵⁹⁹ Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995); Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal du Midi* (Princeton: Princeton University Press, 2009); Ashley Carse, "Nature as Infrastructure: Making and Managing the Panama Canal Watershed," *Social Studies of Science* 42, no. 4 (2012): 540-563.

⁶⁰⁰ On "infrastructural work" in the history of science, see: Geoffroy Bowker, *Science on the Run: Information Management and Industrial Geophysics at Schlumberger 1920-1940* (Cambridge: M.I.T Press, 1994); Roberts, "Le Centre de Toutes Choses".

⁶⁰¹ On naturalists and governance in the eighteenth century, see: Grove, *Green Imperialism*; Lisbet Koerner, *Linnaeus: Nature and Nation*; Spary, *Utopia's Garden*; John Gascoigne, *Joseph Banks and the English Enlightenment: Useful Knowledge and Polite Culture* (Cambridge: Cambridge University Press, 2003); Schiebinger and Swan (eds.) *Colonial Botany*; Jonsson, *Enlightenment's Frontier*.

authority in this period came to rest partly on their claims to understand and master the complex ecological interrelationships that sustained balance within the "oeconomy of nature."⁶⁰²

Richard Grove has shown that Poivre was a sensitive observer of environmental disturbances in his study of the forestry conservation policy that Poivre pursued in the late 1760s to counter the desiccation of the island caused by clear-cutting.⁶⁰³ For Grove, Poivre's understanding of an "essential interdependence" between man and nature, and his vision of a natural world sustained by balance and harmony, stemmed from the influence of physiocracy.⁶⁰⁴ While historians have recently shown that the principles of physiocracy were grounded in a belief in natural laws of equilibrium, there is no evidence that Poivre himself had any ties to the physiocratic school.⁶⁰⁵ Rather, Poivre was

⁶⁰² Camille Limoges, "Économie de la Nature et Idéologie Juridique Chez Linné," *Actes du XIIe Congrès International d'Histoire des Sciences* 9 (1971-1974): 25-30; Frank N. Egerton, "Changing Concepts of the Balance of Nature," *Quarterly Review of Biology* 48, no. 2 (1973): 322-350; Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1994); Koerner, *Linnaeus: Nature and Nation*; Jonsson, *Enlightenment's Frontier*.

⁶⁰³ Grove, *Green Imperialism*, ch. 5

⁶⁰⁴ Grove, *Green Imperialism*, 192.

⁶⁰⁵ Paul Christensen, "Fire, Motion and Productivity: the Proto-Energetics of Nature and Economy in François Quesnay," in *Natural Images in Economic Thought*, ed. Philip Mirowski (Cambridge: Cambridge University Press, 1994), 249-288; Spencer H. Banzhaf, "Productive Nature and the Net Product: Quesnay's Economies Animal and Political," *History of Political Economy* 32, no. 3 (2000): 517-551; Jessica Riskin, *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment* (Chicago: University of Chicago Press, 2002), ch. 4; Loïc Charles, "The Visual History of the *Tableau Économique*," *European Journal of the History of Economic Thought* 10, no. 4 (Winter 2003): 527-550; Schabas, *The Natural Origins of Economics*, ch.3; Liana Vardi, *The Physiocrats and the World of the Enlightenment*. Cambridge: Cambridge University Press, 2012.

celebrated as a precursor of physiocracy by the movement's major popularizer Pierre Samuel Du Pont de Nemours, who edited Poivre's works after his death and retroactively assimilated his thought and the legacy of his projects of agrarian reform to the physiocratic canon.⁶⁰⁶ Subsuming Poivre's ideological recourse to the natural world as a self-balancing system and his calls for interventionism that would restore this balance (a process he likened to a physician restoring the humoral balance within a sick body) within the doctrine of physiocracy is thus profoundly anachronistic.

The misguided, but persistent, conflation of Poivre's socio-natural interventions with physiocracy stems not only from the successful propagandistic efforts of self-proclaimed physiocrats like Du Pont de Nemours, but also from historians' tendency to assign priority to theoretical formulations and intellectual concepts, rather than to analyze the processes through which theorizing and its articulation are co-constructively linked with other practices. In historical accounts, physiocracy has often figured as the causal force behind oeconomic projects of agricultural improvement, botanical experimentation and acclimatization pursued by French naturalists in the period. Yet rather than seeing Poivre's interventions as directed by the theoretical presuppositions of physiocracy, it would perhaps be more accurate to say that various articulations of this economic doctrine were at least partially constituted by its proponents' selective appropriation and conceptualization of the practices of actors engaged in oeconomic pursuits. Rather than

⁶⁰⁶ George Weulersse, *Le Mouvement Physiocratique en France de 1756 à 1770* (Paris: La Haye, 1968) 1: 158-159, 249-250; Nevertheless, following Grove, historians have continued to describe Poivre as a "physiocratic naturalist." See: Spary, "Of Nutmegs and Botanists"; Jonsson, *Enlightenment's Frontier*, 123, 126. For the broader historiographical problem of subsuming various strands of eighteenth-century agrarian political economy into physiocracy see: Shovlin, *Political Economy of Virtue*; Vardi, *The Physiocrats and the World of the Enlightenment*.

attributing historical agency and analytical priority to intellectual concepts like physiocracy (or other economic systems like mercantilism and cameralism), this chapter instead seeks to understand the spatio-temporal specificity of Poivre and his collaborators' interventions, by examining the amalgam of conceptual tools, material practices and socio-moral aspirations that gave shape to their efforts to engineer new social and material environments.

Building the granary of the Indian Ocean

Following the retrocession of the Îles de France and Bourbon by the Compagnie des Indes in 1764, the royal administration envisioned a profound change in the function these colonies were to play within the French empire. The string of defeats in the international arena that France faced in the first half of the eighteenth century at the hands of its commercial rivals had given rise to a variety of proposals of agrarian-based reforms aimed at domestic and imperial regeneration.⁶⁰⁷ In this context, the islands became central to French ministers' attempts to maintain a national presence in the Indian Ocean following France's disastrous defeats at the hands of the British in the Seven Years' War (1756-1763).⁶⁰⁸ The promotion of subsistence crop agriculture in the Mascarene Islands

⁶⁰⁷ John Shovlin, *The Political Economy of Virtue: Luxury, Patriotism and the Origins of the French Revolution* (Ithaca: Cornell University Press, 2006); Paul Cheney, *Revolutionary Commerce: Globalization and the French Monarchy* (Cambridge: Harvard University Press, 2010); Sophus Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge: Harvard University Press, 2011); Pernille Røge, "A Natural Order of Empire: The Physiocratic Vision of Colonial France after the Seven Years' War," in *The Political Economy of Empire in the Early Modern World*, eds. Sophus Reinert and Pernille Røge (Basingstoke: Palgrave Macmillan, 2013), 32-52.

⁶⁰⁸ Madeleine Ly-Tio-Fane, "Premiers Projets d'Entrepôt à l'Île de France, 1766-1788," *Sociétés et Compagnies de Commerce en l'Orient et dans l'Océan Indien, Actes du*

became a crucial component of French geopolitical strategy in the region in the aftermath of the signing of the Treaty of Paris.⁶⁰⁹ By providing sustenance for troops stationed in their ports and in commercial and military outposts further afield, settlements in the Mascarene Islands were to become the centerpiece of the French military and commercial presence in the greater Indian Ocean.⁶¹⁰ Wheat and rice were to form the focus of productive activity on the Île de France and Bourbon, henceforth to be principally considered by administrators as subsistence colonies, while the spread of cash crop plantations was to be curtailed.⁶¹¹

In order to transform the islands into a granary for the Indian Ocean, the Foreign minister Étienne François de Choiseul (1719-1785) appointed his protégé Pierre Poivre as intendant of the Île de France and Île de Bourbon.⁶¹² Poivre was emblematically useful for the royal administration's project of agricultural reform. Not only was he highly

Congrès International d'Institut Maritime des Mascareignes (Paris: S.E.V.P. E. N, 1967), 487-498; Auguste Toussaint, *La Route des Îles, contribution à l'histoire maritime des Mascareignes* (Paris: S.E.V.P.E.N 1967), 487-498.

⁶⁰⁹ The Abbé Raynal provided a summary of the various and often conflicting agendas of company officials and state administrators in relation to the economic and political role that the islands were to play within the French empire in his *Histoire philosophique*: Guillaume-Thomas Raynal, *Histoire Philosophique et Politique des Établissements et du Commerce des Européens dans les deux Indes* (Genève, 1783), 2: 338-352.

⁶¹⁰ Ly-Tio-Fane, "Problèmes d'approvisionnement de l'Île de France au Temps de l'Intendant Poivre," 115; Louis Malleret, *Pierre Poivre* (Paris: École Française d'Extrême Orient, 1974), 349-374, 501-545.

⁶¹¹ "Mémoire du Roi pour servir d'instructions aux Sieurs Dumas, Commandant general, et Poivre, Commissaire general de la Marine, faisant fonction d'Intendant aux Isles de France et de Bourbon, 28 Novembre 1766," COL/C/4/17, f. 3-22, Archives Nationales d'Outre-Mer, Aix-en-Provence.

⁶¹² On Poivre's patronage connections see: Malleret, *Pierre Poivre*, 257-258; Spary, "Of Nutmegs and Botanists," 196-201.

regarded within circles of high-level administrators and *philosophes* for his botanical and horticultural expertise, but he also shared a public commitment to the platform of agriculture-based political oeconomy that was then favored by architects of colonial policy in the Indian Ocean like Choiseul.⁶¹³ Poivre's inaugural speech to the colonists of the islands demonstrated the convergence between ministerial will and his own ideological commitment to the principles of agrarian political oeconomy. He exhorted the colonists to be "carried by a patriotic emulation" and devote themselves to the production of subsistence crops, declaring that the "state has yet no need for coffee or cotton, the troops we will send to defend you cannot survive on these." The royal administration's turn to staple crop production, he announced, would usher in the beginning of a new agrarian and moral order in which "blind self-interest" would give way to patriotic devotion to the kingdom, securing the long-term prosperity and security of both the colonists and the French empire.⁶¹⁴

During the period of his intendency from 1767 to 1772, Poivre enacted a series of political, institutional, and infrastructural reforms that were meant to maximize the production of subsistence crops.⁶¹⁵ In order to entice colonists to devote themselves to the

⁶¹³ For Poivre's reputation as naturalist and political economist amongst *philosophes*: Yves Laissius, "Note sur les manuscrits de Pierre Poivre (1719-1786) conservés à la Bibliothèque Centrale du Muséum d'Histoire Naturelle," *Proceedings of the Royal Society of Arts and Sciences of Mauritius* 4 (1973): 31-56; Louis Malleret, *Pierre Poivre*, 223-266.

⁶¹⁴ Poivre, "Discours Prononcé par P. Poivre," 212, 214.

⁶¹⁵ Compare with strategies developed to address the problem of provisioning colonial populations in the French Antilles: Bertie Mandelblatt, "A Transatlantic Commodity: Irish Salt Beef in the French Atlantic World," *History Workshop Journal* 63 (2007): 18-47.

cultivation of wheat and rice, royal storehouses were established so that they could sell their excess grain at a fixed price.⁶¹⁶ Freedom of trade in agricultural goods within the India Ocean was granted to colonists to stimulate agricultural production.⁶¹⁷ Granaries were rebuilt, equipped with preservation technologies and closely monitored by inspectors to ensure that supplies of grain were being properly conserved.⁶¹⁸ Proposals were floated to establish a colonial Chamber of Agriculture, which would be composed of local naturalists and officials who would ensure the prosperity of agriculture.⁶¹⁹ Colonists were required to maintain a proportionate amount on their land concessions, previously granted "without discernment and oeconomy" by the Compagnie des Indes, for subsistence agriculture, commercial crops and trees.⁶²⁰ Poivre also attempted to introduce and breed new species of wheat and rice brought from Asia by travelling naturalists, using the existing infrastructure of botanical experimentation to acclimate these crops to the soil the Isle de France and Isle de Bourbon.⁶²¹

⁶¹⁶ "Fixation des Prix de Grains," COL/4/17, f. 84, ANOM, Aix-en-Provence; "Provisionnement des grains et des viandes," COL/C/4/25, f.55, ANOM, Aix-en-Provence.

⁶¹⁷ Poivre, "Discours," 200; "Liberté du Commerce," 1769, COL/C/4/25, f. 168, ANOM, Aix-en-Provence.

⁶¹⁸ "Greniers et Magasins," COL/C/4/18, f. 475, ANOM, Aix-en-Provence.

⁶¹⁹ "Mémoire sur la subsistence des troupes et des escadres," COL/C/4/25, f. 171, ANOM, Aix-en-Provence; "Chambre d'agriculture proposée," COL/C/4/153, ANOM, Aix-en-Provence.

⁶²⁰ "Situation de l'Isle relativement à la culture, COL/C/4/25, f. 40, ANOM, Aix-en-Provence; "Concessions," COL/C/4/29, f. 43, ANOM, Aix-en-Provence.

⁶²¹ Poivre's horticultural experiments with wheat and rice in the islands dated back to his time as an agent of the Compagnie des Indes in the 1740s and 1750s: "Relation abrégée des voyages faits par le Sieur Poivre pour le service de la Compagnie des Indes de 1748,"

Yet various obstacles presented themselves to this agriculture-based platform of economic reform. Chief among these, according to Poivre, were the *moeurs* of the colonists themselves. Their lack of patriotic attachment to the islands had created an itinerant population of fortune seekers who sought to turn a quick profit rather than to settle and cultivate the land. Colonists "wandered from project to project," cultivating coffee, cotton, sugar cane, pepper, cinnamon, mulberry trees, tea and cacao, rather than ensuring that the colony produced adequate levels of food provisions.⁶²² Complaining about the "indifference" of the colonists for agriculture, Poivre remarked:

there is not one colonist on this island who is determined to spend more than ten years here, it is this inconstancy, and this invincible love for the country where he is born that makes the Frenchman so unsuitable for establishing solid colonies.⁶²³

In order for agriculture to succeed in the Isle de France, the inhabitants would have to "begin to regard this island as their *patrie*."⁶²⁴ The vicissitudes of patronage and ideological conflicts with the colonial administration also produced wavering levels of

MS. 319, f. 17-21, BCMNHN, Paris; Pierre Poivre "Suite des Observations sur l'État de l'Agriculture," in *Les Oeuvres Complètes de Poivre* (Paris, 1797), 148; "Mémoire du S. Cossigny," COL/C/4/153, ANOM, Aix-en-Provence; "Abbé Gallois à M. Dubucq," COL E/197, f. 12-13, ANOM, Aix-en-Provence; Lissa Roberts, "Le Centre de Toutes Choses."

⁶²² "État des Cultures et de l'élevage," MS 89, no. 40, Service Historique de la Défense, Département Marine, Brest.

⁶²³ "Seconde expédition aux isles Philippines et aux Molluques," COL C/4/29, f. 18, ANOM, Aix-en-Provence; See also his complaint on the lack of patriotism of the colonists in the "Discours," p. 204. [Je connais à peine un ou deux colons dans cette isle qui soient déterminés à y passer encore dix années. C'est cette inconstance et cet amour invincible pour le pays où le français est né qui le rend si peu propre à établir des colonies cultivés.]

⁶²⁴ "Mémoire," COL/C/4/17, f. 143, ANOM, Aix-en-Provence.

official support for projects to turn cultivation in the islands towards subsistence crops.⁶²⁵ Poivre repeatedly clashed with the Governors of the islands whom he accused of actively thwarting his project of agrarian reform by delegating excessive authority to military commanders who had no inclination or capacity to encourage agricultural production. Amongst these "tartarized Frenchmen," Poivre lamented in a letter to the minister of the Marine, "I have only been able to maintain a germ of emulation for agriculture."⁶²⁶

Agricultural Disasters and Biological Invasions in the Isle de France and Isle de Bourbon

Nature also acted as an obstacle to the ambitions of Poivre and administrators to transform the islands into a granary for France's commercial empire in the Indian Ocean. While the Isle de France and Isle de Bourbon were constantly praised for their remarkable fertility, agricultural blights constantly acted as "contradictions" to this fecundity, and exerted a powerful check on the natural fertility of the soil.⁶²⁷ Hurricanes and droughts periodically wiped out crops causing substantial distress to planters and widespread famines.⁶²⁸ Invasions of biological species introduced to the island

⁶²⁵ Ly-Tio-Fane, "Problèmes d'Approvisionnement," 111-112.

⁶²⁶ "Extrait d'une Lettre de M. Poivre," COL/C4/27, f. 53, ANOM, Aix-en-Provence.

⁶²⁷ Poivre, for instance, remarked that "nature is in general more fertile here than it is in Europe," the "soil is in one of the most fertile that may be found in all the world": "Forges de l'Isle," COL/C/4/18, f. 398, ANOM, Aix-en-Provence; "Mémoire sur l'Isle de France," COL/C/4/27, f. 252, ANOM, Aix-en-Provence. [Quoique l'on ne puisse disconvenir que le sol de l'Isle de France ne soit un des plus fertile qu'il y ait au monde on serait dans l'erreur si on croyait qu'il suffit de semer dans ce sol si fertile pour en tirer des moissons abondantes ... l'agriculture y éprouve quelquefois des contradictions qui ruinent tous les espérances des cultivateurs.]

⁶²⁸ "Mémoire sur les Isles de France et de Bourbon," ANOM COL/C/153; "Mémoires sur l'agriculture et sur les muscades à messieurs de l'Académie de Bordeaux, réponse aux

environments by travellers and colonists also greatly strained agricultural production in the colonies.⁶²⁹ Monkeys, rumored to have been first brought as pets by Portuguese settlers, caused great damage to wheat and corn plantations.⁶³⁰ Henri-Bernadin de St-Pierre, who reckoned that Europeans had brought to the islands "more pains than nature itself has put here," listed parasitic grasses, rats and grain-eating birds, initially brought as curiosities by colonists from the Cape of Good Hope, India, Java and China, as some of the scourges unintentionally introduced to the Isle de France and Isle de Bourbon.⁶³¹

Locusts, however, were by far the most destructive invasive species introduced to the islands.⁶³² Poivre recounted that this insect was "not natural" to the islands, but had

demandes contenues dans le mémoire envoyé au S. Le Juge concernant l'histoire naturelle de l'Isle de France," ANOM COL C/4/9; "Tableau raisonné d'agriculture," ANOM COL/C/4/17, f. 154-159; Richard Grove has shown that droughts were attributed by Poivre and his contemporaries to climatic changes resulting from deforestation: Grove, *Green Imperialism*, ch. 5.

⁶²⁹ "Amélioration de l'agriculture," COL/C/4/18, f. 412, ANOM, Aix-en-Provence.

⁶³⁰ Nicholas Louis de Lacaille, *Journal Historique du Voyage Fait au Cap de Bonne-Espérance par feu M. l'Abbé de La Caille* (Paris: Guilllyn, 1763), 216, 231; Jean-Baptiste-Christian Fusée Aublet, *Histoire des Plantes de la Guiane Française, rangées avec la méthode sexuelle, avec plusieurs mémoires sur différens objets intéressans, relatifs à la culture et au commerce de la Guiane Française, et une notice des plantes de l'Isle-de-France* (London: P-F Didot, 1775), 137.

⁶³¹ Henri-Bernadin de St-Pierre, *Voyage à L'Isle de France, à l'Isle de France, à l'Isle de Bourbon, au Cap de Bonne Espérance, avec des observations nouvelles sur la nature et sur les hommes* (Amsterdam, 1773), 122, 124, 243-244; On the introduction of harmful birds to the islands see: Guillaume Joseph Hyancinthe Jean-Baptiste Le Gentil, *Voyage dans les Mers de l'Inde à l'occasion du passage de Vénus sur le disque du soleil* (Paris: Imprimerie Royale, 1781), 2: 676; Pierre Sonnerat, *Voyage Aux Indes Orientales et à la Chine Fait par Ordre du Roi depuis 1773 jusqu'en 1781* (Paris, 1782), 364; "Observations sur le climat et la nature de l'Isle de France," MS 299, BCMHN, Paris; "Fléaux d'agriculture," COL/C/4/27, f. 252, ANOM, Aix-en-Provence.

⁶³² Insect pests also attacked the coffee and spice plants on the islands: M. de Ballade to M. David, 2 November 1747, COL/C/3/9, f. 18, 67, ANOM, Aix-en-Provence;

been accidentally introduced in the 1740s during the governorship of Mahé de la Bourdonnais, arriving in shipments of hay or crops from Madagascar.⁶³³ Environmental conditions on the islands, as colonists, travellers, naturalists, and officials remarked, had proven favorable to the reproduction of this insect. Esquine, a "terrible weed" that colonists had tried to extirpate from the islands since the 1750s, was identified as a "favorable pasture for these newly hatched insects."⁶³⁴ Henri-Bernadin de St-Pierre wrote in his *Voyage à l'Isle de France* (1773) that the warm climate in the island not only contributed to the remarkable fertility of the soil, but was also "favorable to the propagation of insects," including locusts, "the most redoubtable enemy of agriculture," which he personally witnessed "descending on fields like snow, accumulating on the ground several inches thick and devouring all the crops in a single night."⁶³⁵

Human-induced transformations to the natural environment were also identified as having contributed to the proliferation of locust populations. The transformation of the islands into agrarian environments, as the naturalist Fusée Aublet remarked, provided a substantial amount of "tender" and "succulent" plants to sustain locust populations.⁶³⁶

"Messieurs les syndics directeurs de la Compagnie des Indes," 10 Octobre 1749, COL/C/3/9, f. 29, ANOM, Aix-en-Provence; Madeleine Ly-Tio-Fane, *The Triumph of Jean-Nicolas Céré, and his Isle Bourbon Collaborators* (Paris: Mouton et Cie, 1970), documents 47-48.

⁶³³ "Sauterelles," COL C/4/22, no 28, ANOM, Aix-en-Provence; Georges-Louis Leclerc Buffon, *Histoire Naturelle des Oiseaux*, (Paris: Imprimerie Royale, 1781), 6: 137.

⁶³⁴ "Le Gouverneur Magon au Ministre," COL/E/296, ANOM, Aix-en-Provence; Jean-Baptiste-Étienne Delaleu, *Code des Isles de France et de Bourbon* (Port Louis: Tristan Mallac et Cie, 1826), 217-218.

⁶³⁵ Henri-Bernadin de St-Pierre, *Voyage à l'Isle de France*, 135.

⁶³⁶ Aublet, *Histoire des Plantes de la Guiane Française*, 137.

The excessive multiplication of invasive insects was also attributed to the rapid deforestation on the islands. Jacquelin Duplessis, a planter and military official from the Île de Bourbon, for instance, informed his correspondents at the Société Royale d'Agriculture de Paris that this destructive insect "had spread in every area of the island, wherever forests were cleared in this colony."⁶³⁷ The great clearances of wood that had been undertaken to settle the islands had created vast wastelands and plains, hastening the hatching of locust eggs by reducing soil moisture and exposing them to the heat of the sun.⁶³⁸ Esquine spread quickly amongst the stumps of wood in the cleared areas around the coastline making these areas especially vulnerable to eruptions of locust populations.⁶³⁹ Forest clearance had also had a devastating impact on native bird populations, which eliminated potential predators that might have kept the multiplication of locusts in check.⁶⁴⁰

Endemic locust infestations dealt a strong blow to colonial officials and projectors' bullish assessments of the productive potential of the islands. Poivre reported in the first year of his intendancy that the planters, "discouraged by the lack of assistance from the colonial government and the billions of locusts that attack their crops," had

⁶³⁷ "Copie de la lettre écrite par M. Jacquelin Duplessey ancien officier de dragons à l'Isle de Bourbon, de present chez M. de St. Lazard à Paris," H/1625, f. 194, ANF, Paris; See also: "Sauterelles," COL C/4/153, ANOM, Aix-en-Provence.

⁶³⁸ Lacaille, *Journal Historique du Voyage*, 237; Pierre Poivre, "Destruction des Sauterelles," COL C/4/22, no 28, ANOM, Aix-en-Provence; Poivre "Agriculture," COL C/4/22, no. 28, ANOM, Aix-en-Provence.

⁶³⁹ Delaleu, *Code des Isles de France et de Bourbon*, 217-218.

⁶⁴⁰ "Bureau de Police, Ordonnances," COL/C/4/18, f. 248, ANOM, Aix-en-Provence.

completely abandoned wheat cultivation.⁶⁴¹ Eradicating insect predators served as an essential precondition for meaningful moral and agrarian reform on the islands, by allowing civic-minded settlers to reap the benefits of their labor. Repeated crop failures caused by locust infestations and other agricultural blights had convinced colonists that the islands were "sterile" and that the "soil was not fit for the cultivation of wheat and rice."⁶⁴² Assessing two decades of failed attempts at subsistence agriculture in the islands, the naturalist Pierre Sonnerat (1748-1814) pessimistically remarked in his *Voyage Aux Indes Orientales et à la Chine* (1782) that nature in the Isle de France and Bourbon would always be "ungrateful" to the colonists who inhabited the islands.⁶⁴³ For those who wished to see the islands act as commercial entrepôts rather than as subsistence colonies, the instability of the natural environment provided a useful resource for discrediting Poivre's project of agrarian reform. One author who lobbied the royal administration to restore the commercial function the islands had played under the rule of the Compagnie des Indes, remarked that "the hurricanes which strike each year, and the locusts, rats and other blights which continually afflict planters" were reason enough for it to withdraw its support for the "subsistence party."⁶⁴⁴

The success of Poivre's program of agrarian reform thus required that he combat the opinion circulating within ministerial circles that the islands were "two arid rocks"

⁶⁴¹ "Nouvelles de la colonie," COL/4/18, f. 43, ANOM, Aix-en-Provence; "Tableau raisonné de l'agriculture," COL/C/4/18, f. 156, ANOM, Aix-en-Provence.

⁶⁴² "Grains et approvisionnement du cru," COL/C/4/27, f. 259, ANOM, Aix-en-Provence.

⁶⁴³ Pierre Sonnerat, *Voyage aux Indes orientales et à la Chine* (Paris: Philippe-Denis Pierres, 1782), 360, 364.

⁶⁴⁴ "Mémoire," COL/C/4/19, f. 198, ANOM, Aix-en-Provence.

unsuitable for the cultivation of subsistence crops.⁶⁴⁵ Poivre himself came to temper his initially boisterous assessments of the unbounded fertility of the Isle de France and Isle de Bourbon, by recognizing the fragility of the environment on the islands. However, Poivre never doubted that the natural obstructions that stifled the fertility of the soil in the islands could be overcome through proper stewardship of its natural and human resources. The Isle de France, Poivre remarked in the first months of his intendency, was a "sick body, and indeed a very sick body that was in great need of the arrival of a physician."⁶⁴⁶ Just as a physician healed his patients by removing blockages that hampered the circulation of humors and vital spirits, Poivre promised to restore economic health to the colonies by removing obstructive natural and social forces within the body politic. The war on locusts that he was to launch in succeeding years became a crucial component of this project to ensure a harmonious balance between the natural and human economies of the islands.

Policing the Oeconomy of Nature

Locusts were potentially problematic phenomena within the teleological and providential view of the natural world that was widely shared by naturalists of the mid-eighteenth century.⁶⁴⁷ How could these apparently useless beings, whose only function

⁶⁴⁵ "Mémoire sur les Isles de France, Bourbon et de Madagascar," COL C/4/153, ANOM, Aix-en-Provence.

⁶⁴⁶ Poivre to Praslin, COL/C/4/18, f. 43, ANOM, Aix-en-Provence. [Cette colonie est un corps malade et très malade qui avait un grand besoin de l'arrivée d'un médecin.]

⁶⁴⁷ Clarence Glacken has shown that philosophers and theologians from Antiquity to the Enlightenment wrestled with the problem of insect pests: Clarence Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the*

seemed to be to cause destruction, fit within a universe harmoniously sustained by the will of a purposeful deity? Some Enlightenment naturalists answered this question by arguing that locusts and other plant-eating insects in fact played a useful role within the "oeconomy of nature" that was not immediately demonstrable to the men whose crops they attacked. The naturalist Anders Sparrman, for instance, conjectured that the "intentions of nature" in producing locusts in the Cape of Good Hope was to clear fields of weeds that would otherwise choke up the fertility of the soil:

Perhaps the use of these creatures is the same with that of fire, which latter is applied by the colonists and Hottentots for the purpose of clearing their fields from weeds. The ground is, indeed, by this means, in both cases, stripped quite bare; but merely in order that it may shortly afterwards appear in a much more beautiful dress, being, in this case, decked with various kinds of annual grasses, herbs and stately lilies, which had before been choked up by shrubs and perennial plants ... so as to form with their young shoots and leaves, a delightful verdant pasturage for the use of the cattle and game.⁶⁴⁸

Maintaining the success and prosperity of the pastoral economy thus depended on the regenerative and equilibrating forces that nature had implanted in the form of locusts in the South African grasslands. The naturalist Philibert Commerson (1727-1773), who spent several months botanizing on the Isle de France during Poivre's intendency, similarly remarked that plant-eating insects played an "important role in the general oeconomy of nature," by suppressing the "excessive luxury of the vegetable kingdom." While "vulgar eyes" unjustly held them in contempt, insects were the "most useful

End of the Eighteenth-Century (Berkeley: University of California Press, 1967), 76, 205, 533.

⁶⁴⁸ Anders Sparrman, *A Voyage to the Cape of Good Hope, Towards the Antarctic Polar Circle, and Round the World* (London: G.G.J. and J. Robinson, 1785) 1: 367-368.

ministers of nature" who helped sustain a harmonious balance within the oeconomy of nature through their acts of creative destruction.⁶⁴⁹

While even lowly and despised locusts could play an admittedly useful function within the providential order of nature, their excessive multiplication belied grave disruptions and imbalance within the oeconomy of nature. For Poivre, locust infestations were a symptom of the disorder that the Compagnie des Indes had bequeathed to the royal administration. Poivre repeatedly complained that company officials had ruled without "oeconomy," demonstrating a poor stewardship of social and material resources on the islands. Not only had company officials created favorable environments for the reproduction of locusts through the wanton destruction of forests on the islands, but they had also neglected to develop an administrative system that could curtail the spread of this plague.⁶⁵⁰ Planters had been left to their own devices in coping with this terrible scourge, haphazardly "gathering their negroes" and fruitlessly chasing these insects from field to field "by making much noise and firing shots of gunpowder."⁶⁵¹ The "general disorder" that was evident in both the social and natural environment of the islands, and

⁶⁴⁹ "Notice de M. Commerson sur les observations d'histoire naturelle rédigées à l'occasion du voyage autour du monde de M. de Bougainville," MS Arsenal 6660, no 15, Bibliothèque Nationale de France, Paris.

⁶⁵⁰ "Discours Prononcé par Poivre," COL/C/4/18, f. 72, ANOM, Aix-en-Provence. On the criticism of the Compagnie des Indes for its lack of management of forests see also: Grove, *Green Imperialism*, ch. 5.

⁶⁵¹ Aublet, *Histoire des Plantes*, 138; "État des Cultures et de l'élevage," MS 89, no. 40 Service Historique de la Défense, Département Marine, Brest.

which was made devastatingly clear by endemic locust plagues, was thus a result of the Compagnie des Indes' systematic neglect of the "administration of the police."⁶⁵²

In the first months of his intendency, Poivre used his legislative power as head of the bureau of police to mandate collective locust hunts that he hoped would lead to the complete extirpation of this insect from the islands.⁶⁵³ This practice had been previously instituted in the 1740s under the enlightened governorship of Mahé de la Bourdonnais who had himself apparently marched at the head of the troops that were sent to collect and destroy insect eggs and nymphs on the islands.⁶⁵⁴ In 1767, Poivre revived these laws, which had fallen into abeyance as a result of the lethargy of succeeding administrators and the short sightedness of planters who spurned the cost of organizing these expeditions. Locust hunts were to be coordinated through a strict chain of command leading from the bureau of police to the *syndics* of each neighborhood on the island and local *maréchaux*.⁶⁵⁵ Planters were obliged under penalty of fine, to provide a tenth of their slaves to form armies of pick-axe wielding locust hunters, led by an armed

⁶⁵² "Bureau de Police, Ordonnances," COL/C/4/18, f. 248, ANOM, Aix-en-Provence.

⁶⁵³ For precedents to this practice, see: Ronald C. Jennings, "The Locust Problem in Cyprus," *Bulletin of the School of Oriental and African Studies* 51, no. 2 (February 1988): 281-313; Benjamin Arbel and Elie Barnavie, "Sauterelles et Mentalités: Le cas de la Chypre Vénitienne," *Annales: Économies, Sociétés et Civilisations* 44, no. 5 (1989): 1057-1074.

⁶⁵⁴ Aublet, *Histoire des Plantes*, 137-138; Poivre, "Destruction des Sauterelles," ANOM COL/C/4/22, no 28; Mahé de la Bourdonnais himself described his struggles against locusts in: Bertrand-François Mahé de la Bourdonnais, *Mémoires historiques de B.F. Mahé de la Bourdonnais des Îles de France et de Bourbon* (Paris: Pélicier et Chalet, 1827), 18, 62.

⁶⁵⁵ "Détail sur les avantages des chambres syndicales," COL/C/4/18, f. 272, ANOM, Aix-en-Provence; "Sauterelles," COL C/4/153, ANOM, Aix-en-Provence.

commandeur drawn from each *quartier* of the island, who would search for, collect and burn locust eggs and larvae.⁶⁵⁶ In order to encourage planters to carry out this task even more zealously, the Conseil Supérieur even promised to reward the colonists who provided the largest bounty of locusts to their local syndic with a young healthy slave (*noir pièce d'inde*).⁶⁵⁷

In his attempt to re-impose order within the socio-natural oeconomy of the islands, however, Poivre had recourse not only to civil laws but also to the laws of nature. After having witnessed the severity of the locust infestations in the Mascarene Islands during his travels as an agent of the Compagnie des Indes in the late 1740s, Poivre had concluded that human effort alone would never rid the colonies from this plague:

I realized that the only means by which the Isle de France could be delivered from these destructive insects was to provide it with the means that *nature itself* has taken to reduce the multiplication of harmful insects.⁶⁵⁸

Within the conception of a providential oeconomy of nature, each insect species possessed natural predators that served to prevent their excessive multiplication. The Swedish naturalist Carl Linnaeus, who gave this theory of ecological balance its canonical eighteenth-century form, wrote that birds that "wage war against insects"

⁶⁵⁶ Delaleu, *Code des Isles de France et de Bourbon*, 217-218.

⁶⁵⁷ "Règlements," COL C/4/25, f. 230, ANOM, Aix-en-Provence; Delaleu, *Code des Isles de France et de Bourbon* (Port Louis, 1826), 217-218.

⁶⁵⁸ "Sauterelles," COL C/4/153, ANOM, Aix-en-Provence [En 1751, dans le cours de mes voyages j'avais pensé que le seul moyen de délivrer l'Isle de France de ces insectes destructeurs était de leur apporter les moyens que la nature a pris pour diminuer la multiplication des insectes nuisibles]

played a vital role in the "republic" and "oeconomy of nature."⁶⁵⁹ For Linnaeus, insectivorous birds were "ministers of the republic of nature" that fulfilled their "offices" by reducing the "superfluous" number of insects within the natural world.⁶⁶⁰ Henri Bernadin de Saint-Pierre similarly argued the internecine war waged within the insect kingdom was a providential balancing mechanism that sustained the "harmony of nature." Were it not for the "perpetual war" that harmful insects in the Isle de France waged upon one another, he wrote, the island would be uninhabitable to humankind.⁶⁶¹ Because locusts were "not natural" to the Isle de France and Bourbon, however, countervailing natural forces that could keep their numbers in just proportion were absent from the islands. The "equilibrium" that sustained "the splendor of the republic of nature" would thus have to be engineered by Poivre himself.⁶⁶²

In fact, Poivre had found this "police of nature" in the late 1740s, while conducting natural historical observations around Pondicherry, a French commercial

⁶⁵⁹ Carl von Linné, *Systema Naturae per Regna Tria Naturae Secundum* (Holmiae: L. Salvii, 1766), 17, 113; On Linnaeus' conception of the oeconomy of nature see: R.C. Stauffer, "Ecology in the long manuscript version of Darwin's *Origins of Species* and Linnaeus' *Oeconomy of Nature*," *Proceedings of the American Philosophical Society* 104 (1960): 23-241; Limoges, "Introduction," 7-22; Koerner, *Linnaeus: Nature and Nation*, ch.4; The influence of Linnaen ideas in France is thoroughly documented in Frans. A. Stafleu, *Linnaeus and the Linneans: The Spreading of Their Ideas in Systematic Botany, 1735-1789* (Utrecht: A. Ossthoek's Uitgeversmaatchaj, 1971); Pascal Duris, *Linné et la France, 1750-1850* (Geneva: Droz, 1993).

⁶⁶⁰ Linné, *Systema Naturae*, 14.

⁶⁶¹ Bernadin de St-Pierre, *Voyage à L'Isle de France*, 135; See also: Linnaeus, *Politia Naturae*, 109.

⁶⁶² Linné, *Systema Naturae*, 17, 166-167.

outpost on the Malabar Coast.⁶⁶³ It was here that he first encountered the *oiseau martin* or *mynah*, a bird which "lived on scarcely anything but locusts," and which he praised for its "nuanced colors which lead the spectator to admire the magnificence of God in even his smallest creations."⁶⁶⁴ By the early 1750s, Poivre had introduced preserved specimens of the *oiseau martin* within circles of metropolitan naturalists through the networks of natural historical exchange that he had developed during his travels in the Indian Ocean.⁶⁶⁵ Poivre sent one such preserved specimen to the abbé Jean-Thomas Aubry (1714-1785), among others, a notable collector of natural historical specimens.⁶⁶⁶ A description and depiction of this bird, drawn from the specimen in Aubry's cabinet, was included in Mathurin-Jacques Brisson's highly popular *Ornithologie* (1760) under the

⁶⁶³ In his *Politia Naturae* Linnaeus described insectivorous birds as the "police of nature": Carl von Linné, *Politia Naturae*, 113.

⁶⁶⁴ "Sauterelles," COL C/4/153, ANOM, Aix-en-Provence; Pierre Poivre, "Mémoires d'un voyage touchant les isles du Detroit de la Sonde, Siam, la Cote Coromandel, les isles de France, quelques endroits de la cote d'Afrique etc. fait pendant les années 1745, 1746, 1747," in *Un manuscrit inédit de Pierre Poivre: les mémoires d'un voyageur*, edited by Louis Malleret (Paris: École Française d'extrême orient, 1968), 122.

⁶⁶⁵ Poivre's most notable correspondent was Antoine Ferchault de Réaumur, to whom he sent a number of ornithological specimens and natural curiosities that he prepared himself or obtained from local peddlers during his travels in the Indian Ocean: Poivre to Réaumur, 18 March 1754, Dossier Poivre, Archives de l'Académie des Sciences, Paris; Poivre to Réaumur, 19 March 1759, Dossier Poivre, AAS, Paris; "État des animaux deséchés provenans des Philippines et de Madagascar contenus dans la caisse no 2 marquée MDR," 1757, Dossier Poivre, AAS, Paris; See also numerous mentions of bird specimens sent by Poivre to Réaumur in: Mathurin-Jacques Brisson, *Ornithologia, sive Synopsis Methodica sistens aium divisionem in ordines* (Paris: C-J-B Bauche, 1760).

⁶⁶⁶ "Note sur Jean-Thomas Aubry, cure de Saint-Louis," <http://www.pierrepoivre.fr/Aubry%20cure%20de%20St%20Louis.pdf> (accessed October 30th, 2013); For a description of Aubry's cabinet, which contained nearly 500 specimens of exotic birds see: Antoine-Joseph Dezallier d'Argenville, *La Conchyliologie ou Histoire Naturelle des coquilles de mer* (Paris: G. de Bure, 1780), 226.

entry "*merle des philippines*," where it was described as an eater of "grasshoppers and other insects."⁶⁶⁷ Linnaeus also included the *oiseau martin* (or *paradisea tristis* as he named it) in the twelfth edition of his *Systema Natura* (1766), classifying it in the sixth-order of his ornithological taxonomic system amongst other insectivorous birds with cone-shaped beaks.⁶⁶⁸



Figure 9. Engraving of the *merle des Philippines*. Source: Mathurin-Jacques Brisson, *Ornithologia, sive Synopsis Methodica sistens aium divisionem in ordines* (Paris: C-J-B Bauche, 1760), 279-280.

By the early 1750s, Poivre had also begun to send live specimens of this bird to colonial administrators on the Île de France and the Île Bourbon through agents of the Compagnie des Indes. In order to "wage a serious war" against locusts, the naturalist Philippe Guéneau de Montbeillard (1720-1785) recalled, Poivre and the governor of the Île Bourbon Desforges-Boucher had brought several pairs of these birds from India "with the intention of multiplying them and to oppose them as an army to their redoubtable

⁶⁶⁷ Brisson, *Ornithologia*, 279-280.

⁶⁶⁸ Linné, *Systema Naturae*, 166-167.

enemies."⁶⁶⁹ Over the next two decades, shipments of these birds were sent to the islands on cargoes returning from India and the Philippines.⁶⁷⁰ As intendant, Poivre continued to have specimens of the *oiseau martin* sent from India, and he passed legislation to conserve and increase populations of these birds on the islands. A hunting ordinance from 1767, exhorted "every colonist to make every possible effort to conserve this bird essential and useful to the progress of our cultivations."⁶⁷¹ Fines of five hundred *livres* were to be levied on colonists who shot at these birds or undertook any action that would be detrimental to their multiplication.⁶⁷² This conservationist legislation seems to have been commonly disregarded by colonists, however, for Poivre repeatedly underlined in his correspondence that a stricter enforcement of the laws prohibiting the killing of the *oiseau martin* was necessary for the general prosperity of the colony.⁶⁷³

The *oiseau martin* was not the only species that was introduced to the islands to control harmful insect populations. Aside from the *oiseau martin*, Henri-Bernadin de St-Pierre took note of attempts to introduce frogs to devour mosquitoes on the islands, and

⁶⁶⁹ Buffon, *Histoire Naturelle des Oiseaux*, 6: 137.

⁶⁷⁰ "Sauterelles," COL C/4/153, ANOM, Aix-en-Provence; Jacques-Christophe Valmont de Bomare, *Dictionnaire Raisonné Universel d'Histoire Naturelle*, (Lyon: Bruyset, 1791), 5: 271.

⁶⁷¹ "Ordonnance sur la chasse," COL C/4/17, f. 52, ANOM, Aix-en-Provence; Delaleu, *Code des Isles de France et de Bourbon*, 216.

⁶⁷² Delaleu, *Code des Isles de France et de Bourbon*, 216, 224-225.

⁶⁷³ Poivre's nephew Pierre Sonnerat also lamented that once the locust population in the Isle de France had been successfully reduced following the introduction of the 'oiseau martin,' the colonists "who only see the evil that is before them, grew weary of their benefactor, and despite all the proscriptions, continue to kill every day a large number of martins": Pierre Sonnerat, *Voyage Aux Indes Orientales*, 368; See also, Bernadin de St-Pierre, *Voyage*, 243.

of the successful naturalization of insect-eating birds from the Cape of Good Hope.⁶⁷⁴ Poivre asked naturalists on botanical expeditions in Asia to identify and send him other species of birds that were known by local populations to feed on locusts and other harmful insects. When the abbé Galloys, a chaplain of the Conseil Supérieur, was sent by the royal administration to Canton in 1767, Poivre sent him a lengthy list of plants, seeds, trees, fruits and ‘useful animals’ that he was to procure through the Chinese contacts of local French merchants.⁶⁷⁵ Among the useful animals that Poivre wished to naturalize in the Isle de France was a number of insect-eating birds including the *hoa-mi*, and other species of locust-eating sparrows.⁶⁷⁶ Yet it was the *oiseau martin* above all that had been responsible for making the islands suitable for the cultivation of subsistence crops. As Poivre and the Governor François Julien du Dresnay happily reported to the minister of the Marine in 1769:

Locusts ... a terrible scourge which once threatened the total annihilation of our agriculture, are today reduced to nothing ... it is hoped that after this year's hunt we will no longer hear of this scourge and that the martins will suffice to exterminate the rest. These birds expressly introduced in these islands have singularly contributed to the destruction of these insects.⁶⁷⁷

⁶⁷⁴ Bernadin de St-Pierre, *Voyage*, 242-243.

⁶⁷⁵ "Instruction pour M. l'Abbé Galloys conseiller honoraire du conseil de l'isle de France relativement au voyage qu'il va faire par ordre de Monseigneur duc de Praslin en Chine," COL C/4/18, f. 15-21, ANOM, Aix-en-Provence; Documents relating to Galloy's expedition to China and his activities in the Isle de France are in COL/E/297, ANOM, Aix-en-Provence; See also: Louis Malleret, "Pierre Poivre, L'Abbé Galloys, et l'introduction d'espèces botaniques et d'oiseaux de Chine à l'Île Maurice," *Proceedings of the Royal Society of Arts and Sciences of Mauritius* 3 (1968): 117-130.

⁶⁷⁶ For contemporary descriptions of the *hao-mi* see: Brisson, *Ornithologie*, 2: 221, n.7, pl. 23; Buffon, *Histoire Naturelle des Oiseaux*, 3: p. 316.

⁶⁷⁷ "Mémoire sur l'Isle de France," COL C/4/27, f. 252, ANOM, Aix-en-Provence [Les sauterelles ... à la reprise de possession des isles étaient un fleau effrayant il menaçait

The successful naturalization of the *oiseau martin* became an emblem of Poivre's status as an authoritative manager of natural and human oeconomies, and paved the way for the islands' turn towards the naturalization and cultivation of more lucrative botanical specimens. By the end of the 1760s, Poivre judged that the level of subsistence crop production was sufficient enough for administrators to allow planters to cultivate commercial cash crops such as coffee, cinnamon and cotton to supplement their incomes.⁶⁷⁸

The Oiseau Martin: Friend or Foe?

Poivre claimed the eradication of locusts from the islands as one of the great achievements of his intendency. When he reassessed his accomplishments before leaving the Île de France in August 1772, Poivre reminded the minister of the Marine that agriculture was now secure on the islands largely because they had been "delivered through my labors from the terrible scourge of locusts."⁶⁷⁹ However, just as Poivre's claims about the success of his intendency began to be contested by his many enemies and detractors, controversy erupted over the *oiseau martin*'s purported role as beneficent agent of environmental control.⁶⁸⁰ Reports began to circulate back from the colonies that

l'agriculture d'une destruction totale aujourd'hui ce fléau n'est plus rien ... il ne reste que quelques sauterelles il ne sera plus question à l'Isle de France de ce fléau et que les oiseaux appellés martin suffiront pour en exterminer tout le reste, ces oiseaux partis dans les isles exprès ont singulièrement contribué à hâter la destruction de ces insectes]

⁶⁷⁸ "Agriculture," COL C/4/25, f.9, ANOM, Aix-en-Provence.

⁶⁷⁹ "État dans lequel j'ai remis la colonie," COL/C/4/3, ANOM, Aix-en-Provence.

⁶⁸⁰ Leading the charge against Poivre were two former governors of the islands Jean Daniel Dumas and Desroches who objected to the calumnious accusations made against

the *oiseau martin* had itself become an even more terrible threat to agriculture than locusts had previously been. Beginning in the mid-1770s, metropolitan naturalists began to bring to light contestations over efforts to naturalize this bird that had been papered over in Poivre's self-servingly optimistic reports to state officials. Unfortunately for Poivre, the alarm against the *oiseau martin* was first sounded in one of the most popular natural historical texts of the eighteenth-century, the Comte de Buffon's *Histoire Naturelle des Oiseaux*.⁶⁸¹

Buffon had obtained a report on the *oiseau martin* in the early 1770s from his correspondent the Vicomte de Querhoënt, a ship captain who sent Buffon natural historical observations for nearly a decade while stationed in the Cape of Good Hope and the Mascarene Islands.⁶⁸² While Querhoënt noted that the *oiseau martin* had "almost entirely destroyed the locusts that ravaged the harvests before its arrival," he also remarked that they caused damage to colonists' green pea crops and disorders in the coops where they kept their fowl.⁶⁸³ By the time Buffon published the sixth volume of his *Histoire Naturelle des Oiseaux* (1775) even more extensive accounts of the damage

them in Poivre's: "État dans lequel j'ai remis la colonie": "Lettre de Dumas à De Boynes," COL C/4/34, f. 295, ANOM, Aix-en-Provence; "Lettre de Dumas à Desroches," COL C/4/34 f. 295, ANOM, Aix-en-Provence.

⁶⁸¹ On the popularity of Buffon's *Histoire Naturelle* see: Emma Spary, *Utopia's Garden*, 25-33; Clarence Glacken remarked that throughout his works, Buffon showed a marked interest in environmental transformations occasioned by the dispersal of humans, plants and animals throughout the habitable regions of the earth: Clarence Glacken, *Traces on the Rhodian Shore*, 663.

⁶⁸² "Descriptions originales de M. de Queroënc sur les oiseaux de l'Île de France et du Cap de Bonne-Espérance," MS 369 (3), f. 476-489, BCMHN, Paris.

⁶⁸³ "Martin de l'Isle de France," MS 369 (3), f. 483, BCMHN, Paris.

caused by this bird to agriculture on the islands had begun to surface. The article on the *oiseau martin* was prepared by Buffon's collaborator, Philippe Guéneau de Montbeillard, who wrote the entry on the basis of reports sent by long-time resident naturalists of the islands, Pierre Sonnerat and Vérouge de la Nux.⁶⁸⁴ Shortly after the *oiseau martin* had been brought to the islands from India and the Philippines, Montbeillard wrote, colonists had begun to spread the alarm through the islands that the birds were in fact harmful animals that were causing devastation to their crops. Colonists succeeded in influencing colonial officials to proscribe the *oiseau martin* and have the entire island population of this bird destroyed. While the return of the locusts led colonists to "promptly repent" and demand the reintroduction of the *oiseau martin*, they were ultimately vindicated in their initial apprehensions about this animal.⁶⁸⁵ After ridding the island of locusts, and continuing to multiply "prodigiously," Montbeillard wrote, these birds:

threw themselves on all fruits ... unearthed the wheat, rice, corn, beans ... they even do harm by destroying useful insects ... that wage war on the lice that cause so much harm to the coffee plants ... after having delivered these colonies from locusts, they have themselves become an even more redoubtable scourge and even more difficult to extirpate.⁶⁸⁶

While the *oiseau martin* was an undoubtedly useful ally in the war on harmful insects, ensuring that these birds did not multiply beyond a certain limit proved to be a far too difficult task. This could perhaps be achieved through the naturalization of "even stronger birds of prey" but, he concluded, "this remedy would most certainly bring other

⁶⁸⁴ Buffon, *Histoire Naturelle des Oiseaux*, 6: 135-143.

⁶⁸⁵ Buffon, *Histoire Naturelle des Oiseaux*, 6: 138.

⁶⁸⁶ The English naturalist John Latham relates the same anecdote in John Latham, *A General Synopsis of Birds* (London: B. White, 1781), 1: 458-459.

inconveniences."⁶⁸⁷ The disastrous experiment with the *oiseau martin* had revealed the precariousness of the balance that sustained the oeconomy of nature on the islands, and clearly made Montbeillard apprehensive about any other attempts to generate a harmonious cooperation between its elements.

Reports that the *oiseau martin* had become a scourge to agriculture in the Mascarene Islands continued to find their way into print in the 1780s. The naturalist Foucher d'Obsonville, who himself sent shipments of the *oiseau martin* to the Île de Bourbon at the request of the governor while stationed in India, noted with regret in his *Essais Philosophiques* (1783) that the birds had since "multiplied to such an extent that they are now a serious burden to the colonists."⁶⁸⁸ In his entry for the martin in Charles-Joseph Panckoucke's *Encyclopédie Méthodique* (1784), which recycled much of the material used in Buffon's *Histoire Naturelle*, the naturalist Pierre-Jean-Claude Mauduyt de La Varenne (1732-1792) similarly related that despite the tremendous success with which these birds had freed the colony from locusts:

... the damage that they now cause, so we are told, is equivalent to that which was done by the insects which they were meant to oppose ... if they are indeed harmful who will be able to control their multiplication?

While the colonists' experience with the *oiseau martin* suggested that humans ought to exercise caution in their attempts to interfere with nature's oeconomy, Mauduyt nevertheless advocated the introduction of insect-eating birds and animals in the French islands in the Caribbean, so long as their numbers could be kept by colonists within "just limits." The "calculation" of a justly proportional number of insect-eating birds would

⁶⁸⁷ Buffon, *Histoire Naturelle des Oiseaux*, vol. 6, 138.

⁶⁸⁸ Foucher d'Obsonville, *Essais Philosophiques sur les Moeurs de Divers Animaux Étrangers* (Paris: Couturier, 1783), 43.

have to be determined by local naturalists and colonists, whose task would be facilitated by the relatively circumscribed geographical limits of the islands.⁶⁸⁹

“A tribute from the colonies”

Despite these reports about the destructive environmental effects of the *oiseau martin*, naturalists in metropolitan institutions nevertheless began to consider proposals to naturalize this bird in France and its overseas colonies in the 1780s. As the center of French colonial interests shifted definitively to the West Indies, the Mascarene Islands came to be seen in ministerial circles as a center for the westward dispersal of useful biota.⁶⁹⁰ The naval minister César Henri Guillaume de La Luzerne (1738-1821), for instance, informed the intendant of the Jardin du Roi André Thouin (1746-1824) that "our important colonies are in the west, it is thus necessary that our eastern colonies furnish them with plants and useful animals that the western colonies may disperse amongst themselves."⁶⁹¹ Efforts to naturalize plants and animals from the colonies into France

⁶⁸⁹ *Encyclopédie Méthodique, Histoire Naturelle des Animaux* (Paris: Panckoucke 1782-1784), 2: 183; For the authorship of this volume see: Pascal Duris, "Entre Buffon et Linné: la zoologie dans l'Encyclopédie Méthodique," in *L'encyclopédie méthodique (1792-1832): Des Lumières au positivisme*, eds. Claude Blanckaert and Michel Porret (Genève: Librairie Droz, 2006), 579-604.

⁶⁹⁰ Roberts, "Le Centre de Toutes Choses."

⁶⁹¹ "Pièces relatives au projet d'une correspondance agrico-botanique entre les différentes colonies françaises et le Jardin du Roi, ébauchée en janvier 1788, d'après le projet de M le comte de La Luzerne," MS 308, BCMHN, Paris.

itself were also undertaken during this period by metropolitan naturalists and agronomists as part of a broader platform of agricultural improvement.⁶⁹²

Seizing on this contemporary interest in the naturalization and acclimatization of foreign species, colonists from the Mascarene Islands came forward to champion the *oiseau martin*'s value for protecting agriculture in France and the West Indies from the depredations of insects. These colonists, however, clearly felt hampered in their efforts by the well-publicized accounts of the havoc wreaked by the *oiseau martin* in the Mascarene Islands. When the planter Lambert de Rocquefort petitioned the *Société Royale d'Agriculture* to have the *oiseau martin* naturalized in the Provence region (along with species of peas and rice from the islands), presenting it as a "tribute" from the colonies, he felt the need to reassure his auditors that the bird "being carnivorous, poses no threat to cultivable crops." Nevertheless, he cautioned that ship-captains transporting these birds ought not to feed them seeds or grain, "for they will become accustomed to this food and lose their taste for grasshoppers, as cats who are fed from the table become disgusted with chasing rats."⁶⁹³

The most sustained campaign to salvage the *oiseau martin*'s reputation was led by Jacquelin Duplessis, a retired military official and former planter in the Île de Bourbon. In 1786, the Royal Oeconomic Society of Madrid awarded a medal to Duplessis, who submitted an essay on the *oiseau martin* for a competition on the most effective means of destroying locust populations, amidst serious outbreaks of locust infestations in Spain,

⁶⁹² "Pièces relatives au projet d'une correspondance agriculto-botanique entre les différentes colonies françaises et le Jardin du Roi, ébauchée en janvier 1788, d'après le projet de M le comte de La Luzerne," MS 308, BCMHN, Paris.

⁶⁹³ "S. Lambert de Rocquefort," H/1517, f. 20, ANF, Paris.

Italy, Germany and the South of France.⁶⁹⁴ Buoyed by this success, Duplessis then lobbied the Académie des Sciences, the Société Royale d'Agriculture de Paris, the Comité d'Agriculture de Paris, and the Controller General of Finances to have the bird introduced in French colonies and provinces in the south of France affected by infestations of invasive insects.⁶⁹⁵ Having observed that locusts had multiplied rapidly in deforested areas in the Ile de Bourbon, Duplessis warned the royal administration that a similar catastrophe would strike the southern provinces of France, where extensive forest clearance had taken place since the 1770s, unless means were taken to address the situation.⁶⁹⁶ Attesting to the successful experiments conducted with the *oiseau martin* in the Isle de France and Isle de Bourbon, Duplessis urged the government that the "general good" and the "progress of agriculture" depended on the introduction of this bird in regions threatened by locust infestations.⁶⁹⁷

Hoping to counteract the purportedly ill-informed stories about the *oiseau martin* that circulated in popular natural historical texts, Duplessis not only approached

⁶⁹⁴ *Mercure de France*, 26 June 1784; *Mercure de France*, 24 July 1784; *Mercure de France*, 15 July 1784; *Mercure de France*, 14 February 1784; "Prix proposé par la société Royale de Madrid pour le jour de St. Isidor (15 mai) de l'année 1786," H/1625, f. 195, ANF, Paris.

⁶⁹⁵ "Jacquelin Duplessis," H/1625, f. 191-195, ANF, Paris; "Sauterelles," H/1626, f. 235-236, ANF, Paris; "Destruction des Sauterelles," Pochettes de Séance, 16 December 1786, AAS, Paris; "Procès Verbaux du Comité d'Agriculture de Paris," F/10/A, f. 44, f. 189, ANF, Paris.

⁶⁹⁶ Duplessis to Broussonnet, July 13 1786, H/1625, ANF, Paris; For the extensive wood clearance in the Languedoc Region in the 1770s and 1780s see: Noëlle Plack, "Agrarian Reform and Ecological Change During the Ancien Régime: Land Clearance, Peasants and Viticulture in the Province of Languedoc," *French History* 19, no. 2 (2005): 189-210.

⁶⁹⁷ "Copie de la lettre écrite par M. Jacquelin Duplessy à M. le Secrétaire de la Société Royale Économique de Madrid," June 8 1786, H/1625, f. 191, ANF, Paris.

metropolitan institutions, but also received approval from the royal administration to advertise its virtues in newspapers and periodicals. By spreading what he claimed to be more reliable information about the *oiseau martin* through the press, Duplessis hoped to demonstrate "just how ill-informed we have been up to the present on the history of their introduction in France and Isle de Bourbon."⁶⁹⁸ Moreover, "farmers and naturalists" would be able to "appreciate the utility that could be gained from the introduction of this bird in the kingdom."⁶⁹⁹ To this end, Duplessis not only marshaled his own testimony as a former resident of the island, but also obtained and published certificates attesting to the utility of the *oiseau martin* from the royal botanist Jean-Guillaume Brugnière (1749-1798) and the intendant of the Île de France and the Île Bourbon Etienne-Claude de Chevreau (1730-1785), who had shipped hundreds of these birds to Madagascar in 1784.⁷⁰⁰ These documents along with Duplessis' manuscript were left in the hands of the secretary of the *Société d'Agriculture de Paris* Pierre Marie Auguste Broussonnet (1761-1807) and made available to the public for consultation.⁷⁰¹

⁶⁹⁸ "Copie de la lettre écrite par M. Jacquelin Duplessy à M. le Secretaire de la Société Royale Économique de Madrid," June 8 1786, H/1625, f. 191, ANF, Paris.

⁶⁹⁹ Vergennes to Calonne, 15 July 1786, H/1625, f. 191, ANF, Paris.

⁷⁰⁰ "Copie du certificat de M. Brugnière," 11 April 1786; "Copie de la Lettre Ecrite par M. Chevreau Intendant des Isles de France et de Bourbon," 20 May 1786, H/1625, f.193, ANF, Paris.

⁷⁰¹ *Mercur de France*, no 53, 3 December 1785; *Gazette de France*, no 1, 3 January 1786; *Journal de Paris* no 56, 16 January 1786.

Duplessis' efforts to dispute the "untrustworthy relations" about the *oiseau martin* seem to have been highly successful.⁷⁰² In their report to the Société Royale d'Agriculture, the naturalists Valmont de Bomare and Broussonet underlined that rumors about the damage caused by the bird to agriculture in the Mascarene Islands were simply falsities perpetuated by "a few authors who relied on information from overly credulous travellers," a position Bomare was to reiterate in his *Dictionnaire Raisoné d'Histoire Naturelle* (1791).⁷⁰³ The two naturalists commended Duplessis for having "victoriously combatted an error which it was absolutely essential to destroy, because it was given much credit and perhaps prevented the introduction of the *oiseau martin* in many regions where it may have been useful." Although Bomare and Broussonet doubted that the *oiseau martin* could be acclimatized in the south of France, they endorsed the proposal from this "zealous citizen" to ship the birds to colonists in the Caribbean and the inhabitants of warmer climates.⁷⁰⁴ Similarly, the English naturalist John Latham, who had previously reported in his *General Synopsis of Birds* (1781) that the *oiseau martin* had become a "greater plague than that from which their first presence relieved them," later

⁷⁰² "Copie de la lettre écrite par M. Jacquelin Duplessy à M. le Secrétaire de la Société Royale Économique de Madrid," 8 June 1786, H/1625, f. 191, ANF, Paris.

⁷⁰³ "Les Mémoires de M. Duplessy concernant l'oiseau martin par M. Valmont de Bomare et Broussonet," H/1517, f. 193, ANF, Paris; Jacques-Christophe Valmont de Bomare, "Merle des Philippines," *Dictionnaire Raisoné d'Histoire Naturelle* (Lyon: Bruyset, 1791), 271.

⁷⁰⁴ "Les Mémoires de M. Duplessy," H/1517, f. 193, ANF, Paris; A similar verdict was given by the *Académie des Sciences* and the Comité d'agriculture: "Destruction des Sauterelles," Pochettes de Séance, 16 December 1786, AAS, Paris; Procès Verbaux du Comité d'Agriculture de Paris, F/10/A, f. 44, f. 189, ANF, Paris.

reversed his position in a revised edition of this work.⁷⁰⁵ In the *General History of Birds* (1822), Latham credited Jacquelin Duplessis for dispelling the misinformation perpetuated by Buffon, and asserted that the *oiseau martin* was a useful aid to agriculture.⁷⁰⁶

In defending the value of the *oiseau martin* as an instrument of economic management, Duplessis simultaneously cast doubt on the credibility of Buffon's *Histoire Naturelle*, on which subsequent negative judgments of the bird were based, as a reliable purveyor of natural knowledge.⁷⁰⁷ Duplessis pitted the reliability of the experiential knowledge of local inhabitants of the islands against the uncertainty of information hastily gathered by sedentary metropolitan naturalists like Buffon and their travelling informants. Such refutations of the epistemic basis of metropolitan natural histories by colonists seem to have become fairly widespread in the late eighteenth-century. In the 1780s, for instance, a royal veterinarian from the Isle de France circulated a manuscript within ministerial circles that refuted Pierre Sonnerat's natural history of the Mascarene Islands point-by-point on the basis of observations conducted during his thirteen years' residence on the islands.⁷⁰⁸ Yet, as we have seen, Duplessis also solicited support from the scientific community in Paris, although he tellingly did not float his proposal to the

⁷⁰⁵ Latham, *A General Synopsis of Birds*, 3: 458-459.

⁷⁰⁶ Latham, *A General History of Birds*, 3: 147.

⁷⁰⁷ Despite its tremendous success, the *Histoire Naturelle* was not immune from scathing attack by contemporary readers and philosophes see: Philip R. Sloan, *From Natural History to the History of Nature: Readings from Buffon and his Critics* (Notre Dame: University of Notre Dame Press, 1981).

⁷⁰⁸ "Lettre de M. Beauvais, artiste vétérinaire, directeur des haras entretenu par le Roi aux isles de France et de Bourbon sur le voyage aux Indes orientales et à la Chine," COL/F/2C/7, f. 110, ANOM, Paris.

Jardin du Roi, where Buffon had reigned as intendant for nearly half a century. Rather, he sought validation from members of rival institutions of agronomic and natural historical research, at least two of whom, Bruguière and Broussonet, were followers of Buffon's bitter enemy Carolus Linnaeus. Ideological and social cleavages within the community of metropolitan naturalists may thus have played an important part in evaluations of the experiment with the *oiseau martin* in the Mascarene Islands.

Conclusion

In his best-selling book *L'oiseau* (1856), the republican historian-turned-naturalist Jules Michelet praised insectivorous birds as "laborers of mankind" (*ouvriers de l'homme*) who ensured man's subsistence by sustaining the "gentle, peaceful republic of all the forms of life."⁷⁰⁹ Unfortunately, "avaricious" farmers hunted down these "honest workers" with impunity, "blind to the great harmony that we rupture at our peril," unwittingly killing the defenders of their crops.⁷¹⁰ Michelet cited several historical examples that revealed the perils of men's ignorance of the "intelligence of the natural order."⁷¹¹ In the Île de Bourbon, Michelet related, the *oiseau martin* had been proscribed

⁷⁰⁹ Jules Michelet, *L'oiseau* (Paris: Hachette, 1861), 169-178; Lionel Gossman, "Michelet and Natural History: The Alibi of Nature," *Proceedings of the American Philosophical Society* 145 (2001): 325.

⁷¹⁰ Michelet, *L'Oiseau*, 169.

⁷¹¹ Michelet, *L'Oiseau*, 171.

and exterminated by colonists on the island, which was subsequently overrun by locusts, "devouring, desiccating, burning with a sharp aridity what they did not devour."⁷¹²

Michelet's anecdote, which contrasted the philosopher-naturalist's comprehensive understanding of the functioning of the natural order against the short-sightedness of ordinary farmers, distorted the far more contentious history that surrounded the introduction of the *oiseau martin* to the Mascarene Islands. Reports of ecological disturbance caused by the *oiseau martin* circulated widely within ministerial circles and communities of naturalists, raising potential limitations to human understanding of the complexities of the oeconomy of nature. The debate over the *oiseau martin*'s status as beneficent agent or pariah took place within a wide field constituted by natural historical texts, travel books, the periodical press, oeconomic societies, agricultural societies and scientific academies. Within this arena, naturalists and lay observers competed for intellectual authority over the operations of the oeconomy of nature and the appropriate interventions required to rectify temporary imbalances. The majority of colonists on the islands seem to have been relatively marginal participants in this debate, although they made their opinions felt with their firearms by flouting the conservation laws that protected the *oiseau martin*.

This chapter has shown that human-induced transformations of ecological systems began to be envisioned as a strategy (albeit a potentially risky one) for the oeconomic management of natural resources in the mid eighteenth century. The oeconomy of nature was increasingly viewed as prone to manipulation by authoritative naturalists who

⁷¹² Michelet, *L'Oiseau*, 170; The anecdote was repeated by the American conservationist George P. Marsh: George P. Marsh, *Man and Nature, or Physical Geography as Modified by Human Action* (London: S. Low, 1864), 90.

understood its intricate interrelationships, as the expansion of long-distance scientific and trade networks facilitated the global redistribution of natural predators. The introduction of the *oiseau martin* in the Mascarene Islands, part of the "neo-Columbian exchanges" of the eighteenth century, signaled the expansion of naturalists' authority into the domain of environmental management and the beginnings of a phase of ecological globalization mediated by imperial and scientific institutions.⁷¹³ Since the end of the eighteenth century, the geographic range of a wide number of animal species, including the *oiseau martin*, has expanded dramatically as a result of attempts to modify ecosystems for the purpose of improving agricultural production. The *oiseau martin* was widely distributed throughout the French empire in the second half of the nineteenth-century, under the counsel of the naturalist Alfred Grandidier (1836-1921), as the acclimatization of animals became a central tool of French colonialism.⁷¹⁴ Over the course of the twentieth century, this bird spread, through migration and intentional introduction, to every continent except

⁷¹³ Stuart McCook dates these developments to the 1720s, while Frederik Jonsson argues that the "intensifying interaction" between natural history, ecology and politics began as early as the 1620s: Stuart McCook, "The Neo-Columbian Exchange: The Second Conquest of the Greater Caribbean, 1720-1930," *Latin American Research Review* 46 (2011): 11-31; Fredrik Albritton Jonsson, "Natural History and Improvement: The Case of Tobacco," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, edited by Philip J. Stern and Carl Wennerlind (Cambridge: Cambridge University Press, 2013), 117-150.

⁷¹⁴ "Demande formée par M. Grandidier à l'effet d'obtenir l'introduction aux colonies de l'oiseau dit martin pour la destruction des sauterelles," 1867, COL/C/4/146, ANOM, Aix-en-Provence; Raymond Decary, "Sur des Introductions Imprudentes d'Animaux aux Mascareignes et à Madagascar," *Bulletin du Muséum National d'Histoire Naturelle* 5 (1962): 404-407; On the acclimatization movement during the Second Empire see: Michael Osborne, *Nature, the Exotic and the Science of French Colonialism* (Bloomington: Indian University Press, 1994).

South America and Antarctica.⁷¹⁵ Vindicating the earlier concerns of colonists in the Mascarene Islands, it has been classified by the World Conservation Union as one of three birds among the world's 100 worst invasive species.⁷¹⁶ Causing substantial damage to agricultural crops and endangering the biodiversity of non-native habitats, it has been the subject of eradication efforts by conservationists and environmental biologists.⁷¹⁷ The long-term legacy of the martin's introduction to the Mascarene Islands was thus not only the formation of a novel technology of economic management, but also the creation of a global pariah.

⁷¹⁵ R. Liversidge, "Alien Species Introduced into Southern Africa," *Proceedings of the Birds and Man Symposium held in Johannesburg 10-15 April 1983* (Johannesburg: Witwatersrand Bird Club, 1985), 31-44; Derick Peacock, et al. "The Distribution and Spread of the Invasive alien common myna," *South African Journal of Science* 103 (November/December 2007): 465-473.

⁷¹⁶ S. Lowe, M. Browne, S. Boudjelas and M. de Poorter, *100 of the World's Worst Invasive Alien Species* (Auckland: The Invasive Species Specialist Group, 2000); Grarock, et al. "Is it Benign or Is it a Pariah? Empirical Evidence for the Impact of the Common Myna (*Acridotheres Tristis*) on Australian Birds," *PLOS ONE* (July 2012).

⁷¹⁷ James Millet, "Eradication of the common mynah *Acridotheres Tristis* Populations in the granitic Seychelles: successes, failures and lessons learned," *Advances in Vertebrate Pest Management* 3 (2004):169-183.



Figure 12. Global range of the mynah bird. Source: Derick Peacock, et al. "The Distribution and Spread of the Invasive alien common myna," *South African Journal of Science* 103 (November/December 2007): 466.

Part 3: Insect Pathogens in the Age of Global Commerce

Chapter 6. Naming the Hessian Fly: Classification and Natural History in the Age of Global Commerce

Introduction

On a warm evening in Paris in September of 1766, two women from the Faubourg Saint-Antoine stumbled upon a remarkable phosphorescent flying beetle.⁷¹⁸ The light emitted by this insect, perched on one of the houses of the faubourg, was simply astonishing, resembling the "fires of a burning meteor." A small crowd of neighborhood residents, alerted by the two women, gathered to observe this insect, their "eyes hardly being able to withstand its vivacity." The appearance of this strange insect in the eastern suburb of Paris created enough of a buzz to attract the attention of naturalists at the *Académie des Sciences*. Having been captured by the residents of the Faubourg, the insect was then passed along to the *académicien* Fougereux de Bondaroy (1732-1789) who was immediately struck by the "beauty of its light." After comparing the insect with specimens in the *Académie's* entomological collection, Fougereux de Bondaroy determined that the insect originated from Cayenne. By what means had this insect travelled across the Atlantic to the Faubourg Saint Antoine? Fougereux de Bondaroy responded with unequivocal certainty: the insect had travelled in a shipment of Guyanese wood that was used by numerous cabinetmakers in the Faubourg Saint-Antoine. In its larval stage, the insect had burrowed into the wood before being shipped across the Atlantic only to undergo metamorphosis in a cabinetmaker's shop in Paris where it was stored.

⁷¹⁸ What follows is taken from: Auguste-Denis Fougereux de Bondaroy, "Mémoire sur un insecte de Cayenne, appelé Maréchal, et sur la lumière qu'il donne," *Histoire de l'académie royale des sciences* (Paris: L'imprimerie royale, 1769), 339-342.

The appearance of this phosphorescent Guyanese beetle in Paris shows how global biological redistribution became one of the unintended consequences of early modern trans-Atlantic commerce. Ships were not only vectors of commerce but also of biological dispersal, carrying insects and other biota across the globe, along with the commodities of international and colonial trade.⁷¹⁹ Fougereux regretted that only a single specimen of the Guyanese beetle had been imported into Paris, remarking that it otherwise might have been possible to "enrich the natural history of our country with a new species of insects, without fearing that its multiplication could do much harm to our productions."⁷²⁰ Few naturalists of the eighteenth century were as sanguine or optimistic in their assessments of the potential consequences of biological dispersal. Indeed, the prospect of biological invasion was one of the nightmares of Enlightenment savants and state administrators.⁷²¹ The specter of biological invasion haunted the Swedish naturalist Pehr Kalm in 1751, when he found the dreaded New Jersey pea-beetle in a sample of sweet peas he brought back from his voyage to North America:

⁷¹⁹ On the spread of pathogens as a consequence of colonialism and global trade see: Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Westport, Conn: Praeger, 2003 [1972]), chs. 2-4; On the global spread of pests and pathogens from the eighteenth to the twentieth centuries, see: Stuart McCook, "The Neo-Columbian Exchange: The Second Conquest of the Greater Caribbean, 1720-1930," *Latin American Research Review* 46 (2011) 24-27; For a historical perspective from ecologists and biologists see: F. di Castri, "History of biological invasions with Emphasis on the Old World," *Biological Invasions: a Global Perspective* (New York: Scope, 1989), 1-30; Richard N Mack et al, "Biotic Invasions: Causes, Epidemiology, Global Consequences, and Control," *Ecological applications* 10 (June 2000), 690-691.

⁷²⁰ Fougereux de Bondaroy, "Mémoire sur un insecte de Cayenne," 342 [Peut-être aurait-il été possible d'enrichir l'histoire naturelle de notre pays d'une nouvelle espèce d'insectes, sans qu'on pût appréhender que sa multiplication fit un grand tort à nos productions]

⁷²¹ Frederik Jonsson, *Enlightenment's Frontier: The Scottish Highlands and the Origins of Environmentalism* (New Haven: Yale University Press, 2013), 195-202.

On opening the paper, after my arrival in Stockholm, on August the 1st 1751, I found all the pease hollow, and the head of an insect peeping out of each ... I own, that when I first perceived them, I was more frightened than I should have been at the sight of a viper. For I at once had a full view of the whole damage, which my dear country would have suffered, if only two or three of these noxious insects had escaped me. The posterity of many families, and even the inhabitants of whole provinces, would have had sufficient reason to detest me, as the cause of so great a calamity.⁷²²

While the increased mobility of Enlightenment naturalists was promoted as necessary for expanding the power of states and empires it did not come without risks, as Kalm realized. The intensified movement of people, plants and commodities across geographical borders that characterized the incipient early modern global economic order provoked widespread fears of biological invasion.⁷²³

No insect elicited greater panic amongst naturalists and state administrators in the eighteenth and early nineteenth centuries than the so-called 'Hessian Fly.' This insect, suspected by contemporaries to have been imported by Hessian troops during the American Revolutionary War, began to decimate crops on the eastern seaboard of the United States in the 1770s. The insect is relatively well known to historians of early America, who have examined its long-term impact on the organization of American agriculture, and its role in mobilizing the nascent community of agronomists and

⁷²² John Pinkerton (ed.), *A General Collection of the Best and Most Interesting Voyages and Travels in All Parts of the World*, (London: Cadell and Davies, 1808-1814), 12: 434.

⁷²³ On economic globalization in the early modern period see: Immanuel Wallerstein, *The Modern World-System. Mercantilism and the Consolidation of the European World-Economy, 1600-1750*, vol. 2 (New York: Academic Press, 1980); Kenneth Pomeranz and Steven Tropik, *The World that Trade Created: Society, Culture and the World Economy, 1400 to the Present* (Armonk, NY: M.E. Sharpe, 1999); Michael Lang, "Globalization and Its History," *The Journal of Modern History* 78, no. 4 (December 2006): 914-921; Paul Cheney, *Revolutionary Commerce: Globalization and the French Monarchy* (Cambridge: Harvard University Press, 2010); Suzanne Desan, Lynn Hunt and William Max Nelson (eds.) *The French Revolution in Global Perspective* (Ithaca: Cornell University Press, 2013), chs. 1-2.

naturalists of the early Republic.⁷²⁴ Philip J. Pauly has analyzed in detail the diplomatic tensions caused by the fly when the British Privy Council decided at the end of the 1780s, under the advice of the naturalist Joseph Banks, to place an embargo on American wheat.⁷²⁵ Yet the intense concern raised by the Hessian fly amongst French diplomats, royal administrators and naturalists on the eve of the French Revolution has not yet received attention. That French historians have overlooked the Hessian fly scare is somewhat surprising, given the substantial amount of scholarship that has been devoted to understanding how the Bourbon monarchy attempted to manage the subsistence crises and grain shortages that led France down the path to Revolution at the end of the 1780s.⁷²⁶

The aim of this chapter is to examine the strategies developed by diplomats, naturalists and administrators in France to evaluate and manage the risks posed by the global spread of biological pathogens like the Hessian fly from the end of the Ancien Régime to the Restoration period. In the final decades of the eighteenth century, there

⁷²⁴ Alan Taylor, "The Hungry Year: 1789 on the Northern Border of Revolutionary America," *Dreadful Visitations: Confronting Natural Catastrophe in the Age of Enlightenment*, ed. Alessa Johns, (New York: Routledge, 1999), 145-181; Brooke Hunter, "Creative Destruction: The Forgotten Legacy of the Hessian Fly," in *The Economy of Early America: Historical Perspectives and New Directions*, ed. Cathy Matson (University Park, PA: Pennsylvania State University Press, 2006), 236-263;

⁷²⁵ Philip J. Pauly, "Fighting the Hessian Fly: American and British Responses to Insect Invasion, 1776-1779," *Environmental History* 7, no. 3 (July 2002): 485-507.

⁷²⁶ For a sample of scholarship on the politics of provisioning and on the social unrest caused by grain shortages at the end of the Ancien Régime see: George Rudé, *The Crowd in the French Revolution* (Oxford: Clarendon Press, 1960); Steven Kaplan, *Bread, Politics and Political Economy in the Reign of Louis XV* (The Hague: Martinus Nijhoff, 1976); Emmanuel Le Roy Ladurie, *Histoire humaine et comparée du climat: Disettes et révolutions 1740-1860* (Paris: Fayard, 2006), ch. 5; Jean Nicolas, *La rébellion française. mouvements populaires et conscience sociale 1661-1789* (Paris: Gallimard, 2008), 389-399.

was a growing awareness amongst naturalists and *philosophes* that human activity was significant enough to alter the face of the earth on a global scale. Some historians have seen in the Comte de Buffon's *Époques de La Nature* (1778) the earliest indication of a consciousness of global anthropogenic change.⁷²⁷ Early modern theories of anthropic climate change have been the subject of a number of recent studies by environmental historians, but human-induced biological redistribution and biotic invasions also attracted their fair share of attention in the late eighteenth century.⁷²⁸ In his "Discours sur l'origine des animaux et des plantes du nouveau monde," (1798) to take one typical example, the pharmacist-naturalist Joseph Julien Virey (1775-1846) remarked that since Columbus' voyage to the New World, "the entire planet has taken on a new appearance." In order to "nourish his luxury and to attend to his needs," man had caused the "emigration" of innumerable species of plants, insects and animals to all corners of the earth.⁷²⁹ Extensive commerce and trade had transformed man into a biological agent, so that through the

⁷²⁷ Jean-Baptiste Fressoz and Fabien Locher, "L'agir humain sur le climat et la naissance de la climatologie historique, XVIIe-XVIIIe siècles," *Revue d'histoire moderne et contemporaine* 62, no. 1 (2015): 48-78; J.R. McNeill, "Introductory Remarks: The Anthropocene and the Eighteenth-Century," *Eighteenth Century Studies* 49, no. 2 (2016): 117-128.

⁷²⁸ On early modern theories of climate change see: Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism* (Cambridge: Cambridge University Press, 1995), ch.4; Jan Golinski, *British Weather and the Climate of Enlightenment* (Chicago: University of Chicago Press, 2007), ch. 6; Fabien Locher and Jean-Baptiste Fressoz, "Modernity's Frail Climate: A Climate History of Environmental Reflexivity," *Critical Inquiry* 38, no. 3 (2012): 579-598; Anya Zilberstein, *A Temperate Empire: Making Climate Change in Early America* (Oxford: Oxford University Press, 2016).

⁷²⁹ J-J Virey, "Discours sur l'origine des animaux et des plantes du nouveau continent," *Magasin Encyclopédique* 3 (1798): 433-458.

willful and unintentional spread of biota across the continents, "the sun no longer shines on an earth arranged solely by the simple hands of nature."⁷³⁰

The relationship between international commerce and the global movement of pests and pathogens was, however, more than a subject of natural historical reflection. In the late eighteenth and early nineteenth century, the intercontinental spread of harmful biota was becoming an issue of statecraft and international diplomacy.⁷³¹ The first portion of this chapter reconstructs the trans-Atlantic networks of communication within which consular agents, farmers, state administrators and naturalists in Britain, France and the United States exchanged bits of information about the behavior and reproductive patterns of the Hessian fly at the end of the 1780s. Observations of the Hessian fly circulated in this period across the Atlantic in print and private and official correspondence, forming the basis for British and European state administrators' evaluation of the risks associated with importing American wheat. This first phase in efforts to contain the spread of the Hessian fly was marked by profound disagreements between diplomats, administrators and naturalists over the risks posed by this insect to European agriculture. The disagreements over the behavior, purported transportability and provenance of this insect were of a socio-epistemic nature: doubts about the reliability and accuracy of the observations that circulated within these communication networks were intermingled

⁷³⁰ Virey, "Discours," 457.

⁷³¹ On the parallel case of commerce, diplomacy and global disease control see: Mark Harrison, "Disease, Diplomacy and International Commerce: the Origins of International Sanitary Regulation in the Nineteenth Century," *Journal of Global History* 1, no. 2 (2006): 197-217; Katherine Arner, "Making Global Commerce into International Health Diplomacy," *Journal of World History* 24, no. 4 (December 2013): 771-796.

with suspicions that the call for embargo by British naturalists and administrators was motivated by the desire to further national commercial interests.

Compounding these disagreements was the confusion raised by the multiplicity of names bestowed upon this insect by farmers, naturalists, state administrators and diplomats in France, the United States and England. At the beginning of the nineteenth century, the lack of a stable, commonly agreed upon, international system for describing, identifying, and naming insect pests like the Hessian fly came to be seen as a major lacuna in the efforts to contain their spread across borders. Even as Linnaeus' binominal system of nomenclature was beginning to gain ground at the end of the eighteenth century, the case of the Hessian fly demonstrates that the problem of synonymy remained acute for naturalists in this period.⁷³² This chapter traces the emergence of a consensus over practices for classifying insects, as the development of an international "coding system" based on the morphological characteristics of insects came to be seen as vital for managing the risks of biological dispersal in an age of intensified international trade. Classificatory systems, as historians of eighteenth-century science have noted, imposed themselves in this period as an indispensable tool of communication between naturalists, as an ever-increasing number of specimens were traded and collected across the globe.⁷³³

⁷³² On the problem of synonymy see: Londa Schiebinger, "Naming and Knowing: The Global Politics of Eighteenth-Century Botanical Nomenclature," in *Making Knowledge in Early Modern Europe: Practices, Objects and Texts*, eds. Pamela Smith and Benjamin Schmidt (Chicago: University of Chicago Press, 2007), 90-105.

⁷³³ For a sample of literature on classification and natural history see: Patrick Tort, *La raison classificatoire: quinze études* (Paris: Aubier, 1989); Paul Lawrence Farber, *Finding Order in Nature: The Naturalist Tradition from Linnaeus to E.O. Wilson* (Baltimore: Johns Hopkins University Press, 2000), ch.1; B.W. Ogilvie, "The many books of nature: Renaissance naturalists and information overload," *Journal of the History of Ideas* 64, no. 1 (2003): 29-40; Staffan Müller-Wille and Isabelle Charmantier,

Here, I argue that standardized classificatory practices also came to be envisioned at the beginning of the nineteenth century as essential tools of statecraft. The development of a common language that could lead to mutual understanding between naturalists, diplomats and administrators across great distances came to be seen as vital for managing the risks of contagion and biological dispersal in an age of intensified international commercial exchange.

The Hessian fly on the Eve of the French Revolution

On July 13th 1788, a violent hailstorm swept across northern France, destroying a substantial portion of the country's cereal crops.⁷³⁴ After a disastrous harvest decimated not only by hail, but also by a spring drought and excessive summer rains, royal administrators began to prepare for the possibility of severe grain shortages by August 1788.⁷³⁵ The threat of a subsistence crisis was compounded by the outbreak war between Sweden and Russia that cut off supplies of wheat from Poland.⁷³⁶ This conjuncture of events left administrators fearing the consequences of generalized bread shortages in cities across the kingdom, particularly in Paris where, as the *parlementaire* Louis Éthis de

"Natural history and information overload: the case of Linnaeus," *Studies in History and Philosophy of Biological and Biomedical Sciences* 43, no. 1 (2012): 4-15; Daniel Margóczy, *Commercial Visions: Science, Trade and Visual Culture in the Dutch Golden Age* (Chicago: University of Chicago Press, 2014), ch.2

⁷³⁴Anouchka Vasak, "L'orage du 13 juillet 1788," *Le Débat* 130 (2004): 171-188.

⁷³⁵ Brian M. Fagan, *The Little Ice Age: How Climate Made History, 1300-1850* (New York: Basic Books, 2000), 162-166; Emmanuel Le Roy Ladurie, *Histoire humaine et comparée du climat: disettes et révolutions, 1740-1860* (Paris: Fayard, 2006), ch. 5

⁷³⁶ 58 bread riots occurred in the kingdom between June and December of 1788, and 231 between January and the end of April 1789: Jean Nicolas, *La rébellion française, 260-265, 392.*

Corny (1736-1790) reminded the commissary of finances Louis Hardouin Tarbé (1753-1806), "the slightest, ill-founded hint of need becomes the signal for terror and crisis."⁷³⁷ Under these circumstances, American wheat became a vital palliative to the deepening social and political crises that afflicted the kingdom on the eve of the French Revolution.⁷³⁸ French administrators actively sought to supply the French market with American wheat, fearing the inevitable public disturbances that would result from a rapid rise in the price of bread.

For French diplomats, stung by their failure to displace Great Britain as the United States' chief trading partner a decade after the signing of the Treaty of Amity and Commerce of 1778, the turn to American wheat also provided an opportunity to nurture more extensive economic ties between France and the American republic.⁷³⁹ For the Comte de Moustier (1751-1817), French ambassador to the United States, there was a hidden blessing in the catastrophic grain harvest, in that the forced dependence on

⁷³⁷ De Corny to Tarbé, 23 September 1788, H/1444, ANF, Paris.

⁷³⁸ Silvia Marzagalli, "Guerre et création d'un réseau commercial entre Bordeaux et les États-Unis, 1776-1815. L'impossible économie du politique," in *Guerre et Économie dans l'espace atlantique du XVIIe au XXe siècle*, eds. Silvia Marzagalli and Bruno Marnot, 375-394 (Pressac: Presses universitaires de Bordeaux, 2006), 378.

⁷³⁹ On the strategic considerations behind the Treaty of the Amity of Commerce and assessments of its failure see: Jacques Godechot, "Les Relations Économiques Entre la France et les États Unis de 1778 à 1789," *French Historical Studies* 1, no. 1 (1958): 26-39; Peter P. Hill, "La suite imprévue de l'alliance: l'ingratitude américaine, 1783-1789," in *La Révolution Américaine et l'Europe*, eds. Claude Fohlen and Jacques Godechot (Paris: CNRS, 1979), 385-398; Stephane Bégaud, *Aux origines d'une alliance improbable: le réseau consulaire français aux États-Unis (1776-1815)* (Bruxelles: PIE, 2005), 113-181; Paul Cheney, "A False Dawn for Enlightenment Cosmopolitanism? Franco-American Trade during the American War of Independence," *The William and Mary Quarterly* 63, no. 3 (2006): 1-31; Silvia Marzagalli, "The Failure of a Transatlantic Alliance? Franco-American Trade, 1783-1815," *History of European Ideas* 34, no. 4 (2008): 456-464.

American wheat would "extend commercial relations between the two nations, because the Americans will now be able to trade foodstuffs for large quantities of merchandise which they must today renounce due to a lack of credit and capital."⁷⁴⁰ The recourse to American wheat would also serve to rectify the thorny issue of French-American debt, which acquired increasing political salience following the Controller General of finances Charles Alexandre de Callone's (1734-1802) public report on the paltry state of royal finances in 1787.⁷⁴¹ As the financier Jacques-Jean Le Couteux du Molay (1740-1823) wrote, the recourse to supplies of American wheat could help "settle the king's finances" by being traded against the near seven-million-dollar debt incurred by the United States' during the War of Independence.⁷⁴²

Yet as reports about the threat of the Hessian fly circulated through diplomatic channels, royal administrators were forced to consider the risks associated with an increase in imports of American wheat. French consuls in Philadelphia and New York first sounded the alarm at the end of August, when they learned of the Privy Council's ban on American wheat. Pierre-François Barbé de Marbois (1745-1837) immediately wrote from New York to Antoine de Laforest (1756-1846), the *consul général* in

⁷⁴⁰ Comte de Moustier to Montmorin, 18 November 1788, New York, CP/33, Archives du Ministère des Affaires Étrangères, (AME), La Courneuve [On pense que cet événement sera infiniment favorable pour étendre le commerce entre les deux nations puisque les Américains auraient des moyens de payer en denrées la valeur d'une grande quantité de marchandises de France, auxquelles aujourd'hui faute de capitaux et de crédit ils sont obligés de renoncer]

⁷⁴¹ Allan Potofsky, "The Political Economy of the French-American Debt Debate: The Ideological Uses of Atlantic Commerce, 1787 to 1800," *The William and Mary Quarterly* 63, no. 3 (July 2006): 489-516.

⁷⁴² Couteulx du Molay to Tarbé, Paris, 13 October 1788, pièce 247, H/1444, ANF. Paris.

Philadelphia, when he read about the embargo in the *New York Independent Journal*.⁷⁴³ Clearly alarmed by the news, Marbois suggested to Laforest that similar measures should be immediately imposed by the royal administration until the insect had been extirpated from the United States.⁷⁴⁴ Laforest wrote to the Minister of the Marine to advise him on a course of action yet, unlike Marbois, he was unnerved by the Privy Council's ban on American wheat. Laforest dismissed the embargo as a politically motivated policy, based on "erroneous information," that had been crafted by "grain hoarders" to deliberately cause a shortage of wheat in English markets.⁷⁴⁵ While the insect was indeed spreading rapidly in New Jersey, New York and Pennsylvania, its threats to agriculture had been overstated by British naturalists, as it only attacked the stalks of wheat plants and left the grain intact.⁷⁴⁶ Most crucially, Laforest remarked that the insect known as the Hessian fly was already present on French soil, having been identified by the naturalists Duhamel du Monceau and Lullin de Chateaufieux in 1755.⁷⁴⁷

The identification of the Hessian fly as an insect of potential French provenance proved vital to assuaging royal administrators' fears about possible contamination through imports of American wheat. If the British government could be justifiably fearful about

⁷⁴³ *New York Independent Journal* (Saturday August 23rd, 1788), 2; MAE, Nantes, 518 PO/1/64, Marbois to Laforest, New York, 27 August 1788, no 38; See also the report in *The Pennsylvania Mercury* and *Universal Advertiser* (August 28, 1788), 3.

⁷⁴⁴ Marbois to Laforest, New York, 27 August 1788, no 38, 518 PO/1/64, Ministère des Affaires Étrangères (MAE), Nantes,.

⁷⁴⁵ Laforest to Marbois, New York, 8 September 1788, no. 43, 5190 PO/1/17, Ministère des Affaires Étrangères (MAE), Nantes.

⁷⁴⁶ Laforest to Luzerne, 20 August 1788, MAR/G/101, ANF, Paris.

⁷⁴⁷ MAR/G/101, Laforest to Luzerne, 20 August 1788. MAR/G/101, ANF, Paris.

the introduction of an insect that was not present on its soil, the long attested presence of the insect in France made such concerns irrelevant. It was George Morgan, a farmer from New Jersey and a member of the American Philosophical Society, who first suggested that the Hessian fly was the grain moth described by Lullin de Chateauvieux in Henri Louis Duhamel du Monceau's *Traité de la Culture des Terres*, and later named by the latter "the chenille d'Angoumois" (see chapter 1).⁷⁴⁸ In the wake of the British embargo, the Supreme Executive Council of Pennsylvania and the Philadelphia Society for Promoting Agriculture publicly endorsed Morgan's findings in the *Pennsylvania Packet*.⁷⁴⁹ Laforest was evidently swayed by these efforts to dispel British misinformation about the Hessian fly, as he relayed Morgan's findings almost verbatim in his report to the Minister of the Marine.⁷⁵⁰ Jean de Crèvecoeur (1735-1813), the famed author of *Letters from an American Farmer* who served as consul to New York, New Jersey and Connecticut from 1783 to 1789, was likewise convinced of the French provenance of this insect, referring in passing to it in a consular report as the "Angoumois moth, known here as the Hessian Fly."⁷⁵¹

⁷⁴⁸ George Morgan, "Letter addressed to the Society for promoting Agriculture," *The American Museum* (July 1787): 529-532; Henri-Louis Duhamel du Monceau, *Traité de la Culture des Terres*, (Paris, 1755) 4: 163-164; See chapter 2 for Duhamel du Monceau's examination of the Angoumois moth.

⁷⁴⁹ "Extract from the Minutes of the Supreme Executive Council of Pennsylvania," *Pennsylvania Packet* September 10 1788, 2-3.

⁷⁵⁰ "Extract from the Minutes of the Supreme Executive Council of Pennsylvania," September 10 1788 *Pennsylvania Packet*, p.2-3; Laforest to Luzerne, 20 August 1788, MAR/G/101, ANF, Paris.

⁷⁵¹ "Essai sur la population, l'agriculture et les finances et le commerce de l'État de New York," 20 August 1788, f. 100, AE/B/910, ANF, Paris; On Crèvecoeur's functions as consul in New York: Andrew Moore, "The American Farmer as French Diplomat: J.

In Paris, the naturalists Mathieu Tillet, Fougeroux de Bondaroy and Pierre Marie Auguste Broussonet (1761-1807) of the *Société Royale d'Agriculture* offered a similarly reassuring report in August of 1788 after having examined sketches of the insect sent by the British ambassador, the Duke of Dorset.⁷⁵² Identifying the Hessian fly as either the *phalena graminis* or *phalena secalis*, common wheat insects found in the provinces of Northern France, they surmised that it had most likely been transported to the United States in shipments of French wheat.⁷⁵³ Although they could not "pronounce with certainty upon the identity of the species" of the insect, not having been able to examine a specimen themselves, the naturalists were "persuaded" that it was "of a species approaching" that of the chenille d'Angoumois, about which Tillet and Fougeroux de Bondaroy's uncle Duhamel du Monceau had written an extensive report two decades earlier (See chapter 1).⁷⁵⁴ Rejecting the need for an embargo on American wheat, the Société Royale d'Agriculture nevertheless cautioned that shipments of grain should be

Hector St. John de Crèvecoeur in New York after 1783," *Proceedings of the Western Society for French History* 39 (2011): 133-143.

⁷⁵² "Extracts from the Registers of the Royal Society of Agriculture of the 28th August, 1788," 454; Pierre Marie Auguste Broussonet, "Discours prononcé à la séance publique, tenue à l'Archevêché, le 28 Décembre 1789," *Mémoires d'agriculture, d'économie, rurale et domestique* (Paris: Société Royale d'Agriculture, 1789), 33-34.

⁷⁵³ The sketch was very possibly the same circulated by Joseph Banks to Arthur Young: Arthur Young to Joseph Banks, in Neil Chambers (ed.), *Scientific Correspondence of Sir Joseph Banks, 1765-1820* (London: Pickering and Chatto, 2007), 1043; "Extracts from the Registers of the Royal Society of Agriculture of the 28th August, 1788," 454. The *phalena graminis* was identified and named by Linnaeus's student Michael Baeckner in the 1740s: Michael Baeckner, *Noxa Insectorum sub praesidio D.D. Car. Linnaei proposita Michaele A. Baeckne*, (Upsalla: Græcii, 1766), 355

⁷⁵⁴ "Extracts from the Registers of the Royal Society of Agriculture of the 28th August, 1788," 459; Etienne Stockland, "La Guerre aux Insectes: Pest Control and Agricultural Reform in the French Enlightenment," *Annals of Science* 70, no. 4 (2013): 435-460.

purged of this insect by being passed through kilns before entering French ports, in order to "prevent carrying the evil to places where it at present exists not."⁷⁵⁵

Despite these reassuring assessments, the Privy Council's judgment clearly continued to have a negative impact on the international marketability of American wheat. "Fear of the insect," as John Brown Cutting informed the American ambassador to France, Thomas Jefferson, in October 1788, had led the prince-elector of Hanover to prohibit American wheat from entering his territory.⁷⁵⁶ Like Cutting and his friends John Jay and Thomas Paine, who privately challenged Banks' conclusion, Jefferson was convinced that Britain's embargo was part of a "malignant" plot and "political manoeuvre," to "fetter the commerce and check the prosperity of a country, whom it cannot forgive because it could not subdue."⁷⁵⁷ As Jefferson sought to stimulate the shipment of wheat from the Northeast and mid-Atlantic States to French ports, regularly transmitting information about prices of grain and flour to American merchants through commercial agents and diplomats, he feared that British naturalists and administrators' attempt to incite panic amongst foreign nations would interrupt this trade.⁷⁵⁸ In a letter to

⁷⁵⁵ "Extracts from the Registers of the Royal Society of Agriculture of the 28th August, 1788," 459.

⁷⁵⁶ John Brown Cutting to Thomas Jefferson, London, 17 October, 1788. *The Papers of Thomas Jefferson Digital Edition*, Barbara B. Oberg and J. Jefferson Looney (eds.) (Charlottesville: University of Virginia Press, 2008–2015. (PTJ)

⁷⁵⁷ Thomas Paine to Thomas Jefferson, 16 February, 1789, *TJP*.

⁷⁵⁸ André Limozin, a commercial agent for the American Congress stationed in Le Havre, and Stephen Cathalan, consul to the United States in Marseille, were Jefferson's primary relay points for information about the prices of wheat: Stephen Cathalan Sr. to Thomas Jefferson, 11 July, 1788, *PTJ*; Thomas Jefferson to Jean de Crèvecoeur, 9 August, 1788,; André Limozin to Thomas Jefferson, 18 August 1788, *PTJ*; Thomas Jefferson to Alexander Donald, 18 November 1788; Thomas Jefferson to John Jay, 19 November

the British political radical Benjamin Vaughan, he described the Privy Council's ban as a "libel on our wheat" and a "mere assassination" that could have no object but to spread "groundless alarm in those countries of Europe where our wheat is constantly and kindly received."⁷⁵⁹

Jefferson insisted on the safety of American wheat, arguing that the Hessian fly could not be transported in ships bound for Europe as it only attacked the stalks of wheat and did not introduce itself into the grain.⁷⁶⁰ The larvae of an insect known in the United States as the "fly weevil," he admitted, could be carried in grain aboard ships, but Jefferson identified this as an insect of French provenance, ubiquitous on the European continent, the "chenille d'Angoumois."⁷⁶¹ Jefferson's attempt to placate potential French fears about the safety of American wheat was a tall order. In doing so, he ran up against the opinions of powerful authorities on matters of natural history and agronomy such as Joseph Banks and Arthur Young, whose warnings about the threat posed to the European

1788 *PTJ*; Thomas Jefferson to André Limozin, November 30, 1788, *PTJ*; Thomas Jefferson to Morgan, père et fils, January 17, 1789, *PTJ*; Jefferson sought to secure a commission for the American merchants James Swan and Samuel Blackden to exports several hundreds of thousands of barrels of wheat to France: ANF, H/1444, Blackden and Swan to Tarbé, 22 September 1788; Blackden and Swan 15 October 1788, H/1444, ANF, Paris.

⁷⁵⁹ Thomas Jefferson to Benjamin Vaughan, 17 May 1789, *PTJ*; Vaughan defended the Privy Council's decision, assuring Jefferson that there had been no "premeditated view existing to injure your corn trade with this country," but that the Parliament could "run no risques" of allowing the pernicious insect to enter the British Isles: Benjamin Vaughan to Thomas Jefferson, 7 May, 1789, *PTJ*; Benjamin Vauhan to Thomas Jefferson, 22 May 1789, *PTJ*.

⁷⁶⁰ Jefferson to Vaughan, May 17, 1789 *PTJ*.

⁷⁶¹ Jefferson to Vaughan, May 17, 1789, *PTJ*; Thomas Mann Randolph to Thomas Jefferson, 17 February 1792, *PTJ*; At some point in the 1780s, Jefferson obtained a copy of Duhamel du Monceau's *Histoire d'un Insecte qui dévore les grains de l'Angoumois*: Thomas Jefferson to Martha Jefferson Randolph, 4 December 1791, *PTJ*.

continent by the Hessian fly appeared in the *Mercure de France* on June 20th, 1789.⁷⁶² To dispel what he viewed as the misinformation spread by the British natural historical establishment, Jefferson could count on close relationships with royal officials in Paris and Versailles, notably with the foreign minister Montmorin, which he cultivated through his diplomatic duties and by frequenting fashionable *salons* in Paris.⁷⁶³ Jefferson also had important allies across the Atlantic in the diplomatic corps like the consul Laforest who, brushing off British anxieties about the safety of American wheat, coordinated shipments of hundreds of thousands of tons of grain from New York, Philadelphia and Baltimore to Bordeaux in the autumn of 1788.⁷⁶⁴

On November 23rd, 1788 the *Conseil du Roi* announced that bounties would be offered to French and foreign merchants importing wheat and flour from the United States.⁷⁶⁵ The royal administration's decision to encourage shipments of American wheat was partly a matter of political expediency, a last-ditch attempt to push down rapidly escalating bread prices that were leading the kingdom on the path to revolution. Yet the *arrêt* was also a product of the consensus that had developed within Franco-American

⁷⁶² *Mercure de France*, 20 June 1789, 105-109.

⁷⁶³ On Jefferson's relationships with officials and savants in Paris see: Phillip Ziesche, *Cosmopolitan Patriots: Americans in Paris in the Age of Revolution* (Charlottesville: University of Virginia Press, 2010), ch. 1; Iain McLean, "The Paris Years of Thomas Jefferson," *A Companion to Thomas Jefferson*, ed. Francis Cogliano (Malden, Mass.: Wiley-Blackwell, 2012), 110-127.

⁷⁶⁴ La Forest to Montmorin, 9 December 1788, f. 324-326, AE/B/I/946, ANF, Paris.

⁷⁶⁵ "Extract of a letter dated Paris, Nov. 29, 1788 from the honorable Mr. Jefferson to John Jay," *New York Journal*, 19 February 1789; The *arrêt* is partially reproduced in: "Arrêt du Conseil concernant le commerce des grains, 23 Novembre 1788," *Recueil Général des Anciennes Lois Françaises depuis l'an 420 jusqu'à la Révolution de 1789*, eds. Athanase Jourdan and François-André Isambert (Paris: Belin-Leprieur, 1827), 629-630.

diplomatic, ministerial and scientific circles that the Hessian fly posed no substantial biological threat to French agriculture. The American expatriate Lucy Ludwell Paradise informed Jefferson from London in May 1789 of the "very great noise [...] made about this fly that spoils our wheat," but these public declamations found few echoes across the Channel in the months leading up to the French Revolution.⁷⁶⁶ While Britain closed its ports to American wheat between July of 1788 and December of 1789, shipments of American grain to France nearly tripled during the period.⁷⁶⁷ As the Franco-German diplomat Louis-Guillaume Otto remarked, the bad harvests in France and an ill-advised British embargo had at least had the salutary effect of "showing [the Americans] the route to our ports and to accustom them thence."⁷⁶⁸ Consequently, French diplomats and state administrators greeted the British Privy Council's revocation of the embargo on American wheat in December 1789 with a mixture of apprehension and self-satisfaction. Laforest justifiably worried that the renewed British demand for American wheat would create an escalation in the international price of flour and grain at a time when France and its colonies were still reeling from a dearth of breadstuffs.⁷⁶⁹ Yet he also evidently delighted in the fact that the lifting of the prohibition amounted to a public avowal by the British

⁷⁶⁶ Lucy Ludwell Paradise to Thomas Jefferson, May 15, 1789, *TJP*.

⁷⁶⁷ John F. Stover, "French-American Trade During the Confederation, 1781-1789," *The North Carolina Historical Review* 35, no. 4 (October 1958) 406, 409-410; Geoffrey Gilbert, "The Role of Breadstuffs in American Trade, 1770-1790," *Explorations in Economic History* 14, no. 4 (1977) 384; Brooke Hunter, "Wheat, War, and the American Economy during the Age of Revolution," *William and Mary Quarterly* 62, no. 3 (July 2005) 516-517; Silvia Marzagalli, "The Failure of a transatlantic alliance?," 457.

⁷⁶⁸ Otto to Montmorin, New York, 15 February 1790, CP 35, AME, La Courneuve; to Montmorin, New York, 19 February 1790, CP 35, AME, La Courneuve;

⁷⁶⁹ La Forest to Fleurieu, New York, 25 February 1790, AE /B/910, ANF, Paris.

political and natural historical establishment that the "anxieties [*inquiétude*] over American wheat had been ill-founded."⁷⁷⁰

Before leaving Paris in September 1789, Jefferson remarked to Benjamin Vaughan that the British embargo on American wheat had made "no durable impression" in France because French administrators possessed a "good degree of information" and a "general indisposition towards whatever seems to be the views of the court of London."⁷⁷¹ It is unclear whether Jefferson counted political ill-will between France and Britain or the reliability of the information circulating with French scientific and administrative networks as the critical factor contributing to the momentary nature of this alarm. That Jefferson was willing to ambiguously place both factors on the same plane points towards his own, privately held, uncertainties about the true identity and geographical origin of the Hessian fly. This uncertainty stemmed in part from the fact that neither Jefferson, the members of *Société Royale d'Agriculture* nor the diplomats and royal administrators who resisted the calls for an embargo on American wheat had ever seen an actual specimen of the insect. Their opinions were formed exclusively on the basis of inconsistent and conflicting verbal descriptions found in periodicals, natural historical texts correspondence and reports of conversations that circulated across the English Channel and the Atlantic. As one diplomat in the Austrian Netherlands remarked, however, purely verbal descriptions of the insect were "too vague to provide any basis for serious study."⁷⁷²

⁷⁷⁰ La Forest to Fleurieu, New York, 25 February 1790, AE /B/910, ANF.

⁷⁷¹ Thomas Jefferson to Benjamin Vaughan, Paris 13 September 1789, *TJP*.

⁷⁷² Cited in Pauly, "Fighting the Hessian Fly," 495.

Only through the elaboration of a shared set of norms for describing and classifying insects could verbal descriptions, exchanged by naturalists across great distances, provide a basis for the "serious study" of insect pathogens. As naturalists and administrators across Europe and North America came to view the unintentional global dispersal of noxious insects as an unfortunate but necessary consequence of international trade, Linnean typology and nomenclature came to be seen as an indispensable technology for adequately managing this risk. In the following sections of this chapter, I examine how recurring fears about the Hessian fly's proliferation and spread across borders helped bring about this consensus amongst naturalists and administrators in France, Britain and the United States.

Louis Augustin Bosc d'Antic (1759-1828), The Hessian Fly and the Global History of Insects

That binominal nomenclature found few adherents in Ancien Régime France was, as is well known, due in large part to the hostility of the intendant of the Jardin du Roi Georges-Louis Leclerc Comte de Buffon (1707-1788) to Linnaean systematics.⁷⁷³ Buffon's philosophical and epistemological opposition to taxonomy, and to the Linnaean program in particular, had placed classification at the margins of French natural historical practice in the second half of the eighteenth century.⁷⁷⁴ Faced with Buffon's refusal to embrace Linnean typology and nomenclature, French naturalists committed to this system

⁷⁷³ On Buffon's dispute with Linnaeus and his opposition to taxonomy in general see: Daniel Mornet, *Les Sciences de la nature en France au XVIIIe siècle* (Paris: Colin, 1911), 114-122; Phillip R. Sloan, "The Buffon-Linnaeus Controversy," *Isis* 67, no. 3 (September 1976): 356-375; Pascal Duris, *Linné et la France (1780-1850)* (Genève: Droz, 1993), 31-38.

⁷⁷⁴ Frans A. Stafleu, *Linnaeus and the Linnaeans: the Spreading of their Ideas in Systematic Botany* (Utrecht: Oosthoek, 1971), ch. 9.

had been forced to pursue their work in collaboration with naturalists in Britain and Northern Europe, where Linneaus' method had gained firmer ground.⁷⁷⁵ Buffon's death in April 1788 came as a relief to the French followers of Linneaus such as Aubin-Louis Millin de Grandmaison (1759-1818), who looked cheerfully ahead towards a future in which "the new generation, leaving behind the errors and prejudices of the previous one" could now embrace "the true principles, those of the Linnaean school."⁷⁷⁶ In the 1790s, the *nomenclateurs* gained the upper hand, spearheading a reform of the language of natural history during a time of profound institutional change with the domain of the natural sciences.⁷⁷⁷ The natural history of insects was no exception to this general tendency, as naturalists who had embraced Linnaean systematics prior to the Revolution came to define the parameters of the field in this decade.

Chief among these was Louis Augustin Bosc d'Antic (1759-1828), a core member of the informal community of French Linnaeans that had formed at the end of the Ancien

⁷⁷⁵ Georgia Beale, "Early French Members of the Linnean Society of London, 1788-1802: Initial Encounters," *Studies on Voltaire and the Eighteenth-Century* 292 (1991): 129-138; James Livesey, "London by the Light of Montpellier: Scientific Networks between Britain, northern Europe and the Languedoc," in *Cultural Transfers: France and Britain in the Long Eighteenth Century*, eds. Anne Thomson, Simon Burrows and Edmond Dziemboski (Oxford: SVEC, 2011), 85-102.

⁷⁷⁶ Aubin-Louis Millin de Grandmaison, "Discours sur l'origine et le progrès de l'histoire naturelle en France," *Actes de la Société d'Histoire Naturelle* 1 (1792): xiii; Pietro Corsi, "Buffon sous la Révolution et l'Empire," in *Buffon 88 Actes du Colloque international pour le bicentenaire de la mort de Buffon* (Paris: Vrin, 1988), 639-648.

⁷⁷⁷ Pietro Corsi, "Models and analogies for the reform of natural history: features of the French debate, 1790-1800," in *Lazzaro Spallanzani e la biologia del settecento. Teorie, esperimenti, istituzioni scientifiche* (Firenze: Leo S. Olschki editore, 1982), 381-396; Pietro Corsi, "After the Revolution: Scientific Language and French Politics, 1795-1802," in *The Practice of Reform in Health, Medicine and Science, 1500-2000: Essays for Charles Webster*, eds. Margaret Pelling and Scott Mandelbrote (Aldershot: Ashgate, 2005), 223-245.

Régime.⁷⁷⁸ The son of a prominent physician, chemist and entrepreneur, Paul Bosc d'Antic (1726-1784), Louis Augustin had devoted himself at an early age to the study of insects.⁷⁷⁹ His father sent him to the *collège de Dijon*, during which time Bosc d'Antic also attended natural history courses at the city's botanical garden. Louis Augustin settled in Paris in the 1770s, taking up clerical posts in the office of the Controller General and the Postmaster General. Appointed Secretary General to the *Intendance des Postes* in 1778, Bosc used this position to build an extensive correspondence network with naturalists across the continent. The ability to ship letters and packages of specimens free of charge through the *droit de franchise* allowed him to become, as he later recalled, the "center of the correspondence of all the naturalists of Europe."⁷⁸⁰ He also used the position to amass a significant private collection of insects that established his reputation amongst *savants* and entomological collectors.⁷⁸¹ As Georges Cuvier (1769-1832) later wrote, it was the accumulation of an ever-increasing quantity of insect specimens that

⁷⁷⁸ Georgia Beale, "Early French Members," 129-138.

⁷⁷⁹ Augustin François de Silvestre, *Notice Biographique sur M. Louis-Augustin-Guillaume Bosc* (Paris: Huzard, 1829); Georges Cuvier, *Éloge historique de M. Bosc lu à la séance publique de l'académie royale des sciences le 15 juin 1829* (Paris: Didot, 1829); For a brief biography relying on the printed *éloges* of the 19th century see: Jean-Loup d'Hont, "Louis-Auguste-Guillaume Bosc (1759-1828), conventionnel, et naturaliste, premier systemamnticien français des bryozaires actuels," in *Scientifiques et sociétés pendant la Révolution et l'Empire* (Paris: CTHS, 1990), 241-258.

⁷⁸⁰ "Notes sur ma vie pour aider ceux qui s'occupent de biographie," f. 27, MS 1007, Bibliothèque Historique de la Ville de Paris (BHVP), Paris.

⁷⁸¹ See also his technique for preserving insect larvae for natural history collections: Bosc d'Antic, "Moyen simple de déssecher les larves pour les conserver dans les collections entomologiques à coté des insectes qu'elles produisent," *Journal de Physique* 26 (April 1785): 241-244.

"caused him early on to recognize the necessity of adopting a precise nomenclature applicable to such a large number of objects."⁷⁸²

Bosc's exposure to the works of the Danish entomologist and Johan Christian Fabricius (1745-1808) by his friend (and Linnaean fellow traveller) Pierre-Marie Auguste Broussonet (1761-1807) ultimately convinced him of the utility of Linnaeus' system of binomial nomenclature.⁷⁸³ More than a handy tool for organizing private collections of insects, binomial nomenclature was, as Bosc d'Antic wrote in the *Journal de Physique*, necessary for perfecting their study. A stable and systematic nomenclature, Bosc argued, was required to manage the expanding number of insects identified by practitioners of natural history and to preserve this knowledge for posterity:

No naturalist can ignore the progress that has recently been made in the study of insects. But those who occupy themselves with this field know how far it is from the perfection that has been reached in other parts of natural history. Every day new specimens fall in the hands of observers... that are often lost to science, by their failure to publish descriptions *and to make them known to the nomenclateurs*.⁷⁸⁴

While Buffon had coined the term "nomenclateur" as a term of derision, to mock those who in his view mindlessly subjected the bewildering variety of nature's productions to artificial taxonomic systems, Bosc proudly assumed the title, pointing out the important

⁷⁸² "Notes sur ma vie," f. 30; Cuvier, "Éloge," 6.

⁷⁸³ "Notes sur ma vie," f. 26.

⁷⁸⁴ Bosc d'Antic, "Description de l'Orthezia-Characias," *Observations sur l'histoire naturelle, sur la physique et sur les arts* 24 (Paris, 1784): 171 [Aucun naturaliste n'ignore les progrès que l'étude des insectes à fait dans ces derniers temps; mais ceux qui s'occupent de cette étude, savent seuls combien elle est encore loin de la perfection qu'ont atteint les autres parties de l'histoire naturelle. En effet, il en tombe tous les jours entre les mains des observateurs même dans les lieux les mieux connus, qui présentent des particularités dignes d'attention; et souvent il sont perdus pour la science, par la négligence qu'ils apportent à en publier la description, à les faire connoître aux nomenclateurs]

role that taxonomists played as custodians of collective knowledge.⁷⁸⁵ Building and elaborating upon the system of his "master Linneaus," Bosc spent the 1780s adding to and developing new *genera* for insects identified by himself or by his correspondents in Paris and the provinces.⁷⁸⁶ Bosc also busied himself in this decade with the classification of insect pests, a project simultaneously pursued by Fabricius, with whom he developed a personal relationship. When an insect decimated the vineyards of Argenteuil near Paris in 1786, Broussonet read a paper by Bosc on the subject to the Société Royale d'Agriculture de Paris.⁷⁸⁷ After briefly surveying the vernacular names given by winegrowers to insects that attacked their vines, Bosc set himself to providing the first "systematic description" of this insect. Examining specimens of the larva and moth in his cabinet, Bosc placed the insect in the genera *pyralis*, directly above Fabricius' *pyralis viridian*.

Bosc's work as a classifier of the insect kingdom and as a proselytizer of Linnean taxonomy continued within the *sociétés libres* – the voluntary associations that blossomed in the waning days of the Ancien Régime and in the early years of the French Revolution. In December 1787, Bosc helped found the short-lived *Société Linnéenne de Paris* along with Broussonet, Millin de Grandmaison, Guillaume Antoine-Olivier (1756-1814) and André Thouin (1747-1824).⁷⁸⁸ Within the *Société Linnéenne*, Bosc and Olivier

⁷⁸⁵ For Buffon's criticism of the "nomenclateurs" in his *Histoire Naturelle* see: Jacques Roger, *Buffon: Un Philosophe au Jardin du Roi* (Paris: Fayard, 1989), 408.

⁷⁸⁶ "Bosc Cenaculum Insectorum," 5 January 1788, MS 873, BCHMN, Paris.

⁷⁸⁷ Bosc d'Antic, "Mémoire pour servir à l'histoire de la chenille qui a ravagé les vignes d'Argenteuil, par M. Dantic communiqué par Broussonet," *Mémoires d'agriculture, d'économie rurale et domestique* (Paris: Cuchet, 1786), 22-27.

⁷⁸⁸ On the *Société Linnéenne* and the background to its formation see: Georgia Beale, "Early French Members," 1121-1125; Duris, *Linné et la France*, 69-87.

planned to provide a systematic survey of the insects around Paris, pursuing the investigations begun by Olivier in his topographical survey of the *Généralité de Paris* commissioned in 1785 by the intendant of Paris Bertier de Sauvigny (1737-1789).⁷⁸⁹ The *Linnaean Society of London* and the *Société Philomatique de Paris*, a scientific society that the historian Jacques Roger has described as key player in the "Linnean crusade of the 1790s," were also outlets for Bosc's taxonomic work.⁷⁹⁰ Bosc was also a leading figure in the *Société d'Histoire Naturelle de Paris*, a scientific club founded in August 1790 that acted as a successor to the *Société Linnéenne de Paris* (dissolved in the summer of 1789) and as a rival institution to the *Jardin du Roi*.⁷⁹¹ In addition to keeping the

⁷⁸⁹ G-A Olivier, "Mémoires sur quelques insectes observés aux alentours de Paris," H/1514, ANF, Paris; "Extrait des registres de la société royale d'agriculture du 14 février 1788,"; See also: Jean Theodoridès, "Jean-Guillaume Bruguière (1749-1798) et Guillaume-Antoine-Olivier (1756-1814), médecins, naturalistes, et voyageurs," in *Comptes Rendus du 86eme congrès national des sociétés savantes* (Paris: Gauthier-Villars, 1962), 173-185; Ania Guini-Skliar, "Un naturaliste tropézien visite les carrières parisiennes en 1786," in *Carrières et Constructions en France et dans les pays limitrophes*, eds. Jacqueline Lorenz and Jean-Pierre Gely (Paris: CTHS, 2004), 173-186.

⁷⁹⁰ Bosc d'Antic, "Description of two new species of Phalena by Mr. Louis Bosc, of Paris, Foreign Member of the Linnean Society," *Transactions of the Linnean Society of London*, Volume 1 (1791): 196-197; "Description d'un nouveau Bostriche, par M. Bosc," *Bulletin de la Société Philomatique* Septembre 1791; "Description d'une nouvelle espèce d'Iule," *Bulletin de la Société Philomatique* (Novembre 1791); "Description d'un nouveau callopus," *Bulletin de la Société Philomatique* (Décembre 1791); "Description d'un phalangium et d'un cinips," *Bulletin de la Société Philomatique* (Février 1792); On natural history at the *Société philomatique* see: Jonathan Mandelbaum, "Science and friendship: the société philomatique de Paris, 1788-1835," *History and Technology* 5 (1988): 179-192; Jacques Roger, "Les sciences naturelles dans les premières décennies de la Philomatique," in *La Société Philomatique de Paris et Deux Siècles d'Histoire de la Science en France Colloque du Bicentenaire de la Société Philomatique de Paris*, ed. André Thomas, (Paris: Presses Universitaires de France, 1990), 30; On Bosc's enrollment in the Linnean Society of London see: Georgia Beale, "Early French members," 1124.

⁷⁹¹ Until March 4, 1791, the meetings of the *Société* were held at Bosc's residence; As Jean-Luc Chappey has argued the *Société* cannot be reduced to a Linnean "lobby," as it

Société abreast of the latest work in systematic entomology,⁷⁹² Bosc identified and named dozens of new species of insects that he collected in the region surrounding Paris⁷⁹³ or that were sent by correspondents in the French provinces⁷⁹⁴ and farther afield in Senegal⁷⁹⁵, Saint Domingue⁷⁹⁶, Cayenne⁷⁹⁷ and the United States⁷⁹⁸. The *Société*'s

integrated several non-Linneans within its ranks see: Jean-Luc Chappey, *Des Naturalistes en Révolution: les procès verbaux de la Société d'histoire naturelle de Paris (1790-1798)* (Paris: CTHS Sciences, 2009), 15-57.

⁷⁹² The citations that follow are drawn from the transcriptions of the *Société*'s records in Chappey, *Des Naturalistes en Révolution*. The original manuscripts are in: BCMHN, MS 464: Procès verbaux de la Société d'histoire naturelle (27 août 1790-18 prairial an V). Bosc reviewed the following works: Domenico Cirillo, *Entomologiae Neapolitanae* (no 6, Séance du 24 Septembre 1790); Gustave de Paykul, *Monographia staphiliorum succiae*, 1790 (no 15, Séance du 3 Décembre 1790; "M. Bosc a annoncé des theses nouvelles d'entomologie, en forme de dissertation imprimées en Suède" (No 54, Séance du 29 Juillet 1791); Johann Friedrich Wilhelm Herbst, *Systeme naturel de tous les insectes tant exotiques qu'indigènes* (No 56, Séance du 12 Aout 1791);

⁷⁹³ "Nouvelle espèce d'insecte du genre Acheta" (No 6, Séance du 24 Septembre 1790); *Tinea echiella* (no 7, Séance du 8 Octobre 1790); "Description d'un Lacusta des environs de Paris," (Séance du 19 Novembre 1790); *Serropalpus Maculatus* (No 17 Séance du 17 décembre 1790); *Keroplatus tipuloides* (No 21, Séance du 14 janvier 1791); *Quercustosa* (No 27, Séance du 18 Fevrier 1791); *Acanthia compressicornis* (No 41, Séance du 29 Avril 1791); "M. Bosc a lu la description de sept insectes trouvés dans une course faite à Bondy le 8 mai dernier; il a accompagné ses descriptions d'autant de dessins qu'il a laissées à la société" (No 43, Séance du 13 mai 1791); *Rumex repandus* (No 51, Séance du 15 Juillet 1791); *Necydalis marginata*; *Carabus senocephalus* (Séance du 29 15 août 1791); *Opatrum rufipe* (No 60, Séance du 9 Septembre 1791); *Julus guttulatus* (No 63, Séance du 30 Septembre 1791); "M. Bosc a donné la description et le dessin de 4 insectes qu'il regarde comme des espèces nouvelles et qui ont été trouvés dans la seconde course du 4 décembre," (no 76, Séance du 30 décembre 1791); See also the following insects described in the *Actes de la Société d'Histoire Naturelle* (1792): "Serropalpus variegatus" p. 40-41; "Keroplatus tipuloides," 42-43; "Acheta Sylvestris," 44; "Locusta punctatissima" 45; and the *Journal d'histoire naturelle* 1792, "Description de deux mouches," 54-56; Description du Cynips Quercus-Tozae, 154-155; Bostricus Furcatus, 259

⁷⁹⁴ "*Ripiphorus subdipterus*; cet insecte a été trouvé auprès de Montpellier par M. Dorthès," (Séance du 24 mars 1791)

⁷⁹⁵ *Lycoperdon axatum*; *Papilio Bacchus* (No 17 Séance du 17 décembre 1790)

entomological collection grew steadily as Bosc and other members⁷⁹⁹ deposited sketches and specimens of newly identified insects in its museum. To preserve order in the expanding collection, the *Société* made nomenclatural uniformity a *sine qua non* for the integration of new specimens.⁸⁰⁰

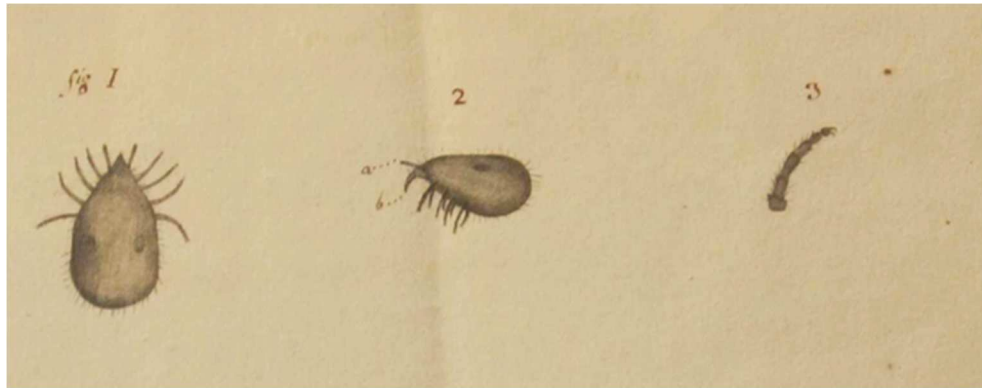


Figure 13. Sketch of insects found around Paris. Source: G-A Olivier, "Mémoires sur quelques insectes observés aux alentours de Paris," H/1514, f. 5, ANF, Paris.

After having carved out a place for himself in the shifting institutional terrain of the natural sciences in the early years of the Revolution, Bosc's activities were abruptly

⁷⁹⁶ *Phalangium maniculum* (No 65, Séance du 14 octobre 1791)

⁷⁹⁷ *Cucumis Lin* (No 65, Séance du 14 octobre 1791)

⁷⁹⁸ "M. Michaux fils a remis à la Société quelques espèces d'insectes qui se sont trouvées dans un envoi de plantes d'Amérique," (No 100, Séance du 15 Juin 1792)

⁷⁹⁹ Fabricius, who joined the Société in December 1790, contributed to the collection: (No 45, Séance du 27 Mai 1791); Others who contributed to the collection were Claude Lermina, lawyer, administrator and natural history enthusiast (No 47 Séance du 10 Juin 1791), Besson (Séance du 15 Août 1791); Dufresne (No 81, Séance du 3 février 1792; Jacques Brez, *La Flore des Insectophiles* (No 82, Séance du 10 février 1792); Geoffroy (30 Novembre 1792)

⁸⁰⁰ (No 47, Séance du 10 Juin 1791); (No 116, Séance du 23 Novembre 1792): The intellectual and material organization of the collection was often a subject of discussion at the meetings: Olivier was appointed keeper of the insect collection in January 1792 (No 79, Séance du 19 Janvier 1792).

cut short by the events of the Terror. A member of the Jacobin Club, Bosc was intimately involved with the activities of the Girondin party.⁸⁰¹ Through the influence of his patrons, the Girondin minister Jean-Marie Roland (1734-1793) and his wife Jeanne-Manon (1754-1793) Roland, Bosc acceded to the head of the postal system after its reorganization in March 1792, much to the delight of his naturalist correspondents. The provincial entomologist Pierre-André Latreille (1762-1833) heralded the news as a "great advancement to natural history," and hoped that Bosc would continue to provide him with the "facility to correspond with all the *savants* who are in close relation with you."⁸⁰² The fall of the Girondin party after the May and June insurrections of 1793, however, forced Bosc to withdraw from his administrative and scientific activities and drove him into hiding at a priory in the forest of Montmorency until the Thermidorian Reaction had made it safe to return to public life.⁸⁰³

Adjustment to life under the Directory proved rather difficult for Bosc. The deaths of the Rolands during the Terror left him without powerful patrons that might have facilitated his access to a post within the central administration of the Directory, which he patiently waited for but never received. To remain solvent, Bosc worked away at the *Entomologie, ou Histoire Naturelle des Insectes*, an enormous editorial enterprise begun by Guillaume Antoine Olivier before the Revolution, that allowed him to gain, as he wrote to the Swiss pharmacist Henri-Albert Gosse (1753-1816), "ten times more in real

⁸⁰¹ Bosc's describes his political activities in the early days of the Revolution in : Bosc d'Antic "Notes sur Ma Vie," f. 32-33, MS 1007, BHVP, Paris.

⁸⁰² Latreille to Bosc, 18 Fructidor, Year 3, MS 1998, BCMHN, Paris.

⁸⁰³ Bosc's name was struck from the record of the Société d'Histoire Naturelle de Paris in February 1793. He was reintegrated in January 1795: No 128, Séance du 15 Fevrier 1793; No 180, Séance du 10 Janvier 1795.

money than my colleagues get in current *assignats*."⁸⁰⁴ Bosc's break finally came in 1796 when he was appointed vice-consul to Wilmington in North Carolina. Bosc fully intended to take advantage of the opportunities afforded by this diplomatic post to contribute to the enrichment of natural history through the observation of the fauna and flora of the United States. Before he left for Charleston in July of that year, Bosc informed the *Société d'Histoire Naturelle* that he would keep them apprised of the "abundant harvests in zoology" that he hoped to make before the winter season.⁸⁰⁵ Latreille held similarly high expectations, writing to Bosc before his departure: "Natural history will grow under your eyes and hands, a new theater of discoveries presents itself to you and I am certain you will let very little pass you by."⁸⁰⁶

Bosc's natural history of the United States began before he ever even set foot on American soil. The ship that took Bosc from Bordeaux to Charleston was itself the site for numerous observations of insects. Bosc kept notes in his journal on the cockroaches, termites and spiders that travelled with him across the Atlantic, and attributed names to previously unidentified species of American origin.⁸⁰⁷ After arriving in Charleston, he spent several months in the South Carolina Low Country identifying new species of insects, always communicating his findings to his correspondent, and relay at the Société

⁸⁰⁴ Lettres adressées à Henri-Albert Gosse, Bosc to Gosse, 25 March 1796, fol. 137, Bibliothèque Publique et Universitaire de Genève, MS 2628: Cited in Pietro Corsi, "After the Revolution," 227.

⁸⁰⁵ Lettre de Bosc à la Société d'Histoire Naturelle, 15 July 1796, MS 298,

⁸⁰⁶ Latreille to Bosc, 24 Messidor Year 4, MS 1998, BCMHN, Paris [L'histoire naturelle va s'agrandir sous vos yeux et sous vos mains un nouveau théâtre de découvertes se présente à vos usages et je crois que vous en laisserez bien peu échapper]

⁸⁰⁷ "Journal de Voyage de Bosc d'Antic," f. 67, MS 1007, BHVP, Paris.

d'Histoire Naturelle, Alexandre Brongniart (1770-1847). Brongniart's roles as a mediator in these investigations were multiple. He shipped essential materials such as the 20,000 pins that Bosc requested for his growing collection of American insects.⁸⁰⁸ Bosc, who was highly aware of the professional risks associated with prolonged distance from centers of European learning, kept himself informed of the latest work in systematic entomology through Brongniart.⁸⁰⁹ The latter also edited Bosc's manuscripts, communicated them to scientific societies in Paris, and had them published in periodicals.⁸¹⁰ This editorial work was crucial for allowing Bosc to establish priority over his discovery and identification of new species. As he reminded Brongniart:

My object in sending you these preliminary findings is to ensure the priority of my discoveries, in view of a treatise I will later publish on the natural productions of America ... you will correct the errors in Latin, communicate everything to the societies, and seek to have them published in some way that will be useful to science.⁸¹¹

Bosc was equally concerned to ensure that the names he attributed to newly identified species remain attached to the organisms in question. Entrusting the management of his

⁸⁰⁸ Bosc to Brongniart, 24 April 1797, MS 2354, BCMHN, Paris.

⁸⁰⁹ Bosc remarked in a letter that the naturalist Palisot de Beauvoir, who spent the decade between 1786 and 1797 traveling and collecting insects in West Africa, Saint Domingue and the United States: "had not been able to keep up with the latest developments in entomology; he still uses Geoffroy to order his insects ... and is completely ignorant of the works of Fabricius." Bosc to Brongniart, 24 April 1797, MS 2354, BCMHN, Paris.

⁸¹⁰ Bosc to Brongniart 24 April 1797, MS 2354, BCMHN, Paris. See observations sent to the Société d'Histoire Naturelle and published in the *Bulletin de la Société Philomatique*: No 254, Séance du 5 Février 1797; No 265. Séance du 7 Mai 1797 "Description d'objets nouveaux d'histoire naturelle trouvés dans une traversée de Bordeaux à Charlestown."

⁸¹¹ Bosc to Brongniart, 24 April 1797, MS 2354, BCMHN, Paris [mon objet en t'envoyant mes trouvailles était de m'assurer la priorité des découvertes pour publier un ouvrage spécial lorsque je me jugerois assez au courant des productions d'Amérique pour lui donner un certain intérêt.... tu corrigeras les fautes de latin, communiquera le tout aux sociétés, et chercher à le faire paroître de quelques manière utile a la science]

growing collection of insects to Brongniart, Bosc reminded him that he could not lend or exchange insects from his cabinet to collectors or naturalists, "unless they promise to conserve the names that I have imposed upon them."⁸¹²

During his travels in the United States, Bosc began to prepare a work on the insects of the Eastern seaboard of the United States. A preliminary version of this work was submitted to the *Société d'Histoire Naturelle*, along with sketches, as "prodrome des objets nouveaux ou mal connus d'histoire naturelle découverts aux environs de Charlestown."⁸¹³ Although this work was never completed, and no copies of the manuscript seem to have survived, it is clear that the work was intended as more than an elaboration of existing taxonomic systems. While Bosc indeed named numerous new species of previously unidentified insects, he was far more surprised by the familiarity of the biota that he encountered in the area surrounding Charleston. In March 1798, as he prepared to take up his post as consul in New York, he informed Brongniart of the surprising number of French insects he found on the East Coast of the United States:

It is remarkable how many insects from France are found here. It is out of proportion with the birds and plants that are also of the same case. More than half of those that I have collected are already in my collection.⁸¹⁴

In reflecting on the intercontinental dispersal of insect species, Bosc no doubt would have recalled how the ships that carried him across the Atlantic teemed with biota that could

⁸¹² Bosc to Brongniart, 24 April 1797, MS 2354, BCMHN, Paris.

⁸¹³ No 265, Séance du 7 Mai 1797; No 265, Séance du 27 Mai 1797.

⁸¹⁴ Bosc to Brongniart, 26 March 1798, MS 2354, BCMHN, Paris. [il est remarquable combien il y a ici d'insectes de France. C'est hors de proportion avec les oiseaux et les plantes qui sont dans le même cas. Plus de la moitié de ce que j'ai récolté est déjà dans ma collection. Je pourrai faire sur ce fait un mémoire qui ne seroit pas sans intérêt pour l'histoire du globe. J'amasse des matériaux.]

very easily be carried from one shore to another. In his letter to Brongniart, Bosc remained silent on the causes of the planetary dispersal of insects, but remarked that he was "amassing materials" for a manuscript on the subject "that is not without interest for the history of the globe."⁸¹⁵

One important actor in this global history of insects was, of course, the Hessian fly. In a series of observations sent to the *Société d'Histoire Naturelle* of the insects of South Carolina, Bosc determined that a pest that infested his granaries stored with corn was in fact the famed Hessian Fly.⁸¹⁶ After careful inspection, Bosc concluded that the Hessian fly was in reality a ubiquitous French insect, the *alucita cerealla*, and that it had almost certainly been imported into the United States from the province of Angoumois. Confirming the judgment of his friend Broussonnet at the *Société Royale d'Agriculture* a decade earlier, he concluded that the Hessian Fly was none other than the *Chenille d'Angoumois*.⁸¹⁷ If the "panic" [*qui-vive*] caused by the Hessian Fly" in France had been misplaced, this heightened vigilance had had at least one lasting, salutary effect. Until the end of the eighteenth century, Bosc wrote in the *Nouveau Dictionnaire d'Agriculture* (1809), agronomists and naturalists had studied grain insects rather haphazardly and with great confusion. The alarm raised by the Hessian Fly, and the subsequent confusion that had followed, had brought to light the pressing need for "systematic" order in the study of

⁸¹⁵ Bosc to Brongniart, 26 Mars 1798, MS 2354, BCMHN, Paris.

⁸¹⁶ Printed in: Bosc, "Description de trois lepidopteres de la Caroline An VIII," *Bulletin des Sciences pour la Société Philomatique*, no 39 an 8.

⁸¹⁷ L-A Bosc d'Antic, "Alucite," *Nouveau Cours Complet d'Agriculture Théorique pratique ou Dictionnaire raisonné et universel d'agriculture* (Paris: Deterville, 1809), 244-245.

grain-insects: "It is to North America that Europe owes its current vigilance on this matter."⁸¹⁸ By purging the 'Hessian Fly' of its vernacular name, and assimilating it into existing taxonomic systems, Bosc had done his part in bringing a measure of order to the science of insects. His entry in the *Nouveau dictionnaire d'agriculture*, it would seem, had quietly put an end to a decade-long debate about the origins and identity of one of the most discussed insect pests of the period.

The Hessian Fly Becomes *Cecidomyia Destructor*: Towards nomenclatural uniformity in Britain, France and the United States

The American naturalist Thomas Say (1787-1834) reopened the seemingly closed debates about the geographical origin and taxonomic identity of the Hessian fly in 1817.⁸¹⁹ Say joined numerous other farmers and naturalists of the early Republic in the search for techniques to eradicate this now endemic problem of American agriculture that periodically resurged in sporadic outbursts of destruction.⁸²⁰ At the Philadelphia Society for Promoting Agriculture, Say proposed that wheat stubble ought to be burned following the harvest, after observing that the Hessian fly deposited its eggs in old stalks of wheat.⁸²¹ By cutting his taxonomic teeth on this famed insect, Say also used the Hessian

⁸¹⁸ L-A Bosc d'Antic, "Alucite," *Nouveau Dictionnaire d'Agriculture*, 244-245.

⁸¹⁹ On Say's life, see: George Ord, "A memoir of Thomas Say," in *The Complete Writings of Thomas Say on the Entomology of North America*, ed. John Le Conte (London: Ballière brothers, 1859), vii-xxii; Harry B. Weiss and Grace M. Ziegler, *Thomas Say: Early American Naturalist* (Springfield, Ill: Charles Thomas, 1931).

⁸²⁰ On American framers' struggle with the Hessian fly throughout the nineteenth century: James E. McWilliams, *American Pests: The Losing War on Insects from Colonial Times to DDT* (New York: Columbia University Press, 2008).

⁸²¹ Thomas Say, "Hessian Fly," *Memoirs of the Philadelphia Society for Promoting Agriculture* 4 (1818): 224-228.

fly to establish his standing within the international community of systematic entomologists. Brushing aside what he claimed were prior misidentifications of the insect by European naturalists, Say proclaimed to the *Academy of Natural Sciences of Philadelphia* in 1817 that the Hessian fly was “a species entirely new to the systems – being now for the first time described.”⁸²² To be sure, the “name of the Hessian fly” was “perfectly familiar to the [Europeans], particularly to their entomologists,” but the “erroneous supposition” that it had been imported to America from Europe had led it to be confused with a number of other Old World insects.

For Say, the signifier “Hessian fly” was doubly objectionable. For one, it perpetuated false information about the geographical origin of the insect that he resolutely affirmed to be indigenous to America. Most importantly, it was an empty signifier that could communicate no information to entomologists who had never seen the insect, having “no meaning of itself and no analogies upon which it depends”:

Here then is one of the uses of a scientific arrangement and an universal nomenclature. The classical name refers directly to a natural assemblage whose habit is the same, or nearly so, hence every entomologist who learns the name of an insect, becomes at the same time acquainted with the general form of the body, manners, mode of life etc.⁸²³

Say was not, as we have seen, the first naturalist to attempt to assimilate “the insect known by the name of the Hessian fly” to the universal system of binominal nomenclature, although the name he attributed to this insect (*cecydomia destructor*) did outlive all others. Neither was Say’s argument for the necessity of a universal language of

⁸²² Thomas Say, “Some account of the insect known by the name of the Hessian fly and of a parasitic insect that feeds on it, Read June 24th 1817,” *Journal of the Academy of Natural Sciences of Philadelphia* 1 (1818): 45-48.

⁸²³ Thomas Say, “Letter from Thomas Say to Richard Peters, September 28, 1817,” *Memoirs of the Philadelphia Society for Promoting Agriculture* (1818), 238.

entomology very original. That this well rehearsed justification for the taxonomic pursuit was beginning to circulate in leading agronomic periodicals like the *Memoirs of the Philadelphia Society for Promoting Agriculture* does, however, point towards the steady coalescence of agronomic, taxonomic and natural historical concerns into a single field of practice that would become known later in the century as the discipline of applied entomology.

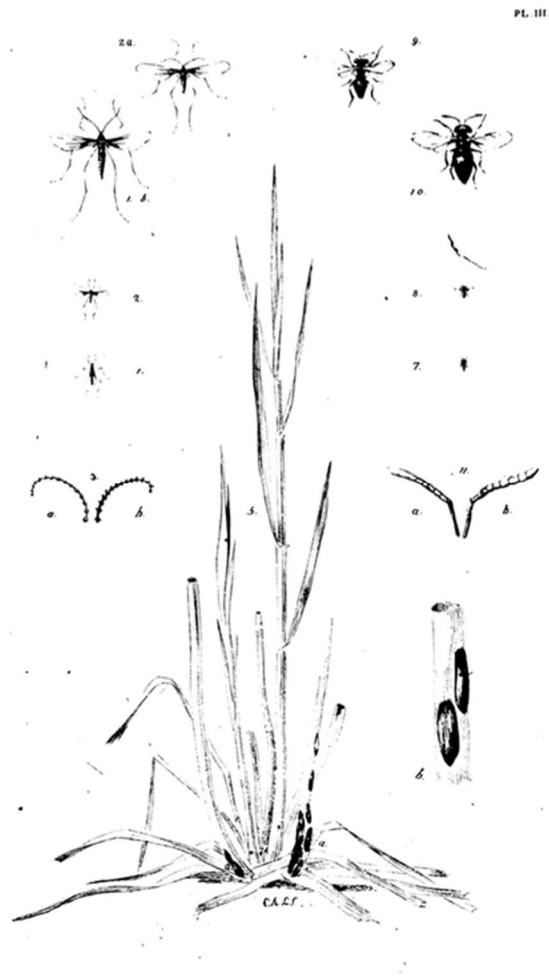


Figure 14. Engraving of the Hessian Fly. Source: Thomas Say, "Some account of the insect known by the name of the Hessian fly and of a parasitic insect that feeds on it, read June 24th 1817." *Journal of the Academy of Natural Sciences of Philadelphia* 1 (1818): 45-48, plate 3.

In the opening decades of the nineteenth century, naturalists began to explicitly argue that the practice of systematic entomology was vital for the biological security of agrarian environments and human populations. In Britain, the case was made most forcefully by the clergyman-naturalist William Kirby (1759-1850). In his *Introduction to Entomology* (1815-1826), a work dedicated to Joseph Banks, Kirby deplored that taxonomy was still ridiculed as a frivolous pursuit. The scare caused by the "famed Hessian fly," he wrote, was as an "extraordinary" demonstration of the "insufficiency of popular description" in natural history, and of the need for a universal scientific language based on binominal nomenclature.⁸²⁴ Banks' evaluation of the threat posed by this insect to British agriculture in the late 1780s, he admitted, had in retrospect been "very imperfect." Yet this "illustrious naturalist," who had never seen the Hessian fly, could not reasonably be blamed for his errant judgment. Rather, the fault lay with the "thousands of unscientific sufferers" who had provided him with "incompetent" and "inconsistent" observations that made a "satisfactory" and conclusive identification impossible. "One entomologist well versed in his science," he wrote, "would at once have determined the order and genus of the insect, and whether it was a known or new species."⁸²⁵ The case of the Hessian fly demonstrated the pressing need for a shared language of natural historical research based on binomial nomenclature. The "systematic arrangement of insects," far from being an idle pursuit, was vital in an age of extensive commercial relations, where,

⁸²⁴ William Kirby and William Spence, *An Introduction to Entomology or Elements of the Natural History of Insects*, vol. 1, (London: Longman, 1818), 51.

⁸²⁵ Kirby and Spence, *Introduction*, 52-53.

Kirby and Spence remarked, "the large proportion of the most noxious insects in every country are not indigenous, but have been imported."⁸²⁶

For Kirby, binominal nomenclature was an indispensable technology for tracking the global circulation of invasive insects across international borders; only a systematic classification of insects could allow administrators and naturalists to adequately coordinate responses for preventing the spread of these "noxious agents." The historian John F. Clark has recently described William Kirby as naturalist committed to the ideals of autarky and "national self-sufficiency."⁸²⁷ Yet Kirby's defense of the taxonomic pursuit was predicated on a certain pragmatic form of internationalism. A universal language of natural history was, Kirby wrote, necessary for international cooperation between entomologists:

By aid of two words alone, every entomologist, though in the most distant region – whether a Swede, a German or a Frenchman, whether a native of Europe, of Asia, of America, or of Africa, knows instantly the very species that is meant, and can that moment ascertain whether it be within his reach. If the new species be new and undescribed, it is only necessary to indicate the genus to which it belongs, the species to which it is most nearly allied, and to describe it in scientific terms, which may be done in few words, and it can at once be recognized by everyone acquainted with the science.⁸²⁸

Such an argument could be seen as harkening back to ideal of an enlightened cosmopolitan Republic of letters, but Kirby saw this cooperation as more than an ideal that sustained exchanges between polite men of letters. It was an absolute necessity for managing the biological risks of the new global commercial order. The policy of

⁸²⁶ Kirby and Spence, *Introduction*, 30.

⁸²⁷ J.F.M., *Bugs and the Victorians* (New Haven: Yale University Press, 2009), ch.1.

⁸²⁸ Kirby and Spence, *Introduction*, 24.

biological isolation pursued by Banks and the Privy Council at the end of the 1780s, Kirby pointed out, was chimerical: "Extensive as is our commerce, it is next to impossible, by any precautions to prevent the importation of these noxious agents."⁸²⁹ Nevertheless, entomologists could assist in regulating and mitigating the spread of these unfortunate byproducts of extensive commercial relations between nations.

In France, the sectarian battle between taxonomists and proponents of the Buffonian tradition of descriptive natural history quietly came to an end in the opening decades of the nineteenth century. At the end of the 1790s, Bosc d'Antic still worried that natural history could "once again fall under the yoke of Buffon, as the priests have done with morals." The declining pace of the "Linnean march" left Bosc concerned that "everything that has been done before and after the Revolution is destined to be scorned."⁸³⁰ In the years immediately following the Revolution, self-styled "sectarians of the binomial nomenclature" like Antoine-Nicolas Duchesne continued to clamor for the "confection of a polyglot vocabulary of natural history" that would provide a pan-European language for the classification and description of plants, animals and minerals.⁸³¹ Yet as Pietro Corsi has shown, these polemical debates over the epistemic value of classification dissipated in the opening decades of the nineteenth century, as taxonomists assumed control of the institutional centers of the natural sciences, leaving Buffon's heirs a near-monopoly of the sizeable market for popular works of natural

⁸²⁹ Kirby and Spence, *Introduction*, 32.

⁸³⁰ Bosc to Brongniart, Charleston, 24 April 1797, MS 2354, BCHMN, Paris.

⁸³¹ Antoine-Nicolas Duchesne, "Sur l'établissement d'une nomenclature européenne d'histoire naturelle," *Magasin Encyclopédique* 7 (1796): 147-160.

history.⁸³² When the entomologist Pierre-André Latreille delivered his inaugural course on entomology at the *Muséum d'Histoire Naturelle* in 1822 he felt no need to provide a justification for systematic entomology, deeming that the "prejudices" and "sophisms" of those who would judge this pursuit "futile" and a "simple amusement" were now "happily restrained to a small number of individuals that it would be difficult to convert."⁸³³

If naturalists at the beginning of the nineteenth century were almost unanimous in embracing binominal nomenclature as necessary disciplinary tool, the multiplicity of existing nomenclatural systems made the problem of synonymy acute. A steady consensus was emerging, however, around Latreille's "natural system" of classification, a system based on multiple morphological characteristics, rather than just on a single characteristic like the wings (Linnaeus) or the mouth (Fabricius).⁸³⁴ Say's attribution of the genus *cecidomya* to the 'Hessian fly,' a genus devised in the early 1800s by Latreille, is a partial indication of this growing consensus.⁸³⁵ Latreille's "natural system," developed in the 1790s, quickly found favor within the Parisian natural historical community on

⁸³² Pietro Corsi, "Décrire ou classer? Taxinomies au XVIIIe siècles," in *Tous les savoirs du monde: Encyclopédies et bibliothèques de Sumer au XXIe siècle*, ed. Roland Schaer (Paris: Flammarion, 1996), 208- 213.

⁸³³ Pierre-André Latreille, "De l'origine et des progrès de l'entomologie," *Mémoires du Muséum d'histoire naturelle*, 8 (1822), 462-463.

⁸³⁴ On Latreille's innovations in systematic entomology see: Claude Dupuis, "Pierre-André Latreille (1762-1833): The Foremost Entomologist of His Time," *Annual Review of Entomology* 19 (1974): 1-13.

⁸³⁵ Latreille introduced the genus *cecidomyia* in: *Nouveau Dictionnaire d'histoire naturelle appliquée aux arts* (Paris: Deterville, 1804), 189; *Histoire naturelle générale et particulière des crustacés et des insectes* (Paris: Dufart, 1806), 292-293; P-A Latreille, *Genera Crustaceorum et insectorum*, Volume 4 (Paris: A. Koenig, 1809), 252.

account of its simplicity and ease of use.⁸³⁶ A reviewer of Latreille's first major work, the *Précis pour des caractères génériques des insectes* (1796), noted that the "natural system" was a welcome alternative to Fabricius' system, based on the parts of the mouths of insects. The difficulty of the observations required to follow Fabricius' system, he wrote, acted as barrier for "beginners and simple amateurs of insects."⁸³⁷ Latreille himself presented this work as a convenient alternative to Fabricius' artificial' system, which "frightens and repels the majority of entomophiles."⁸³⁸

If Latreille's "natural method," based on the "palpable characters that nature has attached" to insects, held unquestionable advantages over competing taxonomic systems, its growing acceptance must also be attributed to his increasingly central role in the institutional arena of the post-Revolutionary natural sciences. Latreille moved from his native Brive to Paris in 1798 to take a position as an assistant naturalist at the *Muséum National d'Histoire Naturelle*, where he helped organize the growing entomological collection alongside Lamarck. He was also highly active in several of the largest natural history publishing enterprises of the period, contributing entries to Olivier's *Nouveau Dictionnaire d'Histoire Naturelle* (1803-1804; 1816-1819), the *Encyclopédie Méthodique. Entomologie* (1812), and to Sonnini's *Histoire Naturelle Générale et*

⁸³⁶ "Mémoire de l'abbé Latreille sur la classification de tous les genres d'insectes," *Procès verbaux de la Société d'histoire naturelle*, no 77 Séance du 5 Janvier 1792; no 212 "Séance du 10 Mai 1795," Pierre-André Latreille, "Observations sur la variété des organes de la bouche des tiques et distribution méthodique des insectes de cette famille d'après les caractères établis sur la conformation de ces organes," *Magasin Encyclopédique* 4 (1795): 15.

⁸³⁷ "Extrait d'un précis du caractère générique des insectes," *Magasin Encyclopédique*. 6 (1797): 150-152.

⁸³⁸ Pierre-André Latreille, *Précis des caractères génériques des insectes* (Brives: Prévôt, 1796), v.

particulière des Crustacés et des Insectes (1802-1805). These editorial activities not only helped Latreille make a living, but also gave his taxonomic system wider circulation and acceptance, while also giving him priority in the naming of new species. In 1814, he was elected to the Académie des Sciences de l'Institut de France. At the Académie, Latreille continued to elaborate his taxonomic system, developing new genera, and identifying and naming new species amongst the materials sent to him at the Muséum. He also posited new theories about the biogeographical distribution of insects, based on his work at the Muséum and his extensive correspondence with travelling naturalists.⁸³⁹

Latreille's position at the *Académie* also brought him into close proximity with administrators of the Restoration government. Latreille chaired several commissions at the *Académie* in which he was asked to examine, identify and name insects that posed a potential threat to French agriculture. In August 1817, for instance, the Académie received samples of two insect pests sent by the Ambassador to the United States Hyde de Neuville (1776-1858) to the *Ministre des Relations Extérieures* Armand-Emmanuel du Plessis de Richelieu (1766-1822).⁸⁴⁰ Latreille identified the first insect, known by the residents of Maryland as "the seventeen-year locust," as the *cicada septemdecim*, a locust named and described by Pehr Kalm (1716-1779) in the *Actes de Stockholm* and Peter Collinson (1694-1768) in the *Proceedings of the Royal Society of London*. The second insect was the famous, "mouche hessoise" or "Hessian fly," which Latreille remarked had

⁸³⁹ P-A Latreille, "Introduction à la géographie générale des arachnides et des insectes ou des climats propres à ces animaux, Mémoire lu à l'académie des sciences en 1815," *Mémoires du Muséum d'histoire naturelle* 3 (1817): 37-67.

⁸⁴⁰ *Procès-verbaux des séances de l'académie issues depuis la fondation de l'Institut jusqu'au mois d'août 1835* (Hendaye: Imprimerie de l'Observatoire d'Abbadia, 1915) 6: 211.

recently been placed by the naturalist Thomas Say in the genus *cecidomya*, "which offer numerous species that, under the form of larvae, are very pernicious to cereal crops."⁸⁴¹

Latreille then referred the Minister to Say's publication in the *Journal of the Academy of Natural Sciences of Philadelphia*.

Conclusion

Here then is a clear case of taxonomy being placed in the service of statecraft, and evidence for the rising status of systematic entomologists as advisors whose expertise was vital to managing the global flow of commodities and pathogens. As a linguistic technology, binomial nomenclature had come to provide naturalists and administrators of the beginning of the nineteenth century a stable way of establishing correspondences between the natural world and the encyclopedic entomological knowledge stored in books and periodicals. That binominal nomenclature was progressively becoming an international language of science and statecraft is suggested by the precipitous decline of the terms "mouche hessoise" and "Hessian fly" in books and periodicals published in Britain, France and the United States between 1800 and 1850 after 1825. The term not only disappeared from the lexicon of systematic entomologists, but also in the writings of statesmen and diplomats. The American diplomat D.B. Warden, for instance used the term *cecidomyia destructor* to describe the Hessian Fly in his *Description, Statistique, Historique et Politique des États-Unis de l'Amérique Septentrionale* (1820).⁸⁴²

⁸⁴¹ *Procès verbaux des séances de l'académie*, 211.

⁸⁴² D.B. Warden, *Description statistique, historique et politique des États-Unis de l'Amérique septentrionale* (Paris: Rey et Gravier, 1820), 78.

At the end of the eighteenth century, insect pathogens began to figure in matters of international diplomacy. Suspicions that measures of quarantine could be used to aggressively protect national interests were compounded by the lack of an agreed upon system for identifying, naming and classifying harmful biota. The Hessian fly outbreak had exposed both the potential risks of intensified global commercial exchange and the importance of international cooperation for properly managing this risk. International collaboration in the field of the natural sciences became an attractive solution to both these problems. The foundations of an international order for managing the circulation of insect pathogens were laid at the beginning of the nineteenth century, culminating in the zoological conferences of the late nineteenth century, which provided the institutional locus for the moderation of nomenclatural and political disputes arising from the insect kingdom.

Part 4: Insecticides before DDT: From *Petite Chimie* to *Industrial Chemistry*

Chapter 7: From *Petite Chimie* to *Industrial Chemistry*: Insecticides in France from the Old Regime to the Industrial Revolution (1750-1830)

Introduction

The use of organic and chemical materials in the fight against insect pathogens is coeval with the beginnings of Old World agriculture. Insect pests first appeared as a problem for human civilizations with the development of large-scale storage and movement of food crops in the Near East and Eastern Mediterranean in the Bronze Age.⁸⁴³ Archeologists and palaeoentomologists have demonstrated that from the second millennium BCE, insecticidal plants, ashes and mineral powders were routinely used in storage sites in this region to protect food crops from insects.⁸⁴⁴ The Egyptian medical compendium *Ebers Papyrus* of c. 1600 BC provides the earliest evidence of the written codification of recipes for exterminating domestic and agricultural insect pests.⁸⁴⁵ In later centuries, insect pests moved westward along the trade networks and roads connecting the dense settlements of the Roman Empire to become a significant problem of Roman

⁸⁴³ Paul Buckland, "Granaries Stores and Insects: The Archaeology of Insect Synanthropy," in *La préparation alimentaire des céréales Rapports presents à la table ronde, Ravello au Centre Universitaire pour les biens culturels, avril 1998*, eds. François Sigaut and D. Fournier (Rixensart: Pact, 1990), 69–81.

⁸⁴⁴ Eva Panagiotakopulu, Paul C. Buckland and Peter M. Day, "Natural Insecticides and Insect Repellents in Antiquity: A Review of the Evidence," *Journal of Archaeological Science* 22 (1995): 705-710; Tom Hajkbijl, "The Traditional, Historical and Prehistoric Uses of Ashes as an Insecticide, with an Experimental Study on the Insecticidal Efficacy of Washed Ash," *Environmental Archaeology: The Journal of Human Palaeoecology* 7 (2002): 13-22.

⁸⁴⁵ Leon Banov Jr. and B. Ebell, *The Papyrus Ebers: The Greatest Egyptian Medical Document*. Copenhagen: Levin and Munksgaard, 1937.

commerce and agriculture.⁸⁴⁶ Roman agricultural writers from Cato the Elder (234 BCE–149 BCE) to Columella (4 CE – c.70 CE), Pliny the Elder (23 CE – 79 CE), and Palladius (late 4th CE – mid 5th century CE) offered property-owners remedies for insect vermin that attacked homes, fields and granaries.⁸⁴⁷ Insecticidal recipes of animal, plant and mineral origin abounded in the agricultural texts of classical antiquity that were preserved and recopied into the medieval period.⁸⁴⁸

Along with this corpus of insecticidal recipes, medieval Western Europe inherited from Antiquity a host of insect pests that first spread along Roman military provisioning networks and enlarged their distribution area after the rebirth of towns and trade in the High Middle Ages.⁸⁴⁹ Archeological evidence from medieval rural settlements suggests continuity across Antiquity and the Middle Ages in techniques of pest control.⁸⁵⁰ This can

⁸⁴⁶ Paul Buckland, "The Early Dispersal of Insect Pests of Stored Products as Indicated by Archeological Records," *Journal of Stored Product Research* 17 (1981): 1-12; M.E. Kislev, "Archaeobotany and storage archaeoentomology," in *New light on early farming: recent developments in palaeoethnobotany*, ed. Jane M. Renfrew (Edinburgh: Edinburgh University Press, 1991), 121-136.

⁸⁴⁷ K.D. White, *Roman Farming* (Ithaca, NY: Cornell University Press, 1970), *passim*; Ian C. Beavis, *Insects and other invertebrates in classical Antiquity* (Exeter: University of Exeter, 1988), *passim*.

⁸⁴⁸ On the transmission of Roman agricultural texts see: Marie-Claire Amouretti, "La transmission des connaissances agronomiques dans l'Antiquité: l'exemple des écrits techniques militaires," in *Traditions agronomiques européennes* (Paris: CTHS, 1998), eds. Marie Claire Amouretti and François Sigaut, 17-26; Pierre Jaillette, "Les agronomes Latin: note sur une locution au-dessus de tout soupçon," in *Autour d'Olivier de Serres: Pratiques agricoles et pensée agronomique du Néolithique aux enjeux actuels*, ed. Alain Belmont (Rennes: Presses Universitaires de Rennes, 2002), 194-202.

⁸⁴⁹ Buckland, "Granaries," 74.

⁸⁵⁰ Jan van Doesburg, "Archaeological evidence for pest control in medieval rural settlements in the Netherlands," in *Processing, Storage, Distribution of Food. Food in the*

likely be accounted for by the oral transmission of insecticidal knowledge across the centuries.⁸⁵¹ As the *livres de raisons* of medieval and early modern France demonstrate however, managers of rural estates from the fifteenth century onwards began to write down recipes for agricultural remedies that were transmitted within the family as proprietary knowledge of the domestic household.⁸⁵² While proprietors of these "secrets" shared their recipes with friends and neighbors, the invention of the printing press in the 1460s dramatically increased the circulation of insecticidal recipes in Europe.⁸⁵³

Medieval Rural Environment, eds. Jan Klapste and Petr Sommer Turnhout: Brepols, 2011), 199-211.

⁸⁵¹ For a case study documenting the oral transmission of techniques from Antiquity to the early modern period see: Chandra Mukerji, "Tacit Knowledge and Classical Technique in Seventeenth Century France," *Technology and Culture* 47, no. 4 (2006): 713-733; See also, Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal du Midi* (Princeton: Princeton University Press, 2009).

⁸⁵² For examples, see the database edited by François-Joseph Ruggiu: ecritsduforprive.huma-num.fr; On the transmission of recipes relating to the management of the household through the *livres de raisons* see: Jacqueline Ursch, "Livres de comptes, livres de raison, livres de vie," in *Les écrits du for privé: objets matériels, objets édités*, eds. Michel Cassan, Jean-Pierre Bardet and François-Joseph Ruggiu (Limoges: Presses Universitaires de Limoges, 2007), 115-131; Nicole Lemaître, "Les livres de raison en France (fin XIIIe-XIXe siècle)," *Testo e Senso* 7 (2006), 13; Scarlett Beauvalet-Boutouyrie and Isabelle Luciani, "Le corps dans les écrits du for privé," in *Les écrits du for privé en France de la fin du moyen âge à 1914*, eds. Jean-Pierre Barde and François-Joseph Ruggiu (Paris: CTHS, 2014), 82-102; On the more general movement from lived experience and orality to the written word, see: Pamela Smith, "Why Write a Book? From Lived Experience to the Written Word in Early Modern Europe," *Bulletin of the GHI* 47 (Fall 2010): 25-50; Pamela Smith, "Making Things: Techniques and Books in Early Modern Europe," in *Early Modern Things: Objects and their Histories, 1500-1800*, ed. Paul Findlen (London: Routledge, 2013), 176-179.

⁸⁵³ The private circulation of recipes between households has been primarily examined by historians of medicine, and primarily in the English context, see: Elaine Leong and Sara Pennell, "Recipe Collections and the Currency of Medical Knowledge in the Early Modern 'Medical Marketplace'" in *Medicine and the Market in England and its colonies, c. 1450-1850*, eds. Mark S.R. Jenner and Patrick Wallis (New York: Palgrave Macmillan, 2007), 133-152.

Insecticides found a place in the printed agricultural manuals, 'books of secrets' and recipe collections that occupied an important part of the book-market from its beginnings in the late 15th and early 16th century centuries.⁸⁵⁴ In France, authors of books of secrets and *maisons rustiques* like Olivier de Serres (1539-1619) continued to compile the insecticidal recipes of classical authors, but also added those culled from their own personal experience or from their (often anonymous) collaborators.⁸⁵⁵

Throughout the early modern period, a dynamic relationship existed between the world of print, manuscript recipes, oral communication and the private experience of agricultural improvers and rural *économés*. Charles Lémery's *Nouveau Recueil de Secrets et Curiosités* (20 editions published between 1674 and 1740), a treasure trove of insecticidal recipes, demonstrates the continuing popularity of the books-of secrets genre in the late seventeenth and early eighteenth centuries.⁸⁵⁶ The oral circulation of

⁸⁵⁴ Karl H. Dannefeldt, "The Control of Vertebrate Pests in Renaissance Agriculture," *Agricultural History* 56, no. 3 (July 1982): 542-559; Mary Fissell, "Imagining Vermin in Early Modern England," *History Workshop Journal* 47 (1999): 1-29; On how to books and books-of secrets in general see: William Eamon, *The Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994); Neil Kenny, *The Uses of Curiosity in Early Modern France and Germany* (Oxford: Oxford University Press, 2004), 206-210.

⁸⁵⁵ On the *maisons rustiques*, see the foundational work of André Bourde and Corinne Beutler: André J. Bourde, *Agronomie et Agronomes en France au XVIIIe siècle*, vol. 1, (Paris: SVPN, 1967), ch.1; Corinne Beutler, "Un chapitre de la sensibilité collective: la littérature agricole en Europe Continentale au XVIe siècle," *Annales ESC* 28, no. 5 (1973): 1280-1301; Corinne Beutler, "La genèse de la maison rustique au XVIe siècle," *Traditions agronomiques européennes*, eds. Marie Claire Amouretti and François Sigaut (Paris: CTHS, 1998), 43-53.

⁸⁵⁶ Maurice Bouvet and Henri Bonnemain, "Une énigme bibliographique: Les secrets d'Hémery, Emery ou Nicolas Lémery," *Revue d'histoire de la pharmacie* 171 (1961): 187-192; Each edition provided its users with dozens of recipes for ridding their homes, clothing, gardens, orchards, granaries and fields of insect pests: Nicolas Lémery, *Nouveau Recueil des plus beaux secrets de medecine pour la guérison de toutes sortes de*

insecticidal recipes and techniques that informed works such as Lémery's is admittedly difficult to detect. It can, however, occasionally be gleaned from the private papers of men and women who took the time to note down the results of their experience fighting crop pests. René Antoine Ferchault de Réaumur (1683-1757), to take one example, kept records of insecticidal tips that he gathered from the managers of rural estates for his own personal use on his domain in Saint-Julien-du-Teroux.⁸⁵⁷ In 1728, he learned from a farm-steward in the commune of Bressuire in Western France that vegetable crops could be protected from caterpillars by sowing hemp seeds in his kitchen garden. Réaumur reminded himself to "try out this experiment," and that it "must also be tried out on treelice."⁸⁵⁸ A year later, he learned of "the falsity of this supposed secret" from a certain M. Gauthier, who informed him that hemp had failed to protect his pea and cabbage crops from the ravages of garden insects. Réaumur also took note of another "expedient method for destroying insects" communicated by a certain Mlle Barbier in Haute Fontaine in the northern province of Picardie, who had succeeded in protecting her stored crops from grain-beetles by releasing chickens into her granary.⁸⁵⁹

Such fleeting, rarely recorded, exchanges of insecticidal tips and tricks between stewards, farmers and estate managers provide insight into the local and regional

maladies augmenté d'un nouveau recueil de recettes et d'expériences, où l'on voit ce que l'art, la nature (Paris: Ribou, 1737), 3: 352-364; 371-373; 407-408; 411; 421-422.

⁸⁵⁷ "Contre les chenilles des choux et des autres légumes, 1728-1729," Fonds Réaumur 69 J, Dossier 31, pièce 12, AAS, Paris; See also: "Pour détruire les fausses teignes du bled, 1744" pièce 37, AAS, Paris.

⁸⁵⁸ Archives de l'Académie des Sciences, Fonds Réaumur 69 J, Dossier 31, "Contre les chenilles des choux et des autres légumes, 1728-1729," pièce 12.

⁸⁵⁹ "Pour détruire les fausses teignes du bled, 1744."

networks of information exchange that helped early modern men and women cope with insect pests. Exchanged between neighbors and correspondents, and compiled in books such as Lemery's *Nouveau Recueil de Secrets* or Louis Liger's *Oeconomie générale de la Campagne* (1701), insecticidal techniques and recipes formed part of a broader range of practices related to estate and household management, or "domestic oeconomy."⁸⁶⁰ In this chapter, I examine how insecticides became a subject of "public oeconomy" between 1750 and 1830 as issues of resource management attracted increasing attention from patriotic improvers, artisan-entrepreneurs, royal administrators and scientific experts.⁸⁶¹ The 'economic' periodical press that took off after 1750, I will show, acted as a clearing-house for insecticidal recipes and techniques, and transformed agricultural improvers' fight against insect pests into a collective practice of oeconomic improvement.⁸⁶²

⁸⁶⁰ On "oeconomy" as a literary genre and field of practice see: Margaret Schabas, *The Natural Origins of Economics* (Chicago: Chicago University Press, 2005), ch. 1; E.C. Spary, *Feeding France*, passim; Lissa Roberts, "Introduction: Practicing Oeconomy in the Long Eighteenth-Century," *History and Technology* 30, no. 3 (2014): 133-148.

⁸⁶¹ On resource management as a focal point of public life after 1750 in Europe, see: Meyer Torsten and Marcus Popplow, "To employ each of nature's products in the most favorable way possible – nature as commodity in eighteenth-century german economic discourse," *Historical Social Research* 29, no. 4 (2004): 4-40; Markus Popplow, "Economizing Agricultural Resources in the German Economic Enlightenment," in *Materials and Expertise in Early Modern Europe: Between Market and Laboratory*, eds. Ursula Klein and Emma Spary (Chicago: University of Chicago Press, 2009), 261-287; Koen Stapelbroek and Jani Marjanen (eds.), *The Rise of Economic Societies in the Eighteenth Century: Patriotic Reform in Europe and North America* (Houndsmills: Palgrave Macmillan, 2012); Spary, *Feeding France*, passim.

⁸⁶² On the economic press, see: Jean-Claude Perrot, "L'économie politique et ses livres," in *Histoire de l'édition française: le livre triomphant (1660-1830)*, eds. Roger Chartier and Henri-Jean Martin, (Paris: Fayard, 1990), 298-326; Phillippe Steiner, "Les revues économiques de langue française au XVIIIème siècle (1751-1776)," in *Les revues d'économie en France: genèse et actualité, 1751-1994*, edited by Luc Marco (Paris: L'harmattan, 1996), 33-78; Christine Théré, "Political Economy and its Authors Before 1789," in *From Bodin to Walras: Studies in the History of French Political Economy*,

The press also helped create a commercial market for insecticides, as chemical practitioners and artisan-entrepreneurs advertised insecticidal remedies for urban dwellers, gardeners and farmers in periodicals and newspapers.⁸⁶³ Primarily centered in Paris, but reaching out into the provinces with the development of the postal system, the trade in insecticides fed off the growing fashion for kitchen and pleasure gardens, a heightened concern for hygiene (*salubrité*) and domestic comfort, and a general public preoccupation with the issue of food security. Secondly, I will examine how state administrators and scientific experts, principally drawn from the medical world, attempted to regulate this burgeoning market for insecticides as part of broader effort to shield the public from the dangers of charlatanism. Finally, I turn to the involvement of chemical practitioners in the production of agricultural insecticides in the colonial and domestic sphere. Between 1770 and 1830, as we will see, laboratory chemistry and the new chemical industries produced new materials and substances that came to be promoted by chemical practitioners and state administrators for their insecticidal properties.

edited by Gilbert Faccarello, (New York: Routledge: 1998), 1-56; John Shovlin, *The Political Economy of Virtue: Luxury, Patriotism, and the Origins of the French Revolution* (Ithaca: Cornell University Press, 2006), 51-58.

⁸⁶³ On relationship between the periodical press, remedies and other commodities related to domestic economy see: Maurice Bouvet, "La publicité medico-pharmaceutique dans les journaux des xvii^e et xviii^e siècles," *La pharmacie française* (November 1921): 269-279; Gilles Feyel, "Medecins, empiriques et charlatans dans la presse provinciale à la fin du XVIII^e siècle," in *Le Corps et la santé: actes du 110^eme congress nationa des sociétés savantes* (Paris: CTHS, 1985), 79-100; Colin Jones, "The Great Chain of Buying: Medical Advertisement, The Bourgeois Public Sphere, and the Origins of the French Revolution," *American Historical Review* 101, no. 1 (February 1996): 13-40; Morag Martin, *Selling Beauty: Cosmetics, Commerce and French Society, 1750-1830* (Baltimore: Johns Hopkins University Press, 2010), ch. 3; Natacha Coquery, *Tenir boutique à Paris au XVIII^e siècle: Luxe et demi-luxe* (Paris: Éditions du CTHS, 2011), ch.1

Insecticides in the Periodical Press and the Marketplace after 1750

Insecticidal recipes and techniques were a pervasive feature of the agricultural and oeconomic press that developed after 1750. These publications became a clearinghouse for technical solutions to problems of domestic and rural oeconomy that bedeviled estate managers and householders. A common culture of improvement was forged through the circulation of insecticidal recipes, tips and tricks among readers of these publications. By making local solutions to the problem of insect pests available to the general reading public, the editors of these publications hitched private practices of estate improvement to a generalized program of agricultural improvement. In one of the leading oeconomic journals of the day, the *Journal Oeconomique*, insecticidal recipes and techniques regularly appeared alongside theoretical debates pertaining to subjects of political economy.⁸⁶⁴ Reports of newly discovered insect repelling plants and effective insecticidal concoctions, mixed with firsthand observations of the behavior and reproductive patterns of insect pests, also appeared in the more ephemeral *Affiches de Paris* and the *Affiches de*

⁸⁶⁴ On the origins of this journal, see: Arnaud Orain, "Le Journal Oeconomique, le cercle de Gournay et le pouvoir monarchique: quelques preuves matérielles d'un lien organique," *Dix-huitième siècle* 45, no. 1 (2013): 565-583; For a small sample of these remedies, see: "Recette distribuée par feu M. le Curé de S. Sulpice, pour conserver les bleds, empêcher les calandes et autres insectes de leur faire aucun tort, et pour délivrer les bleds et les greniers de ces malheureux insectes lorsqu'iols sont infectés," *Journal Oeconomique* (Paris, May 1751), 4-11; "Lettre sur l'utilié de la plante numaria contre les vers sui se mettent dans le bled à l'éditeur du Journal Oeconomique," *Journal Oeconomique* (Paris: June 1751), 4-11; "Moyen particulier d'expulser les punaises de nos habitations, ainsi que de préserver les bleds des calandes des charencons et autres insectes qui les détruisent," *Journal Oeconomique* (Paris: June 1764), 267; "Nouvelle manière de conserver les grains," *Journal Oeconomique* (Paris: December 1766), 546.

Province.⁸⁶⁵ Vectors for the dissemination of useful knowledge geared towards the improvement of daily life, these publications helped support the collective search for a solution to the pervasive problem of insect pests by making the private experiential knowledge of their readers publicly accessible.⁸⁶⁶

The periodical press also facilitated the development of a commercial marketplace for insecticides after 1750.⁸⁶⁷ Medical practitioners and inventors drawn from various occupational and social backgrounds used the press to advertise powders and liquors that could protect homes, bodies, gardens and granaries from the depredations of insect vermin.⁸⁶⁸ Parisian apothecaries, surgeons and druggists developed a subsidiary trade in remedies for eradicating bedbugs from private residences and institutions in the capital, while also reaching provincial consumers through the *Affiches de Province*.⁸⁶⁹ The Alsatian-born apothecary Steinacher, for instance, sold a powder from his shop on the rue

⁸⁶⁵ "Avis pour conserver les grains," *Affiches de Lyon*, 27 October 1750; *Affiches du Poitou*, 12 May 1774; *Affiches, annonces et avis divers du Dauphiné*, 20 May 1774

⁸⁶⁶ Robert Favre and Pierre Rétat, "L'amélioration de la vie quotidienne," In *La presse provinciale au XVIIIe siècle*, ed. Jean Sgard (Grenoble: Centre de recherche sur les sensibilités, 1983), 65-77.

⁸⁶⁷ The development of the market for agricultural remedies, powders and elixirs has yet to be studied, but see: Bourde, *Agronomie et Agronomies*, 1: 207-216; François Sigaut, "Entre pratiques raisonnées et science efficace: l'âge des doctrines en agronomie," in *Traditions agronomiques européennes: élaboration et transmission depuis l'Antiquité*, eds. Marie Claire Amouretti and François Sigaut (Paris: CTHS, 1998), 200-202; For the development of a medical marketplace in France around the same period see: Gilles Feyel, "Medecins, empiriques et charlatans," 79-100; Colin Jones, "The Great Chain of Buying," 13-40.

⁸⁶⁸ What follows below is based on a sample of 41 inventors identified in the *Affiches de Paris*, *Affiches de Province*, the *Avant-coureur*, the *Dictionnaire de l'Industrie* and the archives of the Société Royale de Medecine and the Archives Nationales de Paris.

⁸⁶⁹ "S. Boucher, apoticaire, poudre et liniment pour détruire les punaises," *Affiches de Province* 11 August 1762, no 32.

Dauphine that purported to keep his clients' homes vermin-free, and he also supplied the military hospital in Paris with the substance.⁸⁷⁰ Practitioners of *petite chimie* outside the medical profession also sought to capture a portion of the market for bedbug remedies.⁸⁷¹ A Swiss guard, S. Répond, sold a decoction composed of extracts of anti-verminous Swiss plants for 6 *livres* per pint at the Porte de Cerisaye near the Arsenal, and advertised his wares to the numerous *collèges* and *pensions* of Paris.⁸⁷² Women took an active hand in this burgeoning trade. A certain Dame Simon sold anti-verminous liquors from her home in the rue Grenier Saint Lazare, while a nun at the *Abbaye de Moncelles*, soeur Santerre, retailed her "marvelous water for the destruction of bedbugs" through a *rotisseur* in the Faubourg Saint Antoine.⁸⁷³

Urban tradesmen also developed insecticide substances to protect their consumers' merchandise from the ravages of household insect pests. Bookbinders developed pest-repelling glues that would protect paper from the teeth of harmful insects

⁸⁷⁰ "Steinacher, Poudre contre la vermine," 104 d 38, Archives de la Société Royale de Médecine, Bibliothèque de l'Académie Nationale de Médecine (BANM), Paris.

⁸⁷¹ "S, Le May, traiteur," *Affiches de Paris*, 15 May 1758; "S. de Gonty, Pommade pour la destruction des punaises," *Affiches de Province*, 30 June 1762, no 62; "Dame Simon, demeurant chez le Sieur Bassigny rue Grenier Saint Lazare," *Affiches de Paris* 13 June 1771; "Sieur Follère, Américain," *Affiches de Paris* 15 June 1778; "Liqueur contre les insectes," in *Dictionnaire de l'industrie ou collection raisonnée des procédés utiles dans les sciences et dans les arts*, ed. Henri Duchesne, vol. 2 (Paris: Lacombe, 1776), 410.

⁸⁷² "S. Répond, Suisse du Roi," *Affiches de Paris*, 15 May 1775; *Affiches de Paris*, 15 May 1778.

⁸⁷³ "Dame Simon," *Affiches de Paris*, 13 June 1771; SRM, "Soeur Santerre, apoticaire de l'abbaye de Moncelle, Recette contre les punaises," 104 d 20, Archives de la Société Royale de Médecine, BANM, Paris.

and exterminate the eggs laid in libraries and archives.⁸⁷⁴ A master bookbinder in the place Maubert, S. Le Roux, announced in the *Avant Coureur* in 1772 that he had developed a glue that repelled "all worms and insects that are attracted by the smell of old glue made with bad flour, that destroy entire libraries, cause considerable damage to books, maps and even the wood of library shelves."⁸⁷⁵ Artisans in the textile and clothing trades were as ever on the lookout for new weapons in the fight against vermin that attacked cloth. Tapestry makers, cobblers and secondhand cloth merchants advertised insecticides that could be safely applied on vestments without damaging them or leave behind foul odors.⁸⁷⁶ Finally, the *petite chimie* of inventors and artisans yielded new substances for ridding noxious insects from the bodies of urban dwellers. The *Affiches* are filled with advertisements from wigmakers, perfumers and other "artisans of the body" whose pomades and powders promised to deliver men, women and children from the scourge of head lice.⁸⁷⁷

Inventors also developed remedies for gardeners, farmers and merchants seeking to preserve their trees, kitchen gardens, flower beds, fields and stocks of grain from the

⁸⁷⁴ "S. Ant. Steinner," *Affiches de Paris*, 3 June 1771.

⁸⁷⁵ "Le Roux," *L'avant coureur*, 6 July 1772.

⁸⁷⁶ *Affiches de Paris* 30 Juillet 1778; "Spécifique contre les souris, punaises, etc.," "Eau propre à détruire les vers qui s'engendrent dans les tapisseries," *Dictionnaire de l'industrie*, 410; "S. Machaud, Tapissier, remede contre les punaises," 2 July 1784, f. 331, Archives de la Société Royale de Médecine, BANM, Paris.

⁸⁷⁷ "Tranchard, Marchand Parfumeur," 104 d 56, Archives de la Société Royale de Médecine, BANM, Paris; "Sauvage, Pommade contre les poux," 104 d. 24, Archives de la Société Royale de Médecine, BANM, Paris; Sandra Cavallo, *Artisans of the Body in Early Modern Italy: Identities, Families and Masculinities* (Manchester: Manchester University Press, 2007).

attacks of insects.⁸⁷⁸ The collective preoccupation over techniques of grain conservation that arose in France after 1750 manifested itself in a stream of new powders marketed as infallible weapons against grain-beetles, worms and other insects that consumed cereals stored in granaries.⁸⁷⁹ In addition to selling a liquor for ridding houses of bedbugs, the druggist S. Clément sold a powder in his shop in the Rue Zacharie known as *noix tophenix* that protected stored grain from insects and other vermin.⁸⁸⁰ Clément's successor, S. Le Gris, continued to sell this powder after his death, "with great success and acclaim," while his wife, Dame Pommez continued to sell the substance after Le Gris himself died.⁸⁸¹ The Alsatian inventor Constant Brongniart distributed three insecticide powders, one for bedbugs, another for granary insects, and a third for ants and other garden insects, through an extensive retailing network of Parisian shopkeepers.⁸⁸² Gardeners, plant-collectors, nurserymen and seed-merchants, also took part in the burgeoning trade in insecticides.⁸⁸³ An herbalist near the Palais Royal sold a plant, *thlaspi*

⁸⁷⁸ See examples cited below and: "Poudre contre les animaux nuisibles aux maisons et aux jardins," *L'avant-coureur*, 3 May 1762; "S. Desmartez," *Affiches de Province*, 15 November 1769;

⁸⁷⁹ On the public interest in grain conservation in the second half of the 18th century see Thierry Michel, *La Conservation des grains en France au XVIIIe siècle: ruptures, continuités et limites* (Phd thesis: EHESS, 2015).

⁸⁸⁰ *Affiches de Province*, 17 April 1765.

⁸⁸¹ *Mercure de France*, April 1768, 212-214; *Affiches de Paris*, 4 August 1768; *Affiches de Paris*, 22 May 1775.

⁸⁸² *Affiches de Province*, 7 July 1779.

⁸⁸³ On the business of horticulture in late eighteenth-century Paris, see: Michel Traversat, *Les pépinières: étude sur les jardins français et sur les jardiniers et les pépiniéristes* (Phd thesis: EHESS, 2001); Sarah Easterby-Smith, "Cultivating Commerce: Connoisseurship, Botany and the Plant Trade in London and Paris. C. 1760-1815," (Phd thesis: University

champêtre, that protected homes and gardens from insect vermin.⁸⁸⁴ The *pépiniériste* Fleury, for his part, announced his discovery of a substance that could rid gardens of ants, while the seed-merchant Antoine Tatin sold an "infallible remedy [*spécifique*] for the destruction of all insects that are harmful to the products of the earth" at his shop at the Pont Neuf.⁸⁸⁵ Finally, artisans advertised fumigation devices that could spread combustible insecticide materials deep into the soil or on the leaves of trees afflicted by caterpillars and other insects.⁸⁸⁶ One inventor noted that his *fumoir* would be useful not only to gardeners and cultivators in France but also to sugar planters in the Caribbean whose fields were frequently decimated by cane-ants.

The periodical press also provided a bridge between the world of courtly patronage and the wider commercial marketplace for domestic and agricultural remedies. The directors of the estates of the nobility and the monarchy frequently courted inventors whose remedies could rid their gardens, orchards and palaces of insect vermin.⁸⁸⁷ Numerous inventors who had demonstrated the effectiveness of their remedies in the residences and gardens of the nobility and royal family used the press to parlay their

of Warwick, 2009), ch. 1; Sarah Easterby-Smith, "Selling Beautiful Knowledge: Amateurship, Botany and Market-Place in Late Eighteenth-Century France," *Journal for Eighteenth-Century Studies* 36, no. 4 (2013): 531-543.

⁸⁸⁴ *Avant-Coureur*, 17 May 1773

⁸⁸⁵ "S. Fleury, Marchand d'arbre, Moyen infaillible pour faire périr sans retour, les fourmis qui s'attachent aux plantes," *Affiches de Province*, 8 June 1763, no 23; The case of Tatin will be described in more detail below.

⁸⁸⁶ "Fumoir ou soufflet mécanique, à l'usage des cultivateurs," *Observations sur la physique sur l'histoire naturelle et sur les arts* (Paris: Ruault, 1772), 583-584; *L'avant-coureur*, 3 August 1772.

⁸⁸⁷ In addition to the examples cited below see: *Affiches de Paris*, 13 April 1778.

success into more overtly commercial ventures. S. Godon, who headed a royal laundry manufacture in Gentilly, also advertised a secret concoction that purged insect vermin from mattresses in the *Avant-coureur*, noting that its effectiveness was attested by the officers of the *garde meubles du Roi* at Versailles.⁸⁸⁸ Samuel Hirsch, *pensionnaire* of the royal court, similarly underlined in the advertisements for his secret remedies for ridding homes of mites, worms and bedbugs, that their effectiveness had been demonstrated "with great success at Versailles."⁸⁸⁹

The royal gardens also provided a frequent testing ground for inventors of insecticide remedies.⁸⁹⁰ In 1764, the Marquis de Marigny, *directeur des bâtiments du roi*, received word that a gardener from Lorraine, Augustin Pillant, had developed an effective technique for ridding gardens of a common insect pest, the mole cricket [*courtillière*]. Marigny quickly summoned Pillant to Versailles, to determine the effectiveness of his remedy in gardens on the king's domain infested with this insect. Pillant arrived in Versailles armed with certificates from *seigneurs* on whose estates he had been employed, all of which attested to his moral credibility and to the effectiveness of his remedy.⁸⁹¹ Further tests of the remedy were carried out in gardens at Versailles, Fontainebleau, Compiègne and in the Tuileries, in the presence of high ranking royal

⁸⁸⁸ "Manufacture pour laver les matelas et les couvertures," *L'avant coureur*, 7 December 1767.

⁸⁸⁹ *Affiches de Province*, 2 November 1763.

⁸⁹⁰ See also: "Dossier S. de Lion," 1768, O/1/1293, ANF, Paris.

⁸⁹¹ "Portefeuille contenant tous les certificats du nommé Pillant," O/1/1293, no. 318, ANF, Paris; A narrative account of these tests are found in: "Lettre à M. de la Place auteur du Mercure de France, sur un moyen assuré de détruire les courtillières," *Mercure de France* (April 1767), 115-122; and reproduced in Pierre-Joseph Buc'Hoza, *Dictionnaire Vétérinaire et des Animaux Domestiques*, (Paris: Costard, 1775) 5: 444-445.

officials and gardeners employed on the king's estates. Convinced of its effectiveness, Marigny was authorized by the king to purchase the secret, whose formula was to be divulged after Pillant received a gratification of 2400 *livres*.⁸⁹²

Pillant's remedy did not remain a secret for long, as the royal administration quickly publicized it in the periodical press and through provincial administrative networks. Marigny had instructions for preparing and applying the remedy (which simply consisted of filling the underground tunnels dug by these insects with a mixture of hemp oil and water) published in the *Mercure de France*, the *Gazette d'Agriculture* and he sent printed pamphlets to provincial intendants that were to distribute them throughout the countryside.⁸⁹³ He also had descriptions along with still life engravings of the insect printed so that they could be identified "at first glance" by farmers and those "with no knowledge of natural history."⁸⁹⁴ For the royal administration, as the above case demonstrates, the periodical press provided a highly visible way of demonstrating its public commitment to the more generalized program of agricultural improvement and resource management that took off after 1750 in France. In the process of publicizing secret remedies like Pillant's, the monarchy transformed insecticides, long a matter of private or "domestic oeconomy," into objects of "public oeconomy." The king's gardens and estates became a testing ground for substances that could be of public utility for the entire nation. As a further illustration of this tendency, I will now examine the new role

⁸⁹² "Affaires Générales," 16 November 1764, Bons du Roi, O/1/1055, ANF, Paris.

⁸⁹³ See for instance the letter from Marigny to the intendant of Languedoc: Marigny to St. Priest, 10 June 1767, C/5392, ADH, Montpellier.

⁸⁹⁴ The artist for this engraving was M. Perreau, very possibly the same Perreau who acted as an assistant to Antoine Ferchault de Réaumur's insect investigations in the 1730s and 1740s: Terrall, *Catching Nature in the Act*, 51, 53, 216.

taken up by state administrators, and the naturalists and chemical practitioners who advised them, as regulators of the marketplace for insecticides.

Regulating the market for insecticides

Beginning in the 1770s, medical practitioners came to impose themselves as public mediators in the growing commercial market for insecticide remedies. The effects of an unregulated market for insecticides elicited numerous complaints from medical and chemical practitioners. The pharmacist Antoine-Augustin Parmentier (1737-1813) deplored the flood of useless "fumigations, decoctions, strong odors and suffocating exhalations," whose "marvelous properties" were "advertised daily in newspapers." Such concoctions were not only ineffective, he wrote, but they often altered the quality of the grains on which they were applied, and made them "dangerous" for human consumption.⁸⁹⁵ For Parmentier, it was the philanthropic duty of men of science to protect the public from unscrupulous charlatans that foisted ineffective, or worse, harmful, insecticides on cultivators and consumers. For inventors of insecticides, in turn, official recognition of the effectiveness and safety of their products from government officials and publicly appointed chemical experts became a valuable commodity in a competitive market for agricultural remedies. To protect their place within the increasingly competitive market for insecticides, inventors increasingly had recourse to certificates of

⁸⁹⁵ Antoine Augustin Parmentier, "Mémoire sur la culture des céréales en Languedoc," 67, H/748/223, ANF, Paris; Antoine Augustin Parmentier, *Le Parfait Boulanger ou traité complet sur la fabrication et le commerce du pain* (Paris: Imprimerie Royale, 1778), 86-87.

authenticity and seals of approval from medical and scientific institutions, using these documents as a bulwark against counterfeiters and public accusations of charlatanism that continually befell their trade.⁸⁹⁶ When the Alsatian inventor Constant Brongniart approached the lieutenant general of the police Jean-Charles-Pierre Lenoir (1732-1807) to receive public approbation to market his fertilizing, insecticide powder, *la poudre de providence*, he hoped that this seal of approval would dissipate doubts about his remedy, continually “taxed with charlatanism.”⁸⁹⁷

Chemical practitioners in the final decades of the Ancien Régime were frequently called upon to evaluate remedies sent by inventors to the lieutenancy of the police and to the *bureau de subsistances*, two administrative bodies responsible for administering the food supply.⁸⁹⁸ Parmentier and the pharmacist Antoine-Cadet de Vaux (1743-1828) were appointed by Lenoir as expert witnesses in the trials conducted with Brongniart's *poudre*

⁸⁹⁶ In his advertisement for a liquor that would rid apartments of domestic vermin, S. Le May noted that his remedy was "approved by the Académie des Sciences," *Affiches de Paris*, 4 May 1758; Dame Simon sold her remedies with certificates of authenticity to differentiate her products from those of counterfeiters: *Affiches de Paris*, 13 June 1771.

⁸⁹⁷ "Poudre de la Providence," 1775-1778, 127AP/6, ANF, Paris; "Mémoire du S. Brongniart," 127AP/6, ANF, Paris.

⁸⁹⁸ On the lieutenancy of the police and its role in evaluating inventions related to subsistence issues: Alan Williams, *The Police of Paris, 1718-1789* (Baton Rouge: Louisiana State University Press, 1979); Kaplan, *Provisioning Paris*, ch.2; Emma Spary, *Feeding France, passim*; On the *bureau de subsistances* and its personnel see: Frédéric Garrigues, "Les intendants du commerce au XVIIIe siècle," *Revue d'histoire moderne et contemporaine* 45, no. 3 (July/September 1998): 626-661; Igor Moullier, "Une recomposition administrative: le bureau des subsistances, de l'ancien régime à la fin du Premier Empire," *Annales Historiques de la Révolution Française* 352 (Avril/Juin 2008): 29-51.

de providence in wheat fields in the commune of Chatou on the outskirts of Paris.⁸⁹⁹ In March 1778, the intendant of commerce Michaud de Montaran, head of the *bureau de subsistances*, called upon the naturalist Mathieu Tillet and the physician-chemist Pierre Joseph Macquer (1718-1784) of the Académie des Sciences to examine an insecticide powder invented by the seigneur of Agris in the province of Limousin.⁹⁰⁰ The two *académiciens* were to test the efficacy and safety of the substance on wheat stored in private granaries in Corbeil, and to produce a report attesting to the powders' purported ability to "infallibly destroy weevils and to prevent the ravages they cause in wheat" and to ensure that it did not "alter the quality of the wheat or flour, or harm the health of consumers."⁹⁰¹ At the request of the *bureau des subsistances*, members of the Académie des Sciences also examined fumigation devices that inventors developed to facilitate the spread of combustible substances on plants, trees and wheat fields infested with insects.⁹⁰²

⁸⁹⁹ "Poudre de la Providence," 1775-1778, 127AP/6, ANF, Paris; "Mémoire du S. Bronguiart," 127AP/6, ANF, Paris; Cadet de Vaux printed an unfavorable report on this powder in the *Journal de Paris*, 17 September 1778; Lenoir played a key role strengthening the Paris police's ties with pharmacists and scientific experts: Thomas Le Roux, *Le laboratoire des pollutions industrielles: Paris, 1770-1830* (Paris: Albin Michel, 2011), 79-91.

⁹⁰⁰ "Mémoires de M. de Montaran à M. de Montigny de l'Académie des Sciences, rue des vieilles audriettes," 30 March 1778, f. 338-339, F/11/1, ANF, Paris.

⁹⁰¹ "M. de Montaran à M. Tillet de l'Académie des Sciences à l'hôtel des monnois quay de conty," f. 349-350, F/11/1, ANF, Paris.

⁹⁰² "Examen d'un fumoir par M. de Montigny et M. Jussieu," Pochettes de Séances, 1 March 1775, AAS, Paris; Similar machines to exterminate moles were also examined by the académie: "Machine pour détruire les mulots du S. Gasselin," H/1514, ANF, Paris.

The Société Royale de Médecine, established in 1778 to regulate the medical marketplace and combat charlatanism, examined dozens of insecticides from its foundation until its dissolution in 1793.⁹⁰³ The majority of petitions received by the *Société* were from inventors of household insecticides, powders and remedies intended to exterminate bedbugs and other domestic vermin.⁹⁰⁴ Working closely with the lieutenant general of the police Lenoir, physicians at the *Société Royale* distributed or withheld *approbations* and *brevets* to inventors seeking to market these substances "of considerable utility for the nocturnal slumbers of the public."⁹⁰⁵ The safety of domestic remedies was of primary concern for the physicians of the *Société*. After examining the bedbug remedy of a certain Champagnac, a mixture containing arsenic and *acqua fortis*, the physician de la Porte concluded that it was undoubtedly efficacious but that it was "so dangerous, that it would be frightening to see it employed by even the best physicians."⁹⁰⁶ Other more simple domestic remedies, such as the concoction of cow's bile and vinegar

⁹⁰³ On the Société Royale de Médecine and the regulation of the medical marketplace, see: Maurice Bouvet, "La législation des remèdes secrets de 1778 à 1803," *Bulletin de la Société d'histoire de la pharmacie* 38 (1923): 204-216; Charles Gillispie, *Science and Polity in France: The End of the Old Regime* (Princeton: Princeton University Press, 1980), 219; Colin Jones and Lawrence Brockliss, *The Medical World of Early Modern France* (Oxford: Oxford University Press, 1997), 643-668; Catherine Lanoë, *La poudre et le fard: une histoire des cosmétiques de la Renaissance aux lumières* (Seysssel: Champ Vallon, 2008), 327-340.

⁹⁰⁴ "Champagnac, remède contre les punaises," 1784, 97 d. 13 no 1-12, Archives de la Société Royale de Médecine, BANM, Paris.

⁹⁰⁵ SRM 101, d. 18 no 1-9 "Kunman, Recette pour détruire les punaises," Archives de la Société Royale de Médecine, BANM, Paris.

⁹⁰⁶ "Rapport sur le remède de Champagnac," 2 May 1784, 97, d. 13, no. 6, Archives de la Société Royale de Médecine, BANM, Paris; "Jugements de la société royale," f. 13, MSS 14, Archives de la Société Royale de Médecine, BANM, Paris.

proposed by M. Chartier, were simply rejected for their ineffectiveness.⁹⁰⁷ The *commissaires* also weighed in on the practicality of the proposed inventions for agricultural uses. The fumigation machine developed to exterminate wasps and hornets by M. Dupuy, a harness maker from Asnières-sur-Oise, was judged to be ingeniously novel, but "too expensive and of difficult use for country folk."⁹⁰⁸

In the final years of the Ancien Régime, the Comité d'Agriculture, an advisory body established in 1785 by the minister Charles Gravier de Vergennes (1717-1787) and composed of eminent chemists and naturalists drawn from the Académie des Sciences, tested various insecticide remedies sent by inventors and agricultural improvers.⁹⁰⁹ Vergennes himself tested the insecticidal "antidote" sent to the *Comité* by a certain Geneviève Michel in his gardens in near Versailles, and delivered a certificate attesting to its effectiveness.⁹¹⁰ When the Société d'agriculture d'Auch held an essay contest in 1785 to determine the safest and most reliable methods for eradicating fly weevils from

⁹⁰⁷ "Chartier, Recette pour faire mourir les punaises," 1782, 97, d. 17, no 1-4, Archives de la Société Royale de Médecine, BANM, Paris; "Jugements de la société royale," f.139-140, MSS 14, Archives de la Société Royale de Médecine, BANM, Paris.

⁹⁰⁸ "Dupuy, Machine pour détruire les guêpes et les frelons," 1790, 98, d. 37, no 1-2, Archives de la Société Royale de Médecine, BANM, Paris.

⁹⁰⁹ H. Pignonneau and Alfred de Foville, *L'administration de l'agriculture au Contrôle Général des Finances (1785-1787)* (Paris: Guillaumin, 1882); In addition to the cases cited below: "Veuve La Faye," 25 September 1786, f. 170-171, H/1625, ANF, Paris;; "Mémoire de Babaud de Logerie sur les charancons," 1785, f. 39-41, H/1624, ANF, Paris.

⁹¹⁰ "Veuve Tortay, Secret pour détruire les insectes," 1781-1787, f. 252-255, H/1624, ANF, Paris.

granaries, members of the Comité d'Agriculture weighed in on the proposed solutions.⁹¹¹ Mathieu Tillet reviewed dozens of recipes for insecticidal remedies and fumigations submitted by local improvers.⁹¹² "Every farmer has his own supposed method," he noted, "the writers who should in good faith protect the public from charlatanism, fill their own works with these recipes." Sifting through these proposals, Tillet rejected as harmful all those proposed "fumigations of vegetable, mineral and animal matter" that altered the taste of the grain on which they were applied. Fumigations of sulfur and cinnabar were effective insecticides but they imparted such a foul odor to the grain that it became inedible. One author proposed that stores of grain should be fumigated with purified mercury, an undoubtedly effective technique for eradicating insects, "but who will consume wheat preserved in this manner when all know the terrible effects that mercury has on the animal oeconomy."⁹¹³

Inventors of insecticides also found a receptive audience for their products in the various consultative bodies and revolutionary committees that developed during the French Revolution.⁹¹⁴ Under the National Constituent Assembly, the *Comité*

⁹¹¹ "Programme du prix proposé par la Société d'agriculture d'Auch," 1786, H/1626, ANF, Paris.

⁹¹² "Observations du Bureau d'Agriculture sur le prix de la Société d'Agriculture d'Auch," 7 October 1786, H/1626, ANF, Paris.

⁹¹³ "Observations sur les papillons de blés," 1785, f. 22, H/1626, ANF, Paris.

⁹¹⁴ "Contrat de Mariage de Antoine Tatin, grainier et Marie-Marguerite Lebouteux," 20 June 1785, MC/ET/LXV/475, ANF, Paris; At the time of his death, the worth of Tatin's commercial practice was evaluated at 18,000 francs. The total value of his wealth had increased from 30,000 to over 150,000 francs between 1785 and 1824: "Inventaire apres décès, Liquidation de la cte de biens d'entré M et Mad. Tatin et de la succession de M. Tatin," 9 February 1824, MC/ET/XXIV/1214, ANF, Paris.

d'Agriculture et de Commerce took up the task of evaluating pest remedies sent by artisans and farmers, as part of its more general aim of soliciting "enlightened and patriotic observations" on agricultural matters from "citizens of all provinces and of all classes."⁹¹⁵ The deputy Etienne Chevalier remarked that the National Assembly had "revivified agriculture" through the abolition of feudal dues and arbitrary impositions, but that it still needed to combat the "scourge of insects."⁹¹⁶ Amidst an epidemic of caterpillars and plant lice that caused a scarcity of vegetable crops around Paris in July of 1791, the National Assembly received an "infallible remedy [*spécifique*] for the destruction of all insects that are harmful to the products of the earth" from Antoine Tatin, a seed-merchant who had established a thriving commercial practice at the Place de l'École during the Ancien Régime.⁹¹⁷ Following evaluative practices developed under the Ancien Régime, the Parisian scientific community was mobilized to test the effectiveness and safety of this insecticide, with members of the Société Royale d'Agriculture and the Académie des Sciences were asked to submit a report on the matter to the National Assembly.

A first round of tests was carried out in August near the Pont-Neuf in the garden of Philippe-Victoire de Vilmorin (1746-1804), a renowned horticulturalist, seed-merchant

⁹¹⁵ *Plan des travaux du Comité d'Agriculture et de Commerce, présenté à l'Assemblée Nationale, le 8 Mai 1790* (Paris: Imprimerie Nationale, 1790), 4.

⁹¹⁶ "Copie du Rapport Fait à l'Assemblée Nationale au nom de son comité d'agriculture et de Commerce, par Etienne Chevalier, séance du 29 7bre 1791," Q 302, Archives Historiques du Muséum des Arts et Métiers (AHMAM).

⁹¹⁷ "Suite du Procès Verbal de l'Assemblée Nationale du 30 Juillet 1791 au matin," no 720, Q 302, AHMAM, Paris; "Extrait du Procès Verbal de l'Assemblée Nationale du 30 Juillet 1791," Q 302, AHMAM, Paris; "Rapport de L'Assemblée Nationale 26 Septembre 1791," Q 302, AHMAM, Paris.

and son-in-law of the former royal botanist Pierre Andreux.⁹¹⁸ Pierre-Augustin Parmentier, representing the *Société Royale*, along with three "credible" *jardiniers-cultivateurs*, Stainville, Meunier, Audebert fils, and a deputy from the National Assembly were on hand as witnesses to the experiment. Tatin's remedy was applied to infested fruit trees, vegetable plots and on insect specimens brought on pieces of paper that were instantly killed when doused with the substance. In addition to verifying the claimed efficacy of the remedy, the commissaries were also keen to determine whether the physiology of the plants was negatively affected by the causticity of the substance. Happily, the witnesses reported that after, three days of observation, the vegetative properties of the plants doused with the substance "far from showing the slightest alteration were all the more active." Another concern was to the possible negative health effects that these fumigated plants might have on the human beings and domesticated animals who ingested them. A rabbit was fed vegetables that had been soaked in the substance for several days, leading witnesses to conclude that the remedy "caused no harm to the health of men and animals who will eat fruits and vegetables doused with this water."⁹¹⁹

The favorable reports from the Société Royale d'Agriculture and the Académie des Sciences, along with the certificates from Parisian gardeners who had used the insecticide and deemed it "one of the most useful discoveries for humanity," convinced

⁹¹⁸ "Extrait des registres de la Société Royale d'Agriculture du 12 Septembre 1791," Q 302, AHMAM, Paris.

⁹¹⁹ "Copie du rapport fait à l'assemblée nationale au nom de son comité d'agriculture et de commerce, par Etienne Chevalier, séance du 29 7bre 1791," Q 302, AHMAM, Paris.

the Comité d'Agriculture that Tatin ought to receive public praise and a reward.⁹²⁰ On September 29, the deputy Etienne Chevalier encouraged the National Assembly to purchase the remedy from Tatin, who playing the republican card, had renounced "the egoism by which he could have derived great profit" and offered to sell his secret to the *patrie*.⁹²¹ Yet the dissolution of the National Assembly the following day dashed these plans and Tatin was forced to renew his petitions in the fall of 1792 to the Bureau de Consultation des Arts et Métiers, the advisory body to the Ministry of the Interior under the National Convention.⁹²² In the meantime, he continued to advertise his remedy, which still remained secret in the periodical press, offering to sell his recipe to subscribers for the sum of 5 *livres*.⁹²³ The Bureau de Consultation, after carrying out a further round of experiments and taking into consideration Tatin's "application and knowledge in rural oeconomy," purchased the secret for 2,000 *livres*, the composition of which was finally revealed in the *Annales de Chimie* in 1793.⁹²⁴

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⁹²⁰ "Copies des différens certificats et attestations d'expériences faites avec l'eau du S. Tatin," Q 302, AHMAM, Paris.

⁹²¹ "Copie du rapport fait à l'assemblée nationale au nom de son comité d'agriculture et de commerce, par Etienne Chevalier, séance du 29 7bre 1791," Q 302, AHMAM, Paris.

⁹²² "Rapport Concernant le C. Tatin," Q 302, AHMAM, Paris.

⁹²³ "Annonces particulières. Découvertes importantes pour l'agriculture," Q 688, AHMAM, Paris.

⁹²⁴ "Recette de l'eau qui a la propriété de faire périr les insectes, les chenilles, les pucerons, punaises fourmis etc.; de la composition et invention du C. Tatin, Marchard Grainetier-Fleuriste, place du quai de l'École à Paris," *Annales de Chimie* 17 (1793): 212-216.

The final decades of the eighteenth century saw chemical practitioners increasingly involved in the production of everyday material substances and quotidian objects of consumption.⁹²⁵ The intervention of pharmacists and physicians in the marketplace for insecticides was one way in which chemical practitioners were beginning to exert their influence in this domain. Entrusted by royal administrators with protecting the public's health from harmful insecticidal substances emanating from the artisanal sphere, chemical practitioners found a source of public legitimacy in their newfound role as mediators in this market.⁹²⁶ Yet chemical practitioners at the end of the Ancien Régime aspired to become more than merely regulators of the insecticidal market. By providing the key to understanding the natural world, the tools of laboratory-based chemistry also seemed to provide a way of exerting a more complete mastery over its undesirable elements. Chemical practitioners' involvement in the actual production of insecticidal substances opened a new frontier for their discipline, demonstrating how the techniques of analytical chemistry could become useful aids to agricultural production and *salubrité publique*.

The impetus for chemical practitioners' interest in insecticidal substances came in the 1760s, when a virulent outbreak of cane ants in the sugar plantations of Martinique attacked the French colonial presence in the Caribbean at its roots. The ants, rumored to

⁹²⁵ See: Ursula Klein and Emma Spary (eds.) *Materials and Expertise in Early Modern Europe between Market and Laboratory* (Chicago: University of Chicago Press, 2010). Deborah Valenze *Milk: A Local and Global History* (New Haven: Yale University Press, 2011), ch. 8; Spary, *Feeding France*.

⁹²⁶ On the rise of scientific experts in the more general domain of food safety and food security, see: Martin Bruegel and Alessandro Stanziani, "Pour une histoire de la sécurité alimentaire," *Revue d'histoire moderne et contemporaine* 51, no. 3 (2004): 7-16.

have been brought on an English ship from the island of Barbados in 1764, quickly spread to every corner of the island.⁹²⁷ By 1770, forty sugar plantations had been abandoned due to the infestation of cane-ants.⁹²⁸ In a report to the minister of the Marine on the state of the Windward Islands, the governor Louis Florent de Vallière warned that the colony of Martinique would have to be abandoned unless a solution was found to control the spread of these insects.⁹²⁹ With the livelihoods of planters and the fiscal solvency of the colony at stake, the administration rushed to find and publicize effective methods to eradicate these insects from the island.⁹³⁰ The intendant of Martinique collected and printed chemical remedies sent to the administration by French planters, mostly consisting of arsenic mixed with various locally available substances such as sugar, manioc, and the shells of crustaceans.⁹³¹ The colonial administration also acquired recipes from French colonists who had been sent to Barbados to consult with English planters on the techniques used by their commercial rivals to "deliver their cane from

⁹²⁷ "Mémoire du Sieur Bouffer," 1774, COL C8B/13/, f.129, ANOM, Aix-en-Provence.

⁹²⁸ 2 June 1770, COL C8A/69, f. 347, ANOM, Aix-en-Provence.

⁹²⁹ "Rapport d'ensemble sur la situation des Iles du Vent," 1772, COL C8A/71, f. 12, ANOM, Aix-en-Provence.

⁹³⁰ The administration was forced to repeatedly grant exemptions to planters who were unable to pay their taxes due to the epidemic of cane-ants: Peinier to Ennery, 15 November 1767, COL/8A/68, f. 306, ANOM, Aix-en-Provence; See the brief discussion in James McLellan and François Regourd, *The Colonial Machine: French Science and Overseas Expansion in the Old Regime* (Turnhout: Brepols, 2011), 397-401.

⁹³¹ "Extrait du supplément à la Gazette de Martinique donnant des informations sur les moyens de lutter contre les fourmis," 1773, COL/C8A/72, f.302, COL/C8A/72/ f.302, ANOM, Aix-en-Provence; "Mémoire du S. Bouffer, arpenteur général de la Martinique, donnant une méthode pour lutter contre les fourmis, imprimé à la Martinique par Pierre Richard," 1774, COL/C8B/12, f. 129, ANOM, Aix-en-Provence.

these pernicious insects."⁹³² They also learned that English planters in Barbados and Granada burned cane on their fields and replanted the soil after each harvest to produce hardier crops resistant to the attacks of insects.⁹³³

The colonial administration also consulted with local naturalists, determined that a systematic study of the habits and *moeurs* of these insects was needed to develop effective solutions for exterminating them. As one naturalist wrote, the colonists in Martinique were struggling against an unknown enemy, making existing agricultural techniques of pest-control useless: "The species that we are fighting today is unlike that which are known to our colonists. It does not live in a republic. They disperse as they multiply ... and penetrate very deep into the soil."⁹³⁴ Alexandre Barboteau, the royal botanist for the Windward Islands, member of the *Conseil Supérieur* of Martinique and correspondent of the Académie des Sciences, was the first to identify the insects attacking the crops of planters on the island as *formica saccharivore* adopting the nomenclature

⁹³² 2 June 1770, COL C8A/69/ f. 347, ANOM, Aix-en-Provence; "Mémoire contenant la description et usage des ruches fourmillières pour la destruction des fourmis adressé à messieurs les habitants des isles de la martinique et autres isles françoises du vent," 1774, COL/C8B/12, no 129, ANOM, Aix-en-Provence; The Island of Barbados had apparently been infested with cane-ants for sixty years.

⁹³³"Extrait du supplément à la Gazette de Martinique donnant des informations sur les moyens de lutter contre les fourmis," 1773, COL/C8A/72, f.302, ANOM, Aix-en-Provence.

⁹³⁴ "Note sur le caractère des fourmis qui ravagent les cannes à sucre," 1770, COL/8B/23, f. 39, ANOM, Aix-en-Provence; The astronomer Godin des Odonais likewise wrote that the techniques used by Catalan farmers of burning dried grass near ant holes could not be used in Martinique because these because the ants were completely different species with different habits of reproduction: Godin des Odonais, "Lettre aux auteurs du Journal sur la destruction des fourmis," *Abrégé du Journal de Paris* (Paris, 1789) 2: 54.

used by Carolus Linnaeus in his classification of ant species.⁹³⁵ Barboteau examined specimens of these insects sent in a vial by Philippe Athanase Tascher, intendant of the Windward Islands, and determined that they were the same species as those that afflicted planters in Barbados, further corroborating suspicions about their provenance from this island.⁹³⁶ After conducting field investigations on plantations in Martinique, Barboteau determined that these insects nested in the ground at the foot of sugarcane stalks and decimated fields by releasing an acidic substance that caused the plants to wilt and sapped the soil of its nourishing properties.⁹³⁷

Barboteau also evaluated several techniques proposed by *économés* on the islands for eradicating invasive populations of cane ants. He rejected the calls of certain colonists in Martinique for the introduction of insects that consumed cane ants, highlighting the impossibility of domesticating these species and raising the possibility that the natural enemies of the *saccharivore* could themselves become incommodious.⁹³⁸ On the other hand, he endorsed the proposals to naturalize anteaters and insectivorous birds from

⁹³⁵ Barboteau, who later became member of the Conseil Supérieur of Guadeloupe was a correspondent of Henri-Louis Duhamel du Monceau: "Barboteau," COL/E/17, ANOM, Aix-en-Provence; Barboteau to Duhamel du Monceau, MS BD87, Group 14, APS, Philadelphia; Barboteau published several essays on these insects in the *Journal de Physique: Alexandre Barboteau, "Essai sur la Fourmi," Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts* 8 (1776): 383-395; "Suite du Mémoire sur la fourmi," 8 (1776): 444-469; "Suite du Mémoire intitulé essai sur la fourmi," *Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts* 9 (1777): 21- 36; "Des Divers Ennemis de la Fourmi," *Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts* 9 (1777): 88-96.

⁹³⁶ "Suite du Mémoire sur la fourmi," 468-469.

⁹³⁷ "Suite du mémoire sur la fourmi," 466.

⁹³⁸ "Suite du mémoire sur la fourmi," 450.

Guyana, Suriname and Brazil in Martinique.⁹³⁹ Barboteau conducted experiments with chemical remedies on his own plantation, testing the efficacy of pulverized arsenic, mercury and tobacco as insecticides, "three very powerful poisons that are very effective for killing these insects."⁹⁴⁰ He also found that lime, used by Chinese peasants to rid rice paddies of insects, and the "salts" of burned aquatic plants, used by French peasants in the northern provinces of France as pest remedies, worked effectively on his sugar plantation as insecticides and that they had the added advantage of fertilizing the soil.⁹⁴¹ Finally, Barboteau cautioned that whatever technical solutions were to be favored, delivering the island from cane ants would require the development of an effective administrative structure for responding to eruptions of insect pests: inspectors were to be appointed in each parish to coordinate public works to expel cane-ants from Martinique.⁹⁴²

As cane-ants continued to decimate sugar plantations in Martinique, the colonial administration launched an international appeal for assistance in 1775, offering the astounding sum of one million *livres* to an individual "of any nation," who would propose a solution whose efficacy would be judged by 17 commissaries appointed for the task.⁹⁴³

⁹³⁹ "Des divers ennemis de la fourmi," 91

⁹⁴⁰ "Suite du mémoire intitulé essai sur la fourmi," 22.

⁹⁴¹ Other substances that Barboteau tested, with varying degrees of success were: sand, the ashes of animal bones, urine, manure, common salt, soapy water, sulfur, mercury, corrosive sublimate and cinnabar. He also noted that in many areas in Asia, an effective substance was used to kill ants that was composed of pig livers, human and animal hair.

⁹⁴² "Suite du Mémoire intitulé essai sur la fourmi," 36.

⁹⁴³ "Délibération des députés de la colonie offrant une prime d'un million, argent des îles, à la personne qui découvrira un moyen simple et sûr de détruire les fourmis qui dévastent maintenant cette colonie," 9 March 1773, COL/C8A/72, f. 300, ANOM, Aix-en-Provence.

The announcement, advertised in journals and periodicals in France and the Caribbean, stimulated a vigorous response. Proposals for eradicating cane ants streamed into the office of the colonial administration, the ministry of the Marine and the Académie des Sciences. Engineers and surveyors from Martinique and Guadeloupe proposed plans to build ditches, canals and hydraulic pumps so that cane ants could be drowned by flooding infested plantations.⁹⁴⁴ A farmer from the south of France claimed to have discovered a type of soil that possessed the property of exterminating the eggs of ants and preventing them from hatching, although the costs of shipping this substance to Martinique were judged to be prohibitive.⁹⁴⁵ A number of chemical remedies were also proposed from French and German agricultural improvers who recommended the application of compounds of sulfur, saltpeter, potash and various plant substances on infested sugar cane fields in Martinique.⁹⁴⁶

The proliferation of chemical remedies developed by lay practitioners was a source of concern for some observers, who worried about the effectiveness and safety of

⁹⁴⁴ "Mémoire pour concourir pour le prix proposé par tous les habitants sucriers de la Martinique destiné à celui qui indiquera un moyen facile et sûr pour détruire les fourmis dont la Martinique est infectée," 1776, COL C8B/14, f. 28, ANOM, Aix-en-Provence; See a similar proposal from a Swedish geometer sent to the Académie des Sciences: "Moyen de détruire les Fourmis," 17 January 1778, Pochettes de Séances, AAS, Paris.

⁹⁴⁵ "Mémoire sur les fourmis qui ravagent les plantations de l'arundo saccharifera ou canne à sucre dans la colonie de Martinique," 1776, COL C8B/14, f. 28, ANOM, Aix-en-Provence.

⁹⁴⁶ "Mémoire contenant des remèdes sûrs pour extirper les fourmis et garantir les enfants, et les plantes, les mets et les liqueurs contre leurs ravages," MAR G/146, f. 121, ANF, Paris; "Exposé du secret relatif à la destruction totale des fourmis remis à Monseigneur de Sartins, ministre et secrétaire d'état de la Marine, par le secrétaire de Monsieur le Marquis de Pons, ministre du roy près sa majesté le roy de Prusse," MAR G/146, f. 25, ANF, Paris; "Lettre de Fischer, Gouverneur des jeunes messieurs de Fourtenbach," 16 February 1778, MAR G/146, f. 23, ANF, Paris.

these substances. The reward offered by the colonial administration, the surveyor general of Martinique Antoine François Bouffer wrote, had "flattered many charlatans, who all claim to possess secrets that are better than the next."⁹⁴⁷ The administration was wasting valuable resources "testing the recipes of these charlatans," which all turned out to be ineffective at best, and at worst detrimental to the health of slaves who applied them in cane fields. The Chevalier de Gaussens, who himself submitted a remedy to the minister of the Marine, likewise warned of the "dangers to humanity" that could result from the handling of chemical insecticides by agricultural laborers and from the consumption of poisoned cane sugar.⁹⁴⁸ Medical practitioners, like the German physician Johannes Dedekin, likewise condemned the use of arsenic and corrosive sublimate in lay agricultural remedies as health hazards.⁹⁴⁹ The search for an effective and safe solution to the epidemic of cane ants was too important a matter to be left in the hands of charlatans and the unlearned, and would require the specialized skills of chemical practitioners like himself. Antoine-Alexis Cadet de Vaux (1743-1828), a Parisian pharmacist and professor of chemistry at the École Royale Vétérinaire at Alfort, likewise found that "the means

⁹⁴⁷ "Mémoire contenant la description et usage des ruches fourmillières pour la destruction des fourmis adressé à messieurs les habitants des isles de la martinique et autres isles françoises du vent," 1774, COL/C8B/12, no 129, ANOM, Aix-en-Provence.

⁹⁴⁸ "Exposé du secret relatif à la destruction totale des fourmis remis à Monseigneur de Sartins, ministre et secrétaire d'état de la Marine, par le secrétaire de Monsieur le Marquis de Pons, ministre du roy près sa majesté le roy de Prusse," MAR G/146, f. 25, ANF, Paris.

⁹⁴⁹ Johannes Dedekin, "De Lixivio alcalino, optimo formicis extirpandis remedio," 28 February 1775, AAS, Paris; A translation is available in: "Traduction d'un mémoire latin sur la destruction des fourmis adressé à Messieurs de l'Académie des Sciences de Paris, par M. Dedekind, docteur en médecine à Koenigslanten," 24 November 1777, G/146, f. 20, ANF, Paris.

used since the time of Herodotus and Pliny until our own day to destroy the scourge of ants are insufficient," and believed that only "chemistry can provide an effective solution."⁹⁵⁰ By publishing "the frightening details" of the infestations in Martinique in his periodical, the *Journal de Paris*, Cadet de Vaux had hoped to "encourage savants to turn their attention to this matter."⁹⁵¹ The call from colonial administrators in Martinique for a solution to the epidemic of cane ants thus provided an opportunity for chemical practitioners like Dedekin and Cadet de Vaux to extend the authority of chemists into the domain of pest-control and agricultural production.

The basis for medical practitioners' epistemic authority in this field of agricultural management rested in not only in their claims to possess superior knowledge of the properties of chemical substances, but also in their purported ability to better understand the composition of the natural world through chemical analysis. In developing a chemical substance that could "attack the intricate composition" of cane-ants, both Dedekin and

⁹⁵⁰ "Chymie," *Journal de Paris*, 31 July 1778, 847; Cadet de Vaux remains an understudied member of community of Parisian chemical practitioners: L-G. Torau de, *Étude scientifique, critique et anecdotique sur les Cadet, 1695-1900* (Paris: Imprimerie de la Cour d'Appel, 1902); André Vaquier, "Un Philantrope Méconnu: Cadet de Vaux (1743-1828)," *Paris et Île-de-France - Mémoires* 9 (1958): 374; Alex Berman, "The Cadet Circle: Representatives of an Era in French Pharmacy," *Bulletin of the History of Medicine* 40 (1966): 103-105; Charles Cailhol and Jean Flahaut, "Un Pharmacien Créateur du Premier Quotidien Français: Cadet de Vaux," *Revue de l'Histoire de la Pharmacie* (46) 1998: 303-312. Emma Spary, however, has recently detailed Cadet de Vaux's role in the production and analysis of food-surrogates: Emma C. Spary, *Feeding France, passim*.

⁹⁵¹ "Chymie," *Journal de Paris*, 31 July 1778, 847. See preceding articles in the *Journal de Paris* on the cane-ants in Martinique: "Moyen employé pour détruire les fourmis de l'Isle de Martinique, qui sont multipliés au point de ravager presque toutes les plantations de canne à sucre," 17 October 1777, *Abrégé du Journal de Paris*, (Paris, 1789) 2: 50; Godin Des Odonais, "Lettre aux auteurs du Journal sur la destruction des fourmis," 1 January 1778 *Abrégé du Journal de Paris* Volume 2 (Paris: Au Bureau du Journal, 1789): 54.

Cadet de Vaux drew on a pre-existing corpus of chemical experiments that had been developed by naturalists and medical practitioners since the late seventeenth-century.⁹⁵² In 1670, the English physician-naturalists John Ray (1627-1705) and Samuel Fischer discovered that the bodies of ants contained an "acid juyce" that was of the same nature as the "spirit of vitriol," and therefore might be "of singular use in medicine."⁹⁵³ Chemical practitioners in succeeding decades, among them the Dutch naturalist Wilhelm Homberg (1652-1715) and the German apothecary Andreas Sigismund Margraaf (1709-1782), perfected distillation techniques for extracting this acid from ants.⁹⁵⁴ While the exact nature of this acid remained a matter of debate, with some chemists claiming that it was analogous to other acidic substances within the natural world and others claiming that the *acide formicin* was *sui generis*, its purportedly healthful properties earned it a widely

⁹⁵² "Chymie," *Journal de Paris*, 31 July 1778, 847; Historical accounts of chemical experiments on ants can be found in: "Acide Formicin," *Encyclopédie Méthodique. Chymie, Pharmacie et Métallurgie* (Paris: Panckoucke, 1786), 60-63; Pierre-Joseph Buc'Hoz, *Histoire des insectes utiles et nuisibles à l'homme, aux bestiaux à l'agriculture et au jardinage* (Paris: Guillot, 1785), 66-87; Pierre-Joseph Amoreux, *Notice des insectes de la France, réputés vénimeux, tirée des écrits des naturalistes, des médecins et de l'observation* (Paris: Serpente, 1789), 235-240.

⁹⁵³ John Wray, "Extract of a Letter, Written by Mr. John Wray to the Publisher, January 13, 1670," *Philosophical Transactions* 5 (1670): 2063-2066; On Ray's natural historical observations of insects more generally see: Ogilvie, "Attending to Insects: Francis Willughby and John Ray," 357-372.

⁹⁵⁴ Wilhelm Homberg, "Suite des Observations sur l'acide qui se trouve dans le sang, et dans les autres partie animales," *Histoire de l'Académie des Sciences, année 1712* (Paris: Imprimerie Royale, 1731), 267-275; Andreas Margraf, "Observations sur l'huile qu'on peut exprimer des fourmis, avec quelques essais sur l'acide des mêmes insectes," *Opuscules Chymiques de M. Margraf de l'Académie de Berlin* (Paris: Vincent, 1762), 291-311.

accepted place in the standard pharmacopia of the eighteenth century.⁹⁵⁵ Aside from its use in medicine, the discovery of an acidic substance in ants also had important natural philosophical implications.⁹⁵⁶ For the apothecary Guillaume-François Rouelle (1703-1770), whose public and private chemistry courses mesmerized Parisians at mid-century, the acidic substance found in ants and other insects suggested that they could "be considered the transition from the animal kingdom [*règne animal*] to the vegetable kingdom [*règne vegetal*] which abounds in acid."⁹⁵⁷ The acid obtained from ants thus

⁹⁵⁵ The physician Pierre Thouvenel, for instance, claimed that it was analogous to phosphoric acid while Margraff identified it as acetous acid (vinegar). For a brief account of this debate see: A.F. Fourcroy, "Sur la nature chimique des fourmis et sur l'existence simultanés de deux acides végétaux dans ces insectes," *Annales du Muséum d'Histoire Naturelle* (1802), 333; For the medicinal use of acid extracted from ants see among others: Moyse Charas, "De la Distillation des Fourmis," *Pharmacopée royale galénique et chymique*, vol. 2 (Paris: Laurent d'Houry, 1691), 290-291; Nicolas Lémery, *Pharmacopée Universelle contenant toutes les compositions de pharmacie* (Paris: Houry, 1716), 635; Louis Vitet, *Pharmacopée de Lyon ou exposition méthodique des médicaments simples et composés* (Lyon: Perisse, 1778), 526; Pierre Thouvenel, "Analyse des substances médicamenteuses tirées du règne animal," *Histoire de la Société Royale de Médecine* (Paris: P-D Pierres, 1779), 331-334; Continuing this tradition in the early nineteenth century, the naturalist Louis Augustin Bosc d'Antic developed a recipe to prepare a healthful "oeconomical lemonade" by placing sugar cubes on ant hills and mixing the acidic sugar with water.

⁹⁵⁶ On the relationship between the medical and classificatory aims of eighteenth-century chemistry: Jonathan Simon, "Analysis and the Hierarchy of Nature in Eighteenth-Century Chemistry," *The British Journal for the History of Science* 35, no. 1 (March 2002): 1-16.

⁹⁵⁷ "Cours de chymie de M. Rouelle, rédigé par M. Diderot et éclairci par plusieurs notes, divisés en neuf tomes," MS 564, f. 554, Bibliothèque Municipale de Bordeaux; On Rouelle's lectures: Rhoda Rappaport, "G-F. Rouelle: An Eighteenth-Century Chemist and Teacher," *Chymia* 6 (1960): 68-101; Lissa Roberts, "Chemistry on Stage: G.F. Rouelle and the Theatricality of Eighteenth-Century Chemistry," in *Science and Spectacle in the European Enlightenment*, eds. Christine Blondel and Bernadette Bensaude-Vincent, (Ashgate, 2007), 129-140; On the more general context for chemistry lectures in the eighteenth century, see: Bernadette Bensaude-Vincent and Christine Lehman, "Public Lectures of Chemistry in mid-Eighteenth-Century France," in *New Narratives in Eighteenth-Century Chemistry*, ed. Lawrence Principe (Dordrecht: Springer, 2007), 77-96; John Perkins, "Chemistry Courses, the Parisian Chemical World and the Chemical Revolution, 1770-1790," *Ambix* 57, no. 1 (March 2010): 27-47.

potentially revealed a key towards the development of a systematic classification of the natural world based on chemical analysis.⁹⁵⁸

For Cadet de Vaux and Dedekin practical applications in the field of agronomy could be derived from an understanding of the chemical principles of insect life. The acid found in ants, Dedekin wrote, combined with a "subtle phlogiston" to create the oily substance that provided consistency and density to their bodies.⁹⁵⁹ Margraaf's experiments had shown that when this acid was combined with volatile or fixed alkaline salts, it produced neutral salts, suggesting a "great affinity between the two substances."⁹⁶⁰ The "great affinity" between acids and alkalis, a phenomenon "known to all initiated in chemistry," suggested that the application of alkaline salts on ants would most likely "attack this principle most essential to its constitution."⁹⁶¹ By "altering the fluids of the insects" this substance would "tear its fibers asunder, and its frail body not

⁹⁵⁸ On the uses of chemistry in biological classification: D.C. Goodman, "The Application of Chemical Criteria to Biological Classification in the 18th Century," *Medical History* 15, no. 1 (1971): 23-44; Simon, "Analysis and the Hierarchy of Nature," 1-16.

⁹⁵⁹ Johannes Dedekin, "De Lixivio alcalino, optimo formicis extirpandis remedio," 28 February 1775, AAS, Paris; A translation is available in: "Traduction d'un mémoire latin sur la destruction des fourmis adressé à Messieurs de l'Académie des Sciences de Paris, par M. Dedekind, docteur en médecine à Koenigslanden," 24 November 1777, G/146/f. 20, ANF, Paris.

⁹⁶⁰ "Chymie," *Journal de Paris*, 31 July 1778, 847.

⁹⁶¹ The growing importance of "affinity theory" to chemical practice, research and teaching can be dated to the publication of Etienne François Geoffroy's table in the early eighteenth-century: A.M Duncan, "Some Theoretical Aspects of Eighteenth-Century Tables of Affinity," *Annals of Science* 18, no. 3 (1962) 177-194; Christine Lehman, "Innovation in Chemistry Courses in France in the Mid Eighteenth Century: Experiments and Affinities," *Ambix* 57, no. 1 (March 2010): 3-26.

being able to resist its action, this insect will die."⁹⁶² Cadet de Vaux confirmed this theory in his laboratory by suspending cotton imbibed with volatile alkaline salts in a cucurbit filled with ants, creating a white vapor that killed the insects within a matter of seconds. Dedekin conducted similar experiments, sprinkling salts on ants he had collected in a receptacle, although he found that the alkalis needed to be dissolved in warm water to "penetrate and attack their acid to the point of destroying the principle of their life."⁹⁶³ Not only were alkaline salts effective insecticides, but they also had the advantage of being easily and cheaply obtainable to colonists in Martinique. Collected from the ashes of leaves of trees and plants, they could be dissolved in warm water and liberally applied in cane-fields infected with these insects.

Cadet de Vaux used the *Journal de Paris* to appeal to the chemical community for assistance in his program of chemical experimentation on insect-pests, underlining that the importance of this subject "required the union of nothing less than many enlightened chemists."⁹⁶⁴ Indeed, several prominent Parisian pharmacists, many of whom had ties to scientific institutions in the capital and who already risen to prominence in the fields of chemistry, natural history and agronomy, associated themselves to these experiments.⁹⁶⁵

⁹⁶² "Traduction d'un mémoire latin sur la destruction des fourmis," 24 November 1777, G/146, f. 20, ANF, Paris.

⁹⁶³ "Traduction d'un mémoire latin sur la destruction des fourmis," 24 November 1777, G/146, f. 20, ANF, Paris.

⁹⁶⁴ "Chymie," *Journal de Paris*, 31 July 1778, 847; "Réponse à la lettre de M. Le Franc inserée dans le mercure dernier," *Journal de Paris*, 12 September 1778.

⁹⁶⁵ On the community of Parisian pharmacists and their relationship to chemistry and the chemical arts see: Jonathan Simon, *Chemistry, Pharmacy and Revolution in France* (Aldershot: Ashgate, 2005); Stephane Van Damme, *Paris, Capitale philosophique de la*

Among them were Pierre-François Mitouart and Jacques-François de Machy (1728-1803), chemical demonstrators at the Collège de Pharmacie, the chemical demonstrator and *académicien* Antoine Baumé (1728-1804), the pharmacists Phillipe-Nicolas Pia (1721-1799), Pierre Bayen (1725-1798), Nicolas Deyeu, and Antoine-Augustin Parmentier.⁹⁶⁶ A number of chemists without pharmaceutical connections, most notably Antoine-Laurent Lavoisier and the naturalist Louis Augustin Guillaume Bosc also apparently joined Cadet de Vaux in these experiments.⁹⁶⁷

Cadet de Vaux used his personal connections with eminent chemical practitioners in the capital not only to further his research program, but also to deflect criticism that was directed at him from within the Parisian medical community. In September 1778, the *Mercur de France* published a letter from a certain Le Franc, a Parisian physician, who mocked Cadet de Vaux' pretensions to have discovered a remedy for the epidemic of cane

Fronde à la Révolution (Paris: Odile Jacob, 2005), 137-164; Spary, *Feeding France*, chs. 1-4.

⁹⁶⁶ "Chymie," *Journal de Paris*, 31 July 1778, 847; Aside from Parmentier and Baumé, on whom there is an extensive literature, biographical information about these individuals is rather sparse, but see: Paul Dorveaux, "Le Cervelet de Voltaire et les Mitouart," *Bulletin de la Société d'histoire de la pharmacie* 12 (1924): 409-421; Jean Flahaut, "Lavoisier et les pharmaciens de son temps," *Revue d'Histoire de la Pharmacie* 83 (1995): 349-360; Francis Trépardoux, "Philippe-Nicolas Pia (1721-1799), échevin de Paris, pionner du secourisme en faveur des noyés," *Revue d'Histoire de la Pharmacie* 85 (1997): 257-268.

⁹⁶⁷ Lavoisier became heavily involved in agronomy in the 1770s and 1780s, although historians of science have tended to neglect his involvement in this field in favor of his theoretical contributions to chemistry: W.A. Smeaton, "Lavoisier's Membership in the Société Royale d'Agriculture and the Comité d'Agriculture," *Annals of Science* 12, no. 4 (1956): 267-277; Arthur Donovan, *Antoine Lavoisier, Science, Administration and Revolution* (Oxford: Blackwell, 1993), ch. 8; Jean-Pierre Poirier, *Lavoisier: Chemist, Biologist, Economist* (Philadelphia: University of Pennsylvania Press, 1993), ch.12.

ants in Martinique.⁹⁶⁸ Le Franc questioned the utility of these experiments by pointing out that phenomena produced within the controlled environment of the laboratory could not be so easily reproduced *in situ*, on plantations ravaged by cane-ants:

The high consideration that M. Cadet le Jeune enjoys, has no doubt been increased by his fortuitous idea to neutralize the acids of ants with volatile alkalis ... the eagerness with which he sought to reap this sweet reward and high praise led him to hurriedly publish the results of an experiment that succeeded in his laboratory; but for which the application ... is a cruel embarrassment to those concerned with the destruction of ants. It is natural to imagine that M. Cadet will need more than Mrs. Mitouart, de Machy, Pia, Bayen, Parmentier and Deyeux as associates; he will also need a good number of workmen to build cucurbits large enough to attack the inner composition of more than an half ounce of ants; without a cucurbit, farewell to M. Cadet's theory! He will need people to collect daily and for months on end the ants of a ravaged canton and bring them into the giant cucurbit that will have been built.⁹⁶⁹

Le Franc continued by ridiculing more generally the futile projects of philanthropic chemists, who "dazzled by chimerical novelties," offered to the public "supposed

⁹⁶⁸ Le Franc does not appear in the *Almanach Royal* under the list of physicians licensed by the Faculty of Medicine to practice within the city of Paris.

⁹⁶⁹ Le Franc, "Lettre envoyée aux Auteurs du Journal de Paris, qu'ils n'ont pas jugé à propos d'y insérer," *Mercur de France* (5 September 1778), 70. [La haute considération dont jouit M. Cadet le jeune a sans doute été bien augmentée par l'heureuse idée de neutraliser l'acide des fourmis par l'alkali volatil. Le plaisir d'avoir découvert que l'alkali volatil pourrait attaquer la composition intime de la fourmi, lui enlever le principe le plus essentiel à sa constitution et conséquemment le faire perir. L'empressement qu'il a eu de jouir de cette douce récompense de cette haute considération l'a déterminé à publier précipitamment une expérience qui a réussi dans son laboratoire; mais dont l'application dans les lieux où cet insecte dévore les animaux, les jeunes quadrupedes, les enfans, embarasse cruellement ceux que la destruction des fourmis intéresse. Il est naturel d'imaginer, d'après cette experience, qu'il faudra à M. Cadet d'autres associés que Mrs. Mitouart, de Machy Pia, Bayen, Parmentier et Deyeux il aura besoin d'un bon nombre d'ouvriers pour fabriquer des curcubites assez grandes pour attaquer la composition de plus une demi-once de fourmis, car sans curcubite, adieu la confirmation de la théorie de M. Cadet. Il lui faudra des gens à la journée et même au mois pour ramasser les fourmis du canton ravage, et les porter dans la curcubite enorme qu'on aura construit]

discoveries, that are all the more ridiculous because they possess no actual utility."⁹⁷⁰ What was most worrisome was that these men had the ear of the royal administration, as Le Franc underlined when he bemoaned that Cadet de Vaux's experiments would "infallibly be presented to the government, if they have not been already."⁹⁷¹ His letter highlights at once the success with which chemical practitioners were beginning to fashion themselves as experts in matters of public oeconomy, while also pointing to the limitations of their credibility outside of administrative circles. Ultimately, Le Franc concluded, the government and the public would derive nothing more from these experiments than an "abundant smoke, neutralized and incoercible, arising from a cucurbit."⁹⁷²

The two men exchanged barbs in successive editions of the *Journal de Paris* and the *Mercure de France*, with Cadet reprimanding Le Franc for having violated the rules of civility that sustained polite discourse between "those who cultivate the sciences, at least with honor."⁹⁷³ Cadet recast Le Franc's personal attack as an affront to the entire Parisian chemical community, who had encouraged him to carry out and publish the results of his "ridiculous experiments." Contrasting the relative anonymity of his assailant with the authority of the "most recommendable and enlightened chemists," Cadet wrote

⁹⁷⁰ Le Franc, "Lettre envoyée aux Auteurs du Journal de Paris, qu'ils n'ont pas jugé à propos d'y insérer," *Mercure de France* (5 September 1778), 70.

⁹⁷¹ Le Franc, "Lettre envoyée aux Auteurs du Journal de Paris, qu'ils n'ont pas jugé à propos d'y insérer," *Mercure de France* (5 September 1778), 71.

⁹⁷² Le Franc, "Lettre envoyée aux Auteurs du Journal de Paris, qu'ils n'ont pas jugé à propos d'y insérer," *Mercure de France* (5 September 1778), 71.

⁹⁷³ Marque, "Réponse à la lettre de M. Le Franc inserée dans le Mercure dernier," *Journal de Paris* (12 September 1778).

that Le Franc's vituperations were an affront to the honor of all those who "seek to be useful to society and deserve the esteem and consideration of all honest men."⁹⁷⁴ Evidently seeking to defuse the controversy and to place its support behind Cadet de Vaux (who wondered aloud why the chemist and editor Pierre-Joseph Macquer (1718-1784) had allowed such an ignominious letter to be published under his auspices) the editors of the *Mercure de France* published a letter from a Lorraine physician and member of the *Société Royale de Médecine* that expressed unwavering support for Cadet de Vaux's insect experiments.⁹⁷⁵ Marque, who likened Cadet's "sel antifourmineux" to the philosopher's stone, wrote that this substance would be of great benefit to "all of humanity" by providing a potential antidote to all crop eating insects and weeds that contained concentrated acids. The experiments of this "young savant" had opened a new frontier for chemical practitioners, revealing the utility that the tools and techniques of laboratory-based analytical chemistry could provide to the crucial domain of agricultural production.

From *Petite Chimie* to Industrial Chemistry (c. 1790- c.1830)

Le Franc's doubts about Parisian laboratory-based chemistry's viability as a solution to the problem of insect pests proved, in the end, to be well founded. In the Revolutionary and post-Revolutionary periods, the search for insecticides turned from the

⁹⁷⁴ Marque, "Réponse à la lettre de M. Le Franc inserée dans le Mercure dernier," *Journal de Paris* (12 September 1778); See Le Franc's response: Le Franc, "Sur les Fourmis. Réponse de M. Le Franc à M. Cadet le Jeune," *Mercure de France* (5 September 1778): 69-71.

⁹⁷⁵ "Lettre de M. de Marque, Docteur en Médecine, et de la Société Royale de Médecine; aux auteurs du Journal de Paris," *Mercure de France* (12 September 1778): 186-190.

alembics and cucurbits of the chemical laboratory to the condensers and chimneystacks of France's rapidly industrializing urban and peri-urban landscapes. The takeoff of the chemical industries in France from the 1790s onwards produced a plethora of new substances into the environment that came to be identified by chemical practitioners, manufacturing inspectors and administrators as potentially useful for their insecticidal properties.⁹⁷⁶ In the context of increasing public concern about the noxious environmental and health effects of industrial development, the recycling of industrial waste and emissions into substances that could be useful to agricultural production provided a way of acculturating French society to the process of industrialization.⁹⁷⁷ Chemical practitioners who proposed to redeploy industrial excesses such as muriatic acid and copper sulfate into fertilizers, fungicides and insecticides not only sought to provide technical solutions to the persisting problems of food security, they also sought to resolve

⁹⁷⁶ On the development of the chemical industries in France, see: Maurice Daumas, "La montée de la grande industrie chimique," in *Histoire générale des techniques*, (Paris: P.U.F, 1968) 3: 616-645; John Graham Smith, *The Origins and Early Development of the Heavy Chemical Industry in France* (Oxford: Oxford University Press, 1979); Jean Dhombres, *Naissance d'un nouveau pouvoir: sciences et savants en France, 1793-1824* (Paris: Payot, 1989), 783-794; André Guillerme, *La naissance de l'industrie à Paris: entre sueurs et vapeurs 1780-1830* (Seyssell: Champs Vallon, 2007).

⁹⁷⁷ On the politics of industrial pollution and its management see: Pierre-Claude Reynard, "Public Order and Privilege: Eighteenth-Century French Roots of Environmental Regulation," *Technology and Culture* 43, no. 1 (January 2002): 1-28; J-B Fressoz, "Circonvenir les circumfusa. La chimie, l'hygiénisme et la libéralisation des 'choses environnantes,' France, 1750-1850," *Revue d'Histoire Moderne et Contemporaine* 56, no. 4 (2009): 39-76; Thomas Leroux, *Le laboratoire des pollutions industrielles, Paris 1770-1830* (Paris: Albin Michel, 2011).

long-standing tensions between the seemingly incompatible domains of industrial and agricultural production.⁹⁷⁸

On July 4th 1791, the Société Royale d'Agriculture read a report from Pajot des Charmes, a manufacturing inspector from Abbéville in the Somme department, on the agricultural uses of wastewater from bleach factories.⁹⁷⁹ Pajot des Charmes had experimented with the effects of this wastewater in his garden, and found that it accelerated and enhanced the vegetation of all sorts of plants and vegetables. The cauliflower, cabbage, chervil, leeks and peas doused with this liquid were double the size of those irrigated with regular water, and of a greener complexion. Moreover, the wastewater had proven to be extremely effective in exterminating spiders, ants, worms, slugs and other kinds of harmful insects that infested his garden. Pajot des Charmes reported that the vermin that had previously attacked the seeds, shoots and leaves of the vegetables in his kitchen-garden were immediately ejected from their hiding-places when this substance was poured on the surface of the soil. As word spread in Abbéville about Pajot des Charmes' experiments, gardeners lined up at his private laboratory to acquire

⁹⁷⁸ On the recycling of waste in eighteenth and nineteenth century France, see: Sabine Barles, *L'invention des déchets urbains: France 1790-1970* (Seysse: Champs Vallon, 2005); Similar project to integrate rural and urban cycles of production were also prevalent during the same period in the Low Countries: Joppe van Driel, "Ashes to Ashes: the stewardship of waste and economic cycles of agricultural and industrial improvement, 1750-1800," *History and Technology* 30, no. 3 (2014): 177-206; Joppe van Driel and Lissa Roberts, "Circulating Salts: Chemical Governance and the Bifurcation of Nature and Society," *Eighteenth-Century Studies* 49, no. 2 (2016): 233-263.

⁹⁷⁹ Before the Revolution, Pajot de he authored of several reports on the work-related illnesses of artisans: "Pajot de Charmes, Inspecteur des manufactures de draps à Abbéville," 174, dossier 30 no 1 à 21, Archives de la Société Royale de Médecine, BANM; Pajot de Charmes, "Observations sur quelques propriétés que présentent par rapport à l'agriculture les eaux usées des immersions dans le blanchiment des toiles et fils par l'acide marin déphlogistiqué," 4 Juillet 1791, pièce 172, F/10/222, ANF, Paris.

this substance. When reports from local gardeners proved to be resoundingly favorable, Pajot de Charmes suggested that the wastewater from bleach factories ought to be collected throughout the nation, stored and recycled to irrigate fields on a larger scale.

Pajot des Charmes continued to promote the agricultural virtues of used bleach-water through the Revolutionary period. In his *Traité sur l'Art du Blanchiment des Toiles* (1798), he proposed a number of uses for the chemical residues and wastewater produced by bleach factories, and again outlined its potential use as a fertilizer and insecticide.⁹⁸⁰ The fertilizing and insecticide properties of used bleach water, he wrote, could be attributed to potassium chloride (“*muriate de potasse*”), an alkaline “salt” that formed from the combination of potassium carbonate with chlorine (or oxygenated muriatic acid) exhausted of its oxygen. By dissolving the residues of used bleach water with potassium carbonate, and by filtering and evaporating the liquid, this “fixed alkaline salt” could also be obtained in a desiccated state.⁹⁸¹ Reports of muriatic acid and oxygenated muriatic acid’s utility as fertilizing and insecticide agents were widely disseminated in the technical periodical press that flourished in the opening decades of the nineteenth century.⁹⁸² In 1809, the *Société d'encouragement pour l'industrie nationale* reported that a prefect in Réole in the Gironde department had successfully preserved the city's stored

⁹⁸⁰ Pajot des Charmes, *L'art du blanchiment des toiles, fils et cotons de tout genres* (Paris: Dugour and Durand, 1797).

⁹⁸¹ The process is described in further detail in: “Du muriate de chaux, comme engrais,” *Annales des Sciences Économiques*, 367; Anselm Payen, “Procédé pour fabriquer le muriate de chaux,” *Archives des découvertes et inventions nouvelles* (Paris: Treuttel et Würtz, 1824), 370-371.

⁹⁸² Patrice Bret, Konstantinos Chatzis, Liliane Pérez (eds) *La presse et les périodiques techniques en Europe: 1750-1950* (Paris: L'Harmattan, 2008); Valérie Tesnière and Corinne Bouquin, “Une morphologie de la circulation des savoirs de la revue depuis 1800,” *Revue de Synthèse* 135, no. 2-3 (2014): 175-202.

grain and flour from insects with fumigations of oxygenated muriatic acid.⁹⁸³ During the Restoration period, the *Journal de Pharmacie*, the *Société Philomatique de Paris* and the *Annales de l'Agriculture Française* covered the experiments of the Parisian pharmacist-chemists Jean-Baptiste-Alphonse Chevallier (1793-1879), François Cartier, and the Rouen pharmacist Guillaume Dubuc who combined muriatic acid with limestone to create a highly effective fertilizer, calcium chloride.⁹⁸⁴ Reporting on these experiments, and reminding its readers of Pajot Descharmes' priority in the matter, the editors of the *Annales des Sciences Économiques et des Finances* hoped that its readership would "profit from these useful lessons, as economic as they are productive."⁹⁸⁵

Dephlogisticated or oxygenated muriatic acid (re-named chlorine by Humphry Davy (1778-1829) in 1810) was one of the chemical wonders of the late eighteenth century. First produced as a gas in 1774 by the Swedish chemist Carl Wilhelm Scheele (1742-1786) through the combination of magnesium and hydrochloric acid, it was rendered into an aqueous state by the chemist Claude-Louis Berthollet (1748-1822), who

⁹⁸³ *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* (Paris: Madame Huzard, 1809), 42.

⁹⁸⁴ Lemaire Lisancourt "Note sur le muriate de chaux employé comme engrais." *Bulletin des sciences par la société philomatique de Paris* (Paris: Plassan, 1822), 85-86; "Correspondance à Messieurs les rédacteurs du Journal de Pharmacie," *Journal de pharmacie et des sciences accessoires* (Paris: Colas, 1823), 276; Louis-Augustin Bosc d'Antic, "Rapport fait par M. Bosc à la société royale et centrale d'agriculture sur l'emploi du muriate de chaux ou chlorure de chaux en agriculture," *Annales de l'Agriculture Française, contenant des observations et des mémoires sur toutes les parties de l'agriculture* (Paris: Huzard, 1824), 327-334.

⁹⁸⁵ "Annonces de Muriate de Chaux, Comme Engrais," *Annales des Sciences Économiques*, 367.

immediately recognized its utility for the bleaching industry.⁹⁸⁶ By 1800, there were fifty *blanchisseries berthollienes* in France, and four hundred by 1817.⁹⁸⁷ Oxygenated muriatic acid was subsequently introduced in the papermaking industry at the suggestion of the chemist, industrialist and future minister of the interior, Jean-Antoine Chaptal (1756-1832).⁹⁸⁸ The substance also attracted attention as an effective instrument of *salubrité publique* thanks to the chemist Louis-Bernard Guyton Guyton de Morveau (1737-1816).⁹⁸⁹ Physicians in the Revolutionary period advocated its use for liberating insalubrious spaces like cemeteries, hospitals, prisons, ships and army camps from harmful miasmas and vermin.⁹⁹⁰ During the Napoleonic campaign in Poland, the physician François Collette de Chamseru reported that fumigations of oxygenated muriatic acid had completely extirpated the flies and bedbugs that infested the beds of the

⁹⁸⁶ Michelle Sadoun-Goupil, "Science pure et appliquée dans l'oeuvre de Claude-Louis Berthollet," *Revue d'Histoire des Sciences* 27, no. 2 (April 1974): 127-145; John Smith Graham, *The Origins and Early Development of the Heavy Chemical Industry in France* (Oxford: Oxford University Press, 1979), ch.3; Bruno Belhoste, *Paris savant: parcours et rencontres au temps des lumières* (Paris: Armand Colin, 2012), 171-174.

⁹⁸⁷ Guillerme, *Naissance de l'Industrie*, 366.

⁹⁸⁸ Jean-Antoine Chaptal, "Observations sur l'acide muriatique oxygéné," *Mémoires de l'Académie des Sciences de Paris* (Paris: Panckoucke, 1787), 611; Jean-Antoine Chaptal, *De l'industrie française* (Paris: Renouard, 1819) 1: 43-44.

⁹⁸⁹ Thomas Le Roux, "Du bienfait des acides. Guyton de Morveau et le grand basculement de l'expertise sanitaire et environnementale (1775-1809)," *Archives historiques de la Révolution Française* 383, no. 1 (2016): 153-175.

⁹⁹⁰ See the endorsement from the Collège de Pharmacie in the Revolutionary period: "Note sur le gas muriatique," Registre 54, Pièce 12, Bibliothèque Interuniversitaire de Pharmacie, Paris; Alphonse Chevallier, *L'art de préparer les chlorures de chaux, de soude et de potasse* (Paris: Béchet jeune, 1829), 293-326 .

army hospital and the clothing of French troops.⁹⁹¹ Parmentier, who had tested the effects of chemical fumigants on bedbugs as the apothecary-major at the Hôpital des Invalides in the early 1770s, also acclaimed the gas as a highly effective insecticide and disinfectant in his *Code Pharmaceutique des hospices civils* (1811).⁹⁹²

The rise of oxygenated muriatic acid as an important aid to industry and *salubrité* was itself the result of the rapid development of the artificial soda industry in the final decades of the eighteenth century. Muriatic or hydrochloric acid was an important byproduct in the process developed by the chemist Nicolas Leblanc (1742-1806) for producing artificial soda through the combination of sulfuric acid and sea salt. Despite the many uses found for hydrochloric acid between 1790 and 1820, namely in its conversion into chlorine for industrial and sanitary purposes, soda manufacturers produced such great quantities in this period that the excess could not be fully absorbed. In his survey of the progress of the chemical arts in France, Chaptal remarked that muriatic acid, a previously expensive and rare substance produced solely by chemists in the laboratory, was now produced in such great quantities that "it is impossible to employ it in its totality."⁹⁹³ In 1809, the *Société d'Encouragement pour l'Industrie Nationale* offered a prize to find a use for the "overabundant provisions" of muriatic acid produced

⁹⁹¹ "Lettre de M. Chamseru à M. Guyton, sur l'usage des fumigations dans les hôpitaux de l'armée," *Annales de Chimie* (November 1807), 179.

⁹⁹² "Observations sur la lettre de M. Masuyer, médecin concernant les fumigations du gaz acide muriatique oxigéné," *Annales de Chimie* 64 (Octobre 1807), 268; Antoine-Augustin Parmentier, *Code Pharmaceutique à l'usage des hospices civils, des secours à domicile, et des infirmeries des maisons d'arrêt* (Paris: Méquigno, 1811).

⁹⁹³ Chaptal, *De l'Industrie Française* 1: 65.

by newly established soda factories.⁹⁹⁴ Two years later the editors of the *Bulletin* regrettably announced that no submission had been judged worthy of the prize, and hoped in particular that a technique would soon be developed to make muriatic acid "useful to agriculture."⁹⁹⁵

The significant quantities of industrial waste produced by the rapidly developing French chemical industries became a pressing administrative problem for French statesmen and scientists at the beginning of the nineteenth century.⁹⁹⁶ The need to feed a growing urban population by improving agricultural yields also arose in this period as a corollary problem of industrialization.⁹⁹⁷ The recycling of chemical waste into substances useful to agriculture was envisioned a solution to both problems. Reminding their readers of Pajot Descharmes' agricultural experiments with oxygenated muriatic acid two decades earlier, the editors of the *Nouveau Cours complet d'agriculture théorique et pratique* (1821) regretted that the used water from bleach factories was still being discarded, "in pure waste," despite its proven utility as a fertilizing and insecticidal agent.⁹⁹⁸ The time was ripe for Pajot des Charmes to dust off his proposals to make this

⁹⁹⁴ "Prix pour l'emploi le plus avantageux de l'acide muriatique et du muriate de chaux," *Bulletin de la société d'encouragement pour l'industrie nationale* 10 (Paris: Huzard, 1810), 215-217.

⁹⁹⁵ "Prix pour l'emploi," 217.

⁹⁹⁶ André Guillerme, Gérard Jigaudon, and Anne Cécile Lefort (eds.), *Dangereux, insalubres et incommodes: pasyages industries en banlieue parisienne, XIXe-XXe* (Seysse: Champs Vallon, 2004).

⁹⁹⁷ Sabine Barles, *L'invention des déchets urbains*, 19-20.

⁹⁹⁸ "Acide muriatique," *Nouveau Cours complet d'agriculture théorique et pratique concernant la grande et petite culture* (Paris: Deterville, 1821), 1: 113.

industrial byproduct a useful accessory to agriculture.⁹⁹⁹ In a 1824 issue of the *Annales de l'Industrie Nationale et Étrangère*, one of the leading technical periodicals of the Restoration period, Pajot des Charmes described how the liquid waste of soda and bleach factories could be productively recycled to make calcium chloride.¹⁰⁰⁰ Farmers could easily obtain excess muriatic acid, the principal substance needed to make the "new fertilizer," from soda factories near Marseille, Rouen and Paris, from the ubiquitous *blanchisseries bertholiennes*, or from distillers of aqua fortis. The acid could then be poured in large cisterns containing limestone, until the saturation point had been reached. Fitting these cisterns with irrigation hoses, farmers could easily fertilize their fields with the resulting calcium chloride that cost five to six times less than manure. Alternatively, chemical manufacturers could themselves "speculate" on calcium chloride, and draw profits by transforming their waste into the products of an accessory industry.

Pajot des Charmes also subsequently proposed a method for recycling the airborne emissions of muriatic acid.¹⁰⁰¹ The exhalations of gaseous muriatic acid from artificial soda factories were the source of endless complaints and litigation from farmers

⁹⁹⁹ Natalie Jas remarks that in the 1820s a "veritable hunt for fertilizers," was organized in France: Natalie Jas, *Au carrefour de la chimie et de l'agriculture: les sciences agronomiques en France et en Allemagne 1850-1914* (Paris: Éditions des Archives Contemporaines, 2000), 59.

¹⁰⁰⁰ Pajot de Charmes, "Sur la Fabrication du muriate de chaux, considéré comme engrais," *Annales de l'Industrie Nationale et Étrangère ou Mercure Technologique* (Paris: Bachelier, 1824), 113-131; On the *Annales* see: Joost Mertens, "The *Annales de l'Industrie* (1820-1827): A Technological Laboratory for the Industrial Modernization of France," *History and Technology: An International Journal* 20, no. 2 (June 2004): 135-163.

¹⁰⁰¹ Pajot des Charmes, "Sur les moyens de remédier aux inconvénients occasionés par les vapeurs ou gaz délétères, qui s'élèvent des fabriques de soude artificielle," *Annales de l'Industrie Nationale et Étrangère* 21 (1826), 296.

and property owners in the opening decades of the nineteenth century, and solutions for containing this airborne pollution were avidly sought by administrators and technical experts.¹⁰⁰² For Pajot des Charmes, the release of these emissions in the atmosphere was doubly harmful as it amounted to a "pure waste" of a substance that could productively contribute to the "prosperity of agriculture."¹⁰⁰³ When the *Société des amis des sciences, des lettres de l'agriculture et des arts* of Aix-en-Provence held an essay contest in 1824 on the "means to remedy the inconveniences causes by the vapors or injurious gases that are emitted by producers of caustic soda," Pajot des Charmes proposed that condensers ought to be installed in the chimney stacks of soda factories so that that gaseous muriatic acid could be coerced and rendered into a liquid state. Instead of acting as a detriment to agricultural production soda manufacturers could thus recycle the noxious emissions of their factories to produce a "salt" that was "destined to cause a revolution in agriculture."¹⁰⁰⁴ By collecting this liquid in reservoirs lined with limestone, and retailing the resulting calcium chloride to farmers, manufacturers could profit from this "accessory industry," all while providing a "spur to the first of all arts, agriculture." In this way,

¹⁰⁰² On attempts to regulation the airborne emissions of soda factories see: Gilles Denis, "Normandie, 1768-1771: une controverse sur la soude," in *La terre outragée: les experts sont formels!*, eds. Jacques Theys and Bernard Kalaora (Paris: Diderot, 1998), 130-137; André Guillerme, *La naissance de l'industrie*, 245-247; Leroux, *Le laboratoire des pollutions*, 251, 274-283.

¹⁰⁰³ Pajot de Charmes, "Sur la Fabrication du muriate de chaux," 126; On the development of the soda industry in France see: Anne-Claire Déré, "Naissance de l'industrie chimique: la soude factice et ses dérivés," in *La Bretagne des savants et des ingénieurs 1750-1825*, ed. Jean Dhombres (Rennes: Éditions Ouest-France, 1991): 186-201; On the regulation of pollution from soda factories see: André Guillerme, *La naissance de l'industrie à Paris*, 245-247; Leroux, *Le laboratoire des pollutions*, 251, 274-283.

¹⁰⁰⁴ Pajot des Charmes, "Sur les moyens de remédier," 296

industry and agriculture could feed off each other in a positive, mutually reinforcing cycle of improvement.

The metal industries also yielded insecticidal "salts" that began to be routinely employed by farmers and grain merchants in the opening decades of the nineteenth century. During the Napoleonic period, the agricultural improver-cum-chemist Bénédict Prevost demonstrated through well-publicized experiments on his estate in Montauban that copper sulfate was an effective fungicide that could exterminate smut spores and disinfect the seeds of cereal crops. Reports that this "poisonous salt" [*sel vénéneux*] could also make wheat resistant to the attacks of insects subsequently contributed to its widespread use in the washing and preservation of stored wheat.¹⁰⁰⁵ The rapid adoption of copper sulfate in the domain of cereal production and conservation was a result not only of its potency as a fungicide and insecticide but also, as Prevost pointed out, of its cheapness and widespread availability. Copper sulfate was an important byproduct of the metal refining industries, a "salt" formed by the combination of sulfuric acid and silver, gold and copper.¹⁰⁰⁶ When Prevost encouraged his readers to employ copper sulfate obtained from nearby factories, in order to "extirpate the germ of infection from the soil of the empire," he was thus demonstrating how industrial production and its excesses could be harnessed in service of agricultural improvement and imperial regeneration.¹⁰⁰⁷

¹⁰⁰⁵ "Sels considérés comme engrais," *Dictionnaire technologique ou nouveau dictionnaire universel des arts et métiers et de l'économie* (Paris: Thomine) 8: 132.

¹⁰⁰⁶ "Sulfate de cuivre," *Encyclopédie du commerçant. Dictionnaire du commerce et des marchandises*. Paris: Imprimerie de Bourgogne, 1839), 211; Guillerme, *Naissance de d'Industrie à Paris*, 255.

¹⁰⁰⁷ Bénédict Prevost, *Mémoire sur la cause immédiate de la carie ou charbon de blé* (Paris: Bernard, 1807), 54-75.

The idea of using copper sulfate or *vitriol bleu* as an insecticide and conservation agent, it should be pointed out, was not a novelty of the nineteenth century. When, in 1757, the chemist and advisor to the Bureau de Commerce Jean-Hellot (1685-1766) judged the manufacturer Étienne de Lyon's proposal to establish a factory for producing blue vitriol "trivial," the latter responded by pointing to its use for preserving stored grain from insects and other nuisances.¹⁰⁰⁸ The agronomist Alexandre-Henri Tessier (1741-1837) tested the substance in his experiments on wheat smut at the King's estates in Rambouillet in the 1780s. Yet it was only with the rapid development of metal refining industries from the 1790s onwards that the substance came to enter cycles of industrial and agricultural improvement in a significant manner.¹⁰⁰⁹ Far from being considered a "trivial" substance at the beginning of the nineteenth-century, blue vitriol became vital to the industrial production of commodities such as ink, dyed silk and wool. By the 1840s, copper sulfate had become a substance of general use for farmers throughout the country, becoming the subject of a specialized trade. At the same time, questions about the safety of the substance for consumers were beginning to be raised by physicians and public health experts, echoing concerns earlier in the century from the editors of the *Nouveau Dictionnaire d'Histoire Naturelle*, that substance was "a poison, to which we must only have recourse in the case of extreme need."¹⁰¹⁰

Conclusion

¹⁰⁰⁸ "Étienne de Lyon à Hellot," 1757, F/12/1506, ANF, Paris.

¹⁰⁰⁹ On the metal industries see: Anne-Françoise Garçon *Mines et Metal: 1780-1880. Les non-ferreux et l'industrialisation* (Rennes: Presses Universitaires de Rennes, 1998).

¹⁰¹⁰ *Nouveau Dictionnaire d'Histoire Naturelle* (Paris: Deterville, 1817), 486.

The case of muriatic acid and copper sulfate illustrates how tightening links were being formed between chemistry, agriculture and industry in the opening decades of the nineteenth century in France. While chemical practitioners like Cadet de Vaux had begun to demonstrate an interest in developing mineral-based insecticides as early as the 1770s, the takeoff of the chemical industries in the 1790s made such products a truly viable solution to the problem of vermin and insect pests. Largely overlooked by historians, projects to recycle toxic emissions and industrial waste were meant to make industrialization not only more tolerable, but positively beneficial for the agricultural prosperity of the French state. In the hands of industrial chemists like Pajot des Charmes, and of agricultural improvers like Bénédict Prévost, the superfluities of the new chemical industries were transmuted from waste into gold. In the opening decades of the nineteenth century, industrial chemistry had thus emerged alongside the *petite chimie* of urban artisans, gardeners, apothecaries and druggists as a potent weapon in the war against harmful insects.

The aim of this chapter has been to show how chemical experts became important actors in the search for solutions to the problem of insect pests from the 1770s onwards. In the final decades of the Ancien Régime, the commercial ambitions of artisanal-based chemical practitioners ran up against the regulatory ambitions of self-styled chemical experts who acted as advisors to the royal administration on matters of subsistence and public health. As regulators of a burgeoning commercial trade in insecticidal remedies, chemical practitioners came to carve out a role for themselves as safeguards against the charlatanism that purportedly reigned in the marketplace and in the world of print. In the Revolutionary, Napoleonic and Restoration periods, chemical

practitioners working at the intersection of the seemingly disparate fields of medicine, agronomy and industrial manufacturing began to envision productive cycles of material use, re-use and circulation between these domains. It was thus in this period, before the development of the insecticide industries at the end of the nineteenth and early twentieth centuries that chemistry emerged as an essential tool of governance: a set of techniques for managing people, disruptive bits of nature and the environments within which they co-existed.

Conclusion: Living With Insects after 1850

Taken together, the case studies of this dissertation have charted Enlightenment-era administrators', naturalists' and agricultural improvers' increasing interest in insects, and the techniques they developed to assert a greater degree of control over the insect kingdom. The growing visibility of pests and useful insects in the paperwork of state administrators, and in the solicitations of agricultural improvers and patriotic naturalists seems to point towards the development of a new Enlightenment ethos of biological control and domination. It would be tempting to view this new and intensive preoccupation with insects as the symptom of the development of "instrumental rationality," an imperious desire to dominate and exploit Nature through rational means that supposedly developed during the Enlightenment.¹⁰¹¹ Certainly, the fantasy of completely extirpating insect pests from the face of the earth (of the "annihilation of the race" of insect pests as Duhamel du Monceau put it), or of using human art to maximize the productive potential of insects beyond what Nature alone would allow, occasionally transpires through the writings of the eighteenth-century actors studied in this dissertation.

Yet, as I have shown throughout this dissertation, contemporaries were highly sensitive to the limitations of human knowledge as it pertained to insects. The natural theological vision of Nature as infinitely productive, providentially self-regulating, and accessible to human reason, more often than not gave way to a less optimistic recognition that Nature behaved in unpredictable ways and that the operations of the Divine Hand were opaque to human observers. The elusive physiological operations of silkworms, the

¹⁰¹¹ On this theme, see: Max Theodor W. Adorno and Max Horkheimer, *Dialectic of Enlightenment* (London: Verso, 1997 [1944]).

sudden disappearance of previously abundant useful insects from socio-natural environments, and the unpredictable disruptions and disorders in the purportedly self-regulating oecology of nature, all pointed to the inscrutability of Creation. This, however, did not deter contemporaries from attempting to coerce insects into projects for improving nature and society. Indeed, over the course of the eighteenth century, as insect pests were transformed from providential instruments of divine vengeance into desacralized biological entities, the resolve to manage insects, to limit their damage and exploit their productive potential, grew in intensity. For, if insects had previously been seen as knowable but unmanageable instruments of Divine Will, the turn towards an examination of the efficient, social causes of their proliferation and spread led to attempts to more strictly regulate human-insect relationships.

Behind the various techniques devised in the eighteenth and early nineteenth century to properly manage insect populations – from the political regulation of commercial exchanges that threatened to disperse harmful biota, to the development of institutional and private correspondence networks for exchanging knowledge and specimens, the creation of a universal language that could facilitate communication at a distance, and the re-imagining of potentially productive relationships between rural and urban cycles of production – lay new strategies of socio-epistemic and socio-political organization. James E. McWilliams has argued that eighteenth-century techniques of pest control were local, decentralized, pragmatic, and haphazardly devised through the "chaos of experimentation."¹⁰¹² While this characterization may perhaps hold true for early American techniques of pest control, it does not accurately describe the case of

¹⁰¹² McWilliams, *American Pests*, 46.

Enlightenment France and its colonies, where solutions to the problem of insect pests, and projects to exploit the productive potential of insects, often involved the carefully planned movement across great distances, between the metropole and the colonies, between naturalists and chemists in Paris and farmers throughout France and its colonies, of knowledge, materials, and specimens.

The history of insect-human relations in the nineteenth and twentieth centuries presents ruptures and continuities with the preceding period. In the second half of the nineteenth century, entomology became a professional discipline, and the relationship between scientific experts and the state were formalized and institutionalized across Europe and North America. The science of insects was no longer derided as it had been in the previous century, as the professional entomologist came to be seen as a scientific expert whose knowledge was vital to the prosperity of nation states and empires.¹⁰¹³ Certainly, self-trained "amateurs" (who can be seen as heirs to Duhamel du Monceau's philosopher-citizens) continued to make contributions to the development of entomology, but they became more marginal and subordinate to the professionals who dominated the field.¹⁰¹⁴ The professionalization and institutionalization of entomology gave scientific

¹⁰¹³ Paolo Palladino, *Entomology, Ecology and Agriculture: The Making of Scientific Careers in North America, 1885-1985* (Amsterdam: Harwood Academic Publishers, 1996); Stéphane Castonguay, "Naturalizing Federalism: Insect Outbreaks and the Centralization of Entomological Research in Canada, 1884-1914," *Canadian Historical Review* 85, no. 1 (March 2014): 1-34; James E. McWilliams, *American Pests*; J.F.M. Clark, *Bugs and the Victorians*; Marina V. Loskutova, "The Rise of Applied Entomology in the Russian Empire: Governmental, Public and Academic Responses to Insect Pest Outbreaks from 1840 to 1894," in *New Perspectives on the History of Life Sciences and Agriculture*, eds. Denis Phillips and Sharon Kingsland (Imprint: Springer, 2015), 139-162.

¹⁰¹⁴ Alan I. Kaplan, "Entomological Societies," in *The Encyclopedia of Insects*, ed. Vincent H. Resh and Ring T. Cardé (San Diego: Academic Press, 2003), 324-328.

experts the power to enforce insect control practices at a national level; centralization and professionalization went hand in hand. Two techniques inherited from the eighteenth century, biological control and the spread of chemical substances, came to dominate entomologists' proposals for the eradication of insect pests, whose planetary circulation increased with the intensification of global and imperial trade.

At the end of the nineteenth century, projects to recycle waste materials into insecticides had ceded their place to the industrial production of chemical insecticides. In France, the phylloxera outbreak of the 1860s provided the occasion for testing sulfur based compounds on a wide scale.¹⁰¹⁵ In the first half of the twentieth century, chemists and entomologists began a "biological arms race" against invasive insects, by developing potent chemical substances with the aim of maximize agricultural outputs.¹⁰¹⁶ The inter- and intra-imperial spread of biological agents also became a way of re-equilibrating socio-natural environments disturbed by unintentional introductions of pests.¹⁰¹⁷ Both of these techniques of pest management, as is well known, have been decried for their devastating impact on biodiversity, on public health, and on the environment. Critique of

¹⁰¹⁵ George Gale, *Dying on the Vine: How Phylloxera Transformed Wine* (Berkeley: University of California Press, 2011).

¹⁰¹⁶ I have taken the term "biological arms race" from, James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 287.

¹⁰¹⁷ John H. Perkins and Richard Garcia, "Social and Economic Factors Affecting Research and Implementation of Biological Control," in *Handbook of Biological Control*, eds. T.S. Bellows and T.W. Fisher (San Diego: Academic Press, 1999), 993-1009; Richard C. Sawyer, *To Make a Spotless Orange: Biological Control in California* (Ames: Iowa University Press, 1996); Edward Deveson, "Parasites, Politics and Public Science: The Promotion of Biological Control in Western Australia, 1900-1910," *British Journal for the History of Science* 49, no. 2 (June 2016): 231-258.

these techniques has often been formulated in ways that recall eighteenth-century commentators' fears about the consequences of the dis-equilibrating effects of human interventions in the economy of nature. Rachel Carson (1907-1964) famously concluded *Silent Spring* (1962) by characterizing chemical insecticides as weapons that were "as crude as the caveman's club":

Through all these new, imaginative, and creative approaches to the problem of sharing our earth with other creatures there runs a constant theme, the awareness that we are dealing with life – with living populations and all their pressures and counter-pressures, their surges and recessions. Only by taking account of such life forces and by cautiously seeking to guide them into channels favorable to ourselves can we hope to achieve a reasonable accommodation between the insect hordes and ourselves ... the chemical barrage has been hurled against the fabric of life – a fabric on the one hand delicate and destructible, on the other miraculously tough and resilient, and capable of striking back in unexpected ways.¹⁰¹⁸

Carson's belief in a fragile balance of nature, amenable but unpredictably sensitive to human intervention, shows how modern ecological thinking has partial roots in eighteenth-century natural historical thinking.

Human-insect relations were also transformed by the development of chemical engineering and industrial modes of production in the nineteenth and twentieth centuries. Insect secretions like silk and cochineal were displaced by synthetic chemicals that were aggressively promoted as synthetic substitutes in the post-war period.¹⁰¹⁹ Yet increasing concerns about the toxicity of synthetic chemicals since the 1960s have led to a resurgence of interest in the industrial uses of insect secretions, and in the demand for organically produced materials. Much as eighteenth-century naturalists and agricultural

¹⁰¹⁸ Rachel Carson, *Silent Spring* (New York: First Mariner Books, 2002), 296-297.

¹⁰¹⁹ Edward D. Melillo, "Global Entomologies."

improvers encouraged their contemporaries to turn to the insect kingdom to uncover underexploited or ignored sources of wealth, political economists, scientists and engineers have recently been calling for more research in the various uses that could be made of insects for a more sustainable economy. The Food and Agricultural Organization of the United Nations has recently argued that insects and insect proteins may prove vital in the near future as global population growth and resource scarcity threaten the food supply.¹⁰²⁰ Perhaps we have ignored insects at our own peril.

¹⁰²⁰ Afton Halloran and Paul Vantomme "The contribution of insects to food security, livelihoods and the environment," *Food and Agriculture Organization of the United Nations* (April 2013): <http://www.fao.org/edible-insects/en/>

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