

“The Mediterranean Fruit Fly in the Global Arena:
Animals, Governance, and American Globalism in Early Twentieth-Century Hawai‘i”

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Dear seminar participants: What follows is version 2.0 of an essay on introduced animal species and U.S. territorial governance in early twentieth-century Hawai‘i. As I will explain on the 27th, the essay grows out of a new research project of mine on tropical agriculture and the United States’ post-1898 archipelagic empire, as well as a larger planned project on inter-imperial collusion and American empire in the pre-World War I decades. The paper still reflects its origins as a draft written for the most part directly from archival materials and other primary sources, but I have begun to incorporate more of the relevant historical context and secondary literature. I will appreciate your comments on where to take the essay from here, particularly as related to the analytical framing, along with your recommendations for further reading.

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In August 1898, the Hawai‘ian islands became part of a U.S. overseas empire following the annexation of the Republic of Hawaii, itself a creation of a coup organized against the native Hawai‘ian monarchy by the kingdom’s sugar elites, backed by U.S. military power, five years earlier. In an island economy centered around agriculture, U.S. colonial rule required not just the establishment of political authority and the ability to defend territorial claims, but the means to manage the land itself from a biological standpoint. For Hawai‘i’s territorial government, the pursuit of economic interests and the defense of a certain kind of environmental integrity in the islands required constant maintenance and oversight of ecological relationships. Such efforts embedded the Territory of Hawaii not just within the post-1898 archipelagic empire of the United States in the Caribbean and across the Pacific, but also within a global history of island colonizations and their associated environmental challenges, as well as ongoing imperial mobilizations of agricultural expertise in the first half of the twentieth century.

This essay examines the regulation of animal populations as an essential element of colonial rule in the Territory of Hawaii during the 1910s and 1920s. Efforts to contain unwanted insect populations through biological control of pests, proposals to introduce new bird species, and campaigns to exterminate marauding goats together provide opportunities to contemplate the biological dimensions of imperial power in early twentieth-century Hawai‘i. In particular, they draw attention to the inter-imperial and global contexts of species introductions and colonial governance, as well as the forms of scientific authority that emanated from agriculture and forestry bureaus to shape the biological management of empire, whether in the post-1898 insular possessions of the United States or in other imperial spaces around the world.

In the Territory of Hawaii, the Board of Commissioners of Agriculture and Forestry (BCAF) constituted the foremost government agency in charge of maintaining and defending the

islands' agriculturally based economic interests. When insect infestations threatened agricultural commodities, bird enthusiasts proposed new avian species introductions, or goats endangered forest watersheds, the board weighed in on the harsh ecological awakenings that came with humans' pursuit of irreconcilable wants and desires, and the unanticipated consequences of animals' resistance to human control. In doing so, the BCAF engaged with a broader global order of institutions, geopolitical relationships, and evolving forms of organized scientific knowledge that undergirded attempts at environmental governance.

The lay of the land: Ecological successions in Hawai'i

From a deep historical perspective, life in the Hawai'ian islands evolved as a process of biological colonization from the beginning, as barren volcanic formations gained new life forms when seeds, spores, eggs, larvae, and occasionally whole organisms hitched rides on migratory birds or flotsam on the ocean, winged species established themselves on new and rocky shores, and semi-aquatic animals found breeding sites or resting places suited to their requirements. Human arrivals from Polynesia followed, and during the era from roughly AD 1000 to AD 1400, they intentionally introduced taro, sweet potatoes, breadfruit, and other crops, along with pigs, chickens and dogs. Other species, such as rats, traveled as stowaways with their oceanfaring human counterparts. This second era of ecological succession prompted dramatic environmental transformations, including the disappearance of lowland forests and the eradication of multiple bird and plant species. Subsequent human arrivals from Europe, America, and elsewhere in the world in the late eighteenth and early nineteenth centuries were largely unconscious of such changes. They simply looked with admiration at the sophistication of Native Hawai'ian agriculture and aquaculture, as well as the islands' ideal location as a port of call, all of which

augured well for the potential of further “improvement” through colonial intervention. With Hawai‘i’s nineteenth-century integration into the global economy, through the settlement of foreign missionaries, the islands’ importance as a stopping point for whaling ships, and agricultural enterprises that included the boom and bust of the sandalwood trade and the early rise of the sugar industry, the islands entered a third stage of ecological transformation.¹

The introduction of new species, whether by accident or design, was an integral part of Hawai‘i’s new global status from the mid-nineteenth century onwards. Discomfited by lands that they perceived as animal-poor, as well as a lack of birdsong in the islands’ aural environment, European and American settlers brought in livestock animals and, in the second half of the nineteenth century, they also pushed for new bird species whether as sources of game or for purposes of beautification.² Unwanted insects that threatened agricultural endeavors sometimes came with plants, animals, and the ships that carried them, while species admitted intentionally also frequently wreaked unanticipated environmental havoc.

Traditionally, European and American settler societies assumed that invasive species were the price paid for global interchange. By the early twentieth century, however, in an era of growing expectations of governmental power and expanding bureaucratic capacity, a determination to oversee and control species introductions through inspections, quarantines, and other regulatory measures gradually replaced the old laissez-faire approach. California, other Pacific coast states, and the Kingdom of Hawai‘i all implemented plant inspection and quarantine regimes in the 1880s and 1890s, and the federal government eventually followed suit with the Plant Quarantine Act of 1912.³ With the installation of U.S. colonial rule in Hawai‘i, the territorial government’s Board of Commissioners of Agriculture and Forestry quickly established its determination to avoid or contain damage to agriculture and to the islands’ forests

by preventing the introduction of harmful species or, where necessary, implementing biological countermeasures. Biological control of insect pests, which required ambitious entomological expeditions in search of parasites from far-flung corners of the world, quickly became the territory's established method for dealing with invasive insects. Such expeditions also embedded the BCAF within a diverse set of inter-imperial relationships as it pursued the introduction of parasites to feed upon and thereby control the numbers of unwanted insect populations.

In search of biological control: The BCAF's Mediterranean fruit fly expedition of 1912-13

The board's Mediterranean fruit fly expedition of 1912-13 richly illustrates the inter-imperial dimensions of biological control, which created lavish professional opportunities for entomologists as crucial personnel within the agricultural institutions of national and colonial governments around the world. When a devastating outbreak of *Ceratitis capitata* struck the Territory of Hawaii in 1910, the BCAF and its forerunner agency already had well over a decade of experience in sponsoring efforts to find parasites that could be released in the islands to deal with various insects, such as the leaf hoppers and cane borers that threatened sugar cane in the early 1900s. In line with its existing practices, the board hired Italian entomologist Filippo Silvestri to go to west Africa in search of parasites of the Mediterranean fruit fly. More than simply the product of a lone, albeit strategically crucial, imperial outpost, the expedition took place in a context of both national and colonial governments' investments in biological control that underscored the simultaneously global and statist character of economic entomology in the early decades of the twentieth century.

Although natural history treatises identified insect parasites at least as far back as the early 17th century, the earliest attempts to deploy them systematically for horticultural purposes

did not take place until the 1840s, when a Monsieur Boisgiraud, professor of experimental philosophy at Poitiers, deliberately introduced a local ground beetle species to deal with gypsy moth caterpillars that were ravaging a stand of poplars just outside his town, as well as rove beetles to attack earwigs in his own garden. Both apparently destroyed their targets with great success, and interest in using parasitic insects for purposes of pest control gradually spread in natural history and agricultural circles.⁴ Initial experiments generally focused on introducing species available locally or regionally. By the 1870s, however, entomologists began to try introductions across longer distances, including cross continental exchanges in the United States, as well as an attempt to transfer an American mite species to France to try to counter a phylloxera blight that was plaguing the wine industry.⁵

The major breakthrough, which integrated biological control into the agricultural practices of American agricultural agencies and also established the United States as the world leader in combating invasive insects with introduced parasites, came in the late 1880s, in response to the cottony cushion scale and its threat to the nascent California citrus industry. Charles V. Riley, chief of the Bureau of Entomology at the U.S. Department of Agriculture, first expressed interest in using parasites for biological control in the early 1870s while he was Missouri State Entomologist. Attentive to insects' life cycles, he suggested an easy expedient to defend fruit trees by intervening in the life cycle of the rascal leaf-crumpler without unduly damaging the prospects of a tachinid fly that used the leaf-crumpler as its host. Simply by removing the leaf-crumpler's larval cases from tree branches in the winter and depositing them away from orchards, fruit-growers could relegate the larvae to starvation after they emerged as caterpillars in the spring, while also allowing any parasites present that were "well developed or

in the pupa state” to “mature and eventually fly off.” By doing so, Riley observed, “we swell the ranks of our friends while defeating our foes.”⁶

Riley’s interest paid enormous dividends less than two decades later, when the cottony cushion scale (*Icerya purchasi*), whose presence became noticeable in California in 1868, reached explosive proportions in the 1880s. Under Riley’s direction, USDA laboratories established in California searched for chemical means to deal with the scale, while Riley consulted with entomologists abroad to determine its life history. By the late 1880s, he had come to believe that the cottony cushion scale originated in Australia and therefore, according to entomological reasoning, useful parasites would also most likely emanate from there. Consequently, in 1888 the USDA dispatched Albert Koebele, one of the agency’s entomologists stationed in California, to Australia to search for *Icerya*’s “natural enemies.” Koebele quickly identified and shipped to California a species of ladybird, the vedalia (*Novius cardinalis*; now known as *Rodolia cardinalis*), that fed on the scale. Bred and released in California in 1889, the vedalia all but eliminated the cottony cushion scale in just a year, thereby demonstrating in terms that seemed nothing short of miraculous the potential for introduced parasites to contain unwanted insect species.⁷

The historical literature has recognized the importance of Koebele’s Australian journey to the rise of biological pest control in the United States, but not its worldwide ramifications.⁸ From the mid-nineteenth century onward, communications technology, the growing ease of travel, and the intersection of professionalized expertise and state power institutionalized scientific knowledge in ways that spurred international and inter-imperial forms of exchange and collaboration.⁹ These trends, combined with the United States’ own territorial expansion, made the U.S. administrative state not just a bureaucratic apparatus for implementing domestic policy,

but an agent of power well beyond national borders.¹⁰ In the case of agriculture, the USDA sent out California-bred vedalia not just within the United States to Florida or out to the Territory of Hawaii, but to citrus-growing regions in the Cape Colony of South Africa, Portugal, Italy, Syria, and Egypt. Vedalia thus helped to establish the global reach of the USDA, which went from being forbidden by Congress from paying for foreign travel to vigorously exchanging biological materials and sending plant explorers and other personnel abroad on a regular basis.¹¹

Cottony cushion scale proved a fortuitous test, since more complex ecological circumstances surrounding subsequent parasite introductions usually meant far less immediate and successful results, and the difficulties involved ultimately led Riley's successor at the Bureau of Entomology, Leland O. Howard, to prioritize chemical methods over biological control.¹² Howard conceded, however, the virtues of introduced parasites in island habitats such as Hawai'i, where researchers as early as the late 1890s argued that the relative paucity of species created highly favorable conditions for new arrivals. As the Hawai'i-based naturalist Robert C. L. Perkins put it in 1897, "The remote position of the islands, and the consequently limited fauna, giving free scope for increase to new arrivals, the general absence of creatures injurious to the introduced beneficial species, and the equability of the climate, allowing of almost continual breeding, may well afford results which could hardly be attained elsewhere on the globe." After the success of vedalia, both California and Hawaii remained dedicated to biological control through introduced parasites, and successful efforts in the 1900s to deal with the sugar cane leafhopper and the sugar cane borer sealed the BCAF's devotion to entomological expeditions as a basis of pest control.¹³ In addition, scientific communications combined with the movement of entomologists between California and Hawaii tied both locales to each other and to a broader trans-Pacific nexus of economic entomology. When Koebele left the USDA's employ for a

higher salary in the agricultural bureaucracy of the newly formed Republic of Hawaii in the fall of 1893, he was one of several prominent agricultural experts who left California for Hawai‘i at the turn of the century.¹⁴ Moreover, Australia’s role as the origin or transfer point of so many invasive insect species in California and Hawaii—including cottony cushion scale, an olive scalebug known as *Lecanium oleae*, and the sugarcane leafhopper *Perkinsella saccharicida*—signified not just the movement of insect species, but also the transportation infrastructure and economic relationships, ecological commonalities, and concomitant scientific connections that bound distant places across the Pacific together in intricate networks of trade, politics, and exchanges of knowledge exchange.

In light of these circumstances, when the Mediterranean fruit fly ravaged the Hawai‘ian Islands in the early 1910s, territorial officials hoped biological control methods would turn the tide. Unconstrained by the lack of natural predators in the region or the potential for freezing temperatures, the voracious fruit flies, which fed on “practically every fruit crop of value to man,” decimated local fruit production in Hawai‘i.¹⁵ *Ceratitis capitata* arrived in the islands despite strict prohibitions on imported fruit, most likely on ships from Australia that were transporting fruit to Canada.¹⁶ David T. Fullaway, an entomologist employed by the U.S. Department of Agriculture’s experiment station on the outskirts of Honolulu, first detected an adult specimen of the fly in June 1910, which suggested that *C. capitata* had begun to establish itself in the islands two to three years earlier. By 1912, it had spread to Kaua‘i, Moloka‘i, Maui, and the “Big Island” of Hawai‘i, and it threatened not just local fruit production, but hopes to develop mainland markets for fresh tropical fruit from the islands. California officials immediately ramped up inspection regimes and quarantine procedures to protect their own state’s agricultural interests, and federal agricultural experts, under the newly established authority of the Plant Quarantine

Act of 1912, also moved to keep the Mediterranean fruit fly out of North America. Territorial, state, and federal agricultural officials eventually determined that pineapples and properly packed green bananas could still ship safely, but otherwise, the Mediterranean fruit fly ruined aspirations to develop a vigorous trade in fresh tropical fruit out of Hawai‘i.¹⁷

The Territory of Hawaii was just the latest habitat claimed by *Ceratitis capitata*. The species had already reached southern Italy and other parts of the Mediterranean, where it acquired its vernacular name, at least as far back as the mid-nineteenth century. Its range subsequently extended to southern Africa and parts of Australia, and it was also ravaging orange groves in the Middle East by the late nineteenth century. As these distribution patterns indicate, wherever humans transported fruit between temperate zones without hard winters, the Mediterranean fruit fly tended to follow, although it had come no closer than Bermuda to the continental United States as of the early twentieth century.¹⁸ The fly’s range also indicates the extent to which it moved with imperial expansion and global trade, in an era of increasingly dense ties of geopolitics and commerce between far-flung corners of the world. *C. capitata*’s newly established presence in Hawai‘i spoke to the islands’ growing strategic and economic prominence as part of the United States’ post-1898 archipelagic empire.

In response to the fly’s threat, the BCAF turned to Filippo Silvestri, director of the *Istituto superiore agrario* in Portici, Italy and the driving force behind its entomological laboratory, to serve as its consulting entomologist and to undertake a search to find the “enemies” of the Mediterranean fruit fly. Silvestri had visited the Territory of Hawaii and the continental United States in 1908 to explore biological control methods that could be applied in Italy, and his enthused review of U.S. agricultural institutions’ achievements earned him an American entomological following. Furthermore, the Portici laboratory’s role in establishing vedalia in

Italy, along with Silvestri's general knowledge of natural insect control techniques, experience in introducing parasites for Italian agricultural purposes, and specific interest in dealing with the Mediterranean fruit fly along with the potentially related problem of the olive fly and its threat to Italian olive oil production, made him the BCAF's choice for Hawai'i's fruit fly initiative.¹⁹

Biological control expeditions usually focused on attempting to identify the original habitat of the pest in question, in accordance with the guiding assumption that such locations would also possess the best parasites for keeping dangerous insect populations in check. Based on dispersal patterns, Italian entomologists had come to believe that flies of the genus *Ceratitis* most likely originated from the African continent, and that the tropical zones of west Africa constituted the mostly likely source of the Mediterranean fruit fly. Thus in the spring and summer of 1912, Silvestri mapped out an itinerary to search for parasites in west Africa, a journey that would ultimately take him through territories colonized by five different European powers, as well as two dominions of the British empire, before he landed in Honolulu and then returned home to Portici. The fly's own movements, as well as humans' search for parasites to restrain their numbers, forged ties between distant places that underscored the nature of global ecological relationships in an age of empire.

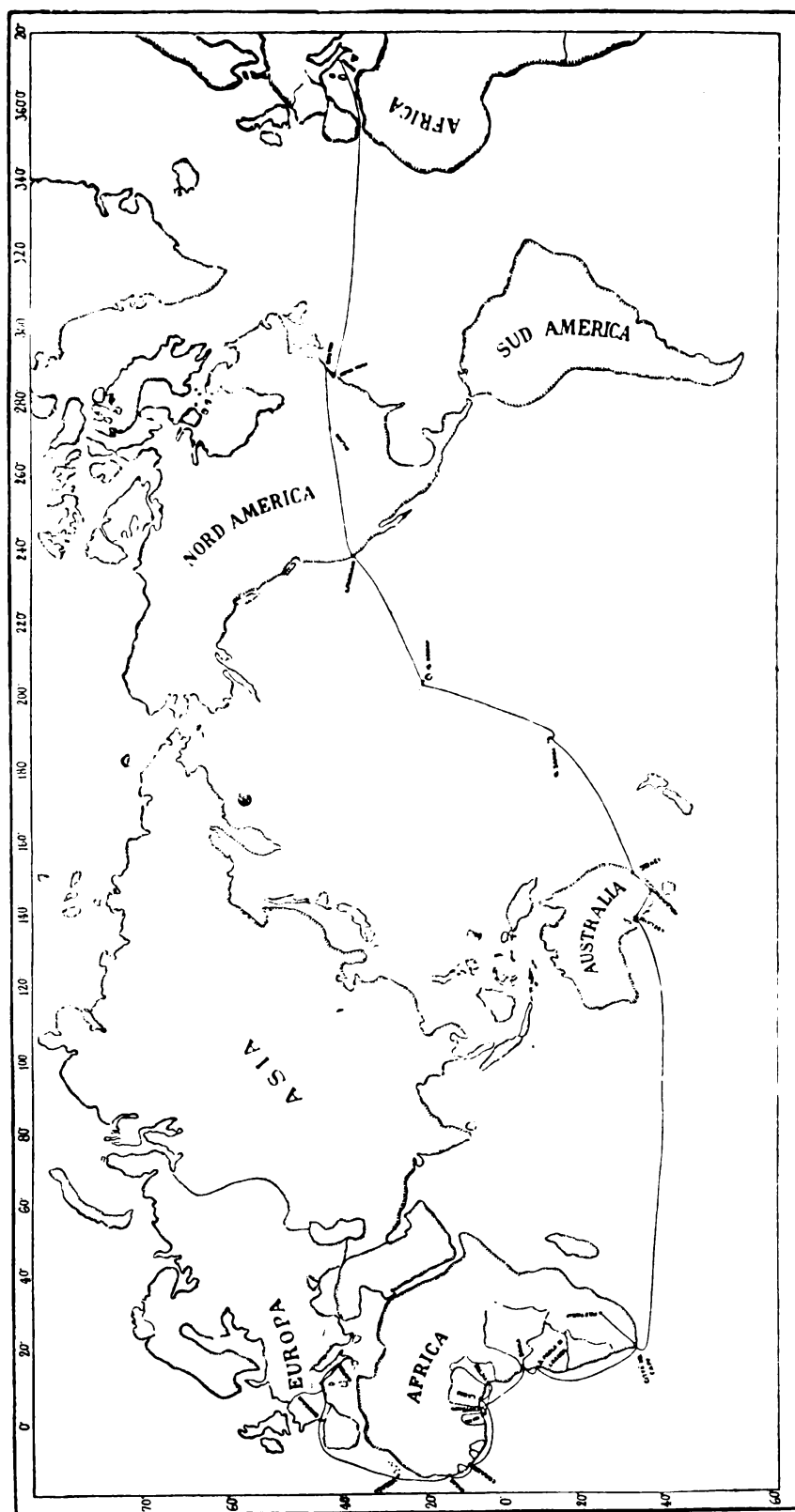
At every step of the way, Silvestri's entomological labors rested upon his ability to navigate and negotiate movements between spaces under diverse forms of rule and with varying levels of institutionalized support. Consider, for example, the mundane logistics of travel. Silvestri needed not just to find the desired parasites, but also to keep propagating them on the long voyage back to Honolulu, which meant that existing infrastructure and transportation routes mattered as much as the parasites' own natural history and likely habitats in planning the expedition. For example, in March 1912, Silvestri identified Senegambia as a good starting

point for his investigations not simply because of the local ecology, but also “there are three steamers a month leaving the port of Dekar [sic] for Lisbon and Bordeaux—and from Dekar by St. Louis and the Senegal River it is possible finally to reach the Niger.”²⁰ The need for breeding sites to maintain populations of collected parasites and their hosts also shaped the travel route, which Silvestri imagined would involve a return to Italy or stopover in Spain for such purposes, although BCAAF president Walter F. Giffard suggested alternatives in “the Canary Islands, Azores or a point in North Africa where *Ceratitis* prevails and where there is direct steamer connection with New York.”²¹ Giffard imagined using New York as a transfer point because there the BCAAF could draw on the Territory of Hawaii’s business contacts. For precise shipping arrangements, the Wall Street office of Alexander & Baldwin, one of the Big Five sugar companies in Hawai‘i and thus an institution with a major interest in the islands’ ecological management for agricultural purposes, could be relied upon to facilitate delivery to Honolulu.²²

Travel also required relying on or outright creating inter-imperial diplomatic and scientific ties. Early in his voyage, for example, Silvestri would discover that the Territory of Hawaii and France’s west African colonies possessed so little connection between them that the local cable office in Conakry, the capital of French Guinea, needed instructions from Paris in order to route a message to Hawai‘i. Another cablegram that Silvestri attempted to send from Dakar, Senegal a month later took twenty days to reach Honolulu, and exchanges of letters showed that the post required a minimum of 25-30 days each way, all of which testified to the tenuousness of ties between Hawai‘i and west Africa.²³ Money transfers constituted another source of difficulty, despite efforts ahead of time to ensure access to funds along the way. Four months into his journey, Silvestri might have run out of money after the British West African Bank refused to accept his carefully chosen London-based bank drafts, were it not for the

intervention and assistance of the colonial secretary in Lagos.²⁴ Formal diplomatic tools, such as letters of introduction and other travel credentials acquired through channels, also worked to facilitate Silvestri's entry into foreign territory and to provide access to colonial departments of agriculture, botanical gardens, and forestry stations for advice and assistance. During the planning stage of the expedition, Giffard emphasized other national and colonial governments' mutual interest in dealing with the Mediterranean fruit fly, which he expected to facilitate Silvestri's work. "This enterprise," he wrote, "is equally important to your own Government and it should interest itself in your behalf by securing from the Ambassadors the very strongest credentials. The British and French Colonies will also be interested in the results of your research work, as these are also suffering from the same pest as we are."²⁵

In July 1912, Silvestri commenced a year-long voyage that would take him around the world, from Italy to west Africa, South Africa, Australia, and Hawai'i, before his return home to Italy. His journey tied together diverse imperial spaces: French, English, German, Belgian, and Portuguese colonial possessions in west Africa, the British dominions of South Africa and Australia, and the U.S. Territory of Hawaii. Along the way, he relied on bureaucrats, imperial botanical gardens, agricultural stations, forestry bureaus, and other colonial officials and institutions to facilitate his search for parasites and the means to keep them alive as he moved from one locale to the next. Colonial authorities provided introductions and hospitality, directors of gardens and other facilities gave tours and permitted collecting, and agricultural and botanical experts shared their knowledge of species in the area, seasonal conditions, and other aspects of the surrounding environment. Unnamed African laborers, whom Silvestri mainly referred to as "natives," also provided guidance, protection, and assistance with collecting. Such everyday



Route Around the World Followed by Professor Silvestri.

activities defined a world of inter-imperial relationships that made biological pest control possible.

From the very start of his voyage, Silvestri's travels underscored the centrality of inter-imperial ties in facilitating biological pest control, whether manifested in his movements through different imperial spaces, or in the advice and assistance he received from local colonial officials, particularly those stationed in imperial agricultural or botanical institutions. His initial stops in Dakar and Conakry in August 1912 illustrate the types of relationships at work. Silvestri disembarked at Dakar on August 2, when his ship spent a day in port. He immediately headed for the markets, where he "found *Ceratitis* larvae in some of the fruit of *Chrysobalanus*, and promptly purchased all that were for sale." Then he visited the Governor General, who examined his credentials and telegraphed ahead to French Guinea to secure a cooperative reception there for the BCAF's consulting entomologist.²⁶ Silvestri also had time to stop at the agricultural research station in nearby Hann, where the director of the experimental gardens advised him that despite an absence of infestations at the moment, after November "it would not be difficult to find infested fruit." More detailed information about local fruit flies was not forthcoming, however, since Silvestri's host "has not given any attention to them."²⁷ Similarly, when he reached Conakry, Silvestri called upon the lieutenant governor of French Guinea, who helped make arrangements for him to visit the local experimental garden in Camayenne. There consultations confirmed what he already feared from his own experience in the market and at a missionary-run garden in Conakry: fruit was not in season, and he had arrived too early to hope for parasite-laden fruit flies. As in Dakar, the director of the experimental garden at Conakry told him that fly-infested melons would not appear until November, and that even then, he did not know the exact species of fruit flies involved.²⁸ Such interactions testified to the inter-

imperial scientific courtesies and institutional networking that accelerated entomological expeditions' search for biological controls in the early twentieth century, as well as the need for local contacts in order to deal with the most basic uncertainties, such as the itinerant entomologist's unfamiliarity with seasonal variations in fruit supply.

Two months of work in different parts of French west Africa in September and October yielded a couple of parasite species on other kinds of fruit flies which Silvestri thought might be useful in combatting the Mediterranean fruit fly, but no sign of *C. capitata* itself. From his failure to find dipterous fly larvae in guavas, mangos, or oranges in any of the places where he collected, Silvestri concluded that the BCAF could "exclude Senegal from the region which can be the original home of *Ceratitidis capitata*."²⁹ French Guinea yielded similarly negative results even as soft fruit entered the high season. Without the Mediterranean fruit fly in sight, Silvestri had little reason to stay in Guinea any longer, and on November 7, he departed for Nigeria.³⁰

With his arrival in Lagos on the morning of November 13, Silvestri entered British colonial territory, and he therefore needed to reestablish his credentials and start navigating a new network of imperial institutions. He immediately visited the colonial secretary in Lagos, who provided letters of introduction to the director of the medical research laboratory in Yaba, and to the heads of the agriculture and forestry departments. After a day of touristic exploration in Lagos, Silvestri went to Yaba. There the medical expert who happened to be present, a Dr. Final, showed him W. M. Graham's collection of west African fruit flies, none of which happened to be specimens of *C. capitata*. A visit to the botanical garden in the Lagos neighborhood of Ebute-Metta on November 15 yielded fruit infested with two *Ceratitidis* species, although again, the Mediterranean fruit fly remained nowhere to be seen. In addition to taking advantage of visits to colonial institutions, Silvestri also consulted local informants, "natives"

who told him fruit was in short supply at that time of year. A trip northeast to Ibadan produced similar findings: the local agricultural office readily put itself at Silvestri's disposal, but its specimen collection did not have any samples of *C. capitata*, and none of the fallen oranges that he found contained any fruit fly larvae.³¹

With these negative findings, Silvestri headed west from Ibadan to Olokemeji, home of the colonial government's forestry department and a major reserve, where he enjoyed a warm reception from vice-director Richard E. Dennett and other staffers at the forestry station. He soon hit pay dirt when he found on a Cayenne cherry tree (*Eugenia uniflora*) one adult female and one male specimen of the Mediterranean fruit fly, and he eagerly started gathering maggoty fruit.³² As he reported to Giffard, "From the 23rd to the 28th I was making repeated excursions into the forests collecting four species of indigenous fruits infested with trypetids and in order to have abundant material I had collected and also bought from the natives a certain quantity of fruit."³³ From these samples Silvestri obtained large numbers of several species of parasitic wasps (genus *Tetrastichus*) and other parasites. Although none of the species he found were growing in *C. capitata*, he had high hopes of breeding at least some of them in the Mediterranean fruit fly.³⁴ Silvestri sensed that he was closing in on a key moment in his travels. As he informed Giffard, "The final program for the work on *Ceratitis capitata* depends on the results of the present researches. I am, however, more than ever convinced that if we are able to find the true home of this fly and its original host plant, we will find parasites also."³⁵

Silvestri was ready to settle in at Olokemeji for an extended period, but the forestry station personnel warned him that fruit infested with *C. capitata* larvae would not appear until March or April. Rather than wait for months, Silvestri decided to return to Lagos, where he spent three weeks breeding the parasites that he had collected thus far, while also making

preparations to go to the Congo and Angola, “in the hope of finding *Ceratitis capitata* there.”³⁶

He headed to the Congo through a circuitous route: after a stop in the German colony of Kamerun, the ship he needed was on its westward swing, so he headed back to the Gold Coast and Dahomey. Silvestri gathered additional parasites along the way, and when he reached the port of Cotonou in the French colony of Dahomey, he found an ample supply of *Ceratitis*-infested fruit that he could use to keep his existing traveling parasites on the go as well as to potentially acquire new ones.

By this time, Silvestri began to reprioritize his parasites’ survival over the search for the Mediterranean fruit fly’s original habitat, and he had to consider how he might deliver live specimens to Honolulu. He thought about attempting a shipment, but with the Mediterranean fruit fly still more or less in absentia, he would have to send them in the parasitized pupae of another kind of *Ceratitis*, an unpalatable proposition since any pupae without parasites might lead to a new introduction of a voracious and uncontrolled fly species. As an experiment, he put his *C. giffardii* specimens that had reached the puparium stage into cold storage to see how they would travel, gathered separately the pupae parasitized with the species he had collected thus far, and dumped his leftover fruit into the ocean before disembarking at Boma, the seat of the Belgian colonial government.³⁷

The Congo was a wash. Silvestri enjoyed a warm reception at Boma from Italy’s consul general and “other compatriots in the Belgian Government service,” but found no fruit in season. Worried that he would not be able to keep his parasites alive without obtaining new supplies of infested fruit, he decided not to risk a trip inland and to proceed to Portuguese Angola. Agriculturists at the station in São Paulo de Loanda delivered the bad news that fruit was always in short supply along the coast, however, which gave him the choice of either traveling to the

lush interior, or heading straight to Capetown, South Africa, where the problem of endemic *Ceratitis capitata* meant its ready availability. By that point, Silvestri was traveling with five species of parasites, although he feared his *Opius* and *Tetrastichus* specimens would not last much longer. A few of the *Ceratitis* pupae that he had collected in Cotonou also turned out to be *C. capitata*, of which he had four live adult samples, but no larvae or pupae for breeding purposes.

Silvestri decided to go to Capetown, and he laid down advance preparations by telegraphing ahead to Charles P. Lounsbury, head of the Division of Entomology in the Union of South Africa's Department of Agriculture, to ask that *C. capitata* larvae and pupae be made available upon his arrival. He did not explain why he abandoned the original idea that he and Giffard had discussed months earlier of returning to Europe to breed parasites. Perhaps the journey back through west Africa would have taken too long or the procurement of an adequate fruit supply was too challenging, or perhaps Silvestri thought it too risky to attempt the transportation of parasites in a host other than the Mediterranean fruit fly. On the plus side, South Africa also offered clear advantages in terms of his own familiarity with the existing entomological infrastructure and South African entomologists' strong ties to the United States, as well as an established, well-traveled oceanic route back to Honolulu. As Karen Brown has pointed out, the American tradition of economic entomology became institutionalized in South Africa with the hiring of Lounsbury, who was American-born and American-trained, and who had the backing of Leland O. Howard, chief of the USDA's Bureau of Entomology. Lounsbury moved to South Africa in 1895 at the age of twenty-three and became the Cape Colony's first government entomologist. After the formation of the Union of South Africa in 1910, he transferred to Pretoria to take over the Union Department of Agriculture's entomology division,

and he ultimately pursued a lifelong career within South Africa's agricultural bureaucracy. In 1899, the Cape also hired a second American, entomologist Charles Mally, to work at the colony's Entomological Office.³⁸

Under Lounsbury's leadership, American-style economic entomology, which shifted the field's concerns from taxonomical classification to insects' life cycles and the management of insect populations that affected agriculture and livestock, brought entomologists into the larger state-building project in the Cape Colony and its mobilization of experts. The entomological dimensions of agricultural governance in the Cape Colony and, subsequently, the Union of South Africa, also evolved within a network of exchanges of knowledge, practices, and parasites with other English-speaking settler societies, especially the United States and Australia. Notably, Lounsbury's major correspondents included Edward M. Ehrhorn, a prominent horticulturist in California's state government who moved to the Territory of Hawaii in 1909 to become superintendent of entomology at the BCAF.³⁹ With this network already in place, Silvestri could expect easy access not just to *Ceratitis capitata*, but also to knowledgeable and like-minded experts already immersed in the problems common to agriculture in California and South Africa. With regular ship traffic between South Africa and Australia, and then Australia and Hawai'i, Silvestri could also anticipate a smooth, hassle-free voyage to Honolulu.

Lounsbury sent word to the Cape Colony's Entomological Office, which granted Silvestri every courtesy from the moment of his arrival on March 6. Silvestri later reported that the secretary of the Entomological Office "helped me to extricate myself from the difficulties of the customs office," and Mally delivered "the pleasant news that he had already secured a few [*C. capitata*] pupae and infested fruit and very soon expected more." Upon his arrival, Silvestri also hunted down additional pupae for his adult parasites to plant their eggs on, and on March 8, he

went with Mally and with the U.S. consul in Capetown to the government's experimental farm in Constantia "to collect many pears and some peaches heavily infested by *Ceratitis capitata*."⁴⁰

Despite these efforts, the supply of Mediterranean fruit fly pupae remained inadequate for Silvestri's needs, so he journeyed to Pretoria, "where Mr. Lounsbury had secured many infested fruits for me," such that "from the 13th to the 15th I had at my disposal a large number of *Ceratitis* pupae." Finally, Silvestri could rest assured of his ability to keep his treasured parasites alive. He returned to Capetown with Lounsbury's gift of "two boxes of quinces heavily infested by *Ceratitis*," and he settled in at the Entomological Office's Rosebank laboratory for parasite breeding.⁴¹ Sadly, he lost his *Tetrastichus* population, which had dwindled to just three females "in rather poor condition" by the time he had first landed in Capetown, and his *Spalangia* were also gone "because the progeny were all males."⁴² But his *Dirhinus giffardii*, *Galesus silvestrii*, and *Opius perproximus* all continued to breed, and he acquired a second *Opius* species and samples of *Trichopria capensis* from Constantia. Silvestri also discovered that his experiment with transporting *Ceratitis giffardii* in cold storage killed off the parasites, which meant that he would have to escort his specimens in person all the way back to Honolulu.⁴³

Travel by ship from South Africa to Hawai'i meant going through Australia, where Silvestri also knew that he would have good entomological company. Strong professional linkages extended between Californian and Australian agricultural science, and both places were embedded within a broader set of trans-Pacific connections that also encompassed New Zealand, Fiji, and Hawai 'i, among other Pacific outposts of Anglo-American settlement.⁴⁴ Silvestri arrived in Adelaide on April 15 after a twenty-day voyage, enjoyed the hospitality of South Australia's leading government entomologist, Arthur M. Lea, moved on to Melbourne, and then headed for Sydney. Silvestri bred parasites steadily all the while, but he also took advantage of

ample opportunities to discuss entomological matters, including the absence of the Mediterranean fruit fly thus far from South Australia and its barely established presence in Victoria, as well as to attempt collection of new parasites and to imbibe some of the natural scenic delights between Victoria and New South Wales.⁴⁵

Now in the home stretch, at least as far as the BCAF was concerned, Silvestri boarded a ship in Sydney on May 3 and arrived in Honolulu thirteen days later. He carried thriving populations of *Dirhinus* and *Galesus silvestrii*, with hundreds of adult specimens of each, but just a dozen specimens of *Opius perproximus*—split evenly between males and females, which gave some hope of their local propagation. He also had a small handful of *Opius humilis* from South Africa and *Diachasma tryoni* from Australia, along with some South African *Trichopria* that would soon emerge as adults. In Honolulu, Silvestri and David T. Fullaway, now on loan to the BCAF staff from the USDA experiment station, busily continued the breeding work. The west African *Opius* line subsequently died out, but just before Silvestri's departure for home on June 13, the BCAF released two colonies of *Dirhinus*, along with some specimens of *Diachasma tryoni* and *Opius humilis*, onto a coffee plantation on the Big Island. Silvestri himself headed for Europe via the continental United States and arrived in Naples after a month-long voyage. He brought *Dirhinus* and *Galesus* parasites with him that subsequently underwent experimental releases in an Italian peach orchard suffering from the Mediterranean fruit fly, as well as an olive grove infested with another fly species that he hoped would prove vulnerable to his west African parasites. Silvestri had taken nearly a year to circumnavigate the globe, with lines of parasites that had traveled nearly as far from their progenitors' original homes to reach Italy the long way around.

Ultimately, the Hawai‘ian results of the expedition were respectable but not as spectacular as hoped, and they were somewhat counterintuitive. Despite the large numbers of *Galesus* and *Dirhinus* brought in from west Africa, neither species took in Hawai‘i. The small handful of *Opius humilis* and *Diachasma tryoni*—just three females of the former and four of the latter—multiplied readily, however, and within a few years, a study by Cyril E. Pemberton of the Hawaiian Sugar Planters’ Association Experiment Station and Ernest A. Back of the USDA’s Bureau of Entomology discovered high rates of parasitism in coffee berries in the Big Island’s Kona district. But Pemberton and another USDA entomologist, H. F. Willard, eventually came to believe that the multispecies introduction had been a mistake, because *Opius humilis* was the more effective parasite against *C. capitata*, but *Diachasma tryoni* kept its numbers in check by killing it whenever the two species happened to parasitize the same larvae.⁴⁶ For the Territory of Hawaii, Silvestri’s expedition helped to keep the pest within tolerable boundaries, but it did not permit a resumption of hopes for a lavish and diverse trade in fresh tropical fruit. In terms of the history of animals and governance in Hawai‘i, however, the travels of Silvestri and his parasitical charges reflected the islands’ place within a global colonial order, the inter-imperial ties that shaped insects’ and humans’ prospects, and the biological concerns that informed U.S. territorial rule in the early twentieth century.

Debates over proposed bird introductions: From economic standards to the threat of “biological complexity”

Proposals to introduce particular species of birds also shed light on the biological aspects of territorial governance and the varied disciplinary, institutional, and ecological balancing acts involved in attempting to maintain the territory’s agricultural interests as well as the basic health

of island ecosystems. From the perspective of BCAF officials, controlled bird introductions promised benefits ranging from insect pest control to forest preservation, but risked the proliferation of new invasive species if experts erred in their assessment of newcomers' likely habits and habitats. As early as the mid-nineteenth century, colonial officials in Mauritius attempted the introduction of the common myna (*Acridotheres tristis*) from India, and they believed that its successful establishment played an important role in containing the threat of grasshoppers and other insects that competed with humans for crops. But the subsequent importation of the myna to Hawai'i proved a cautionary tale because its feeding habits resulted in the widespread distribution of lantana seeds, and lantana, originally brought in from Mexico as an ornamental shrub in the 1850s, became a completely invasive plant that endangered Hawai'ian forestland.⁴⁷ Aside from hopes for birds' entomological usefulness, other motivations for bringing in new species included the zeal of sportsmen for game birds and bird enthusiasts' desires to beautify the islands' landscape and soundscape according to Euro-American standards, which also suggested the unspoken colonial mentalities at work in early twentieth-century debates about birds in the Territory of Hawaii.

Bird introductions came under the purview of the BCAF's Rule II, established in October 1904, which forbade the introduction to the Territory of Hawaii of particular types of bats and crabs, along with "any other animal, bird, reptile or insect injurious, or liable to become injurious to forests, trees, plants or other vegetation of value."⁴⁸ As this language indicated, economic considerations determined the standard for whether or not to bar specific organisms, but, as some BCAF officials pointed out, Rule II did not provide much in the way of precise guidance. In the early 1910s, when the question of bird importations became increasingly pressing, the board deliberated over whether to adopt new, more exacting regulations.⁴⁹

In response to the “constant demand” to introduce songbirds and insect-feeders to Hawai‘i, Walter M. Giffard chaired a Committee on Entomology to consider the need for regulatory reform, and he immediately consulted with experts on whether some bird species might be admitted safely.⁵⁰ Experts’ responses highlighted the unknowns of how introduced birds might behave in a new climate and habitat, as well as the need to protect insect parasites acquired for biological pest control. William A. Bryan, an ornithologist and professor of zoology at the College of Hawaii in Honolulu, was “keen to have bird introduction commenced here without delay,” but only based on proper professional evaluation. At the same time, he acknowledged that no good scientific research existed that could predict with certainty how birds from European or North American climates would behave in Hawai‘i. Nonetheless, Bryan enthusiastically supported the introduction of beneficial bird species—especially insect feeders that would not threaten human food production—following judicious experimentation to determine how they would fare in the islands.⁵¹ Naturalist Robert C. L. Perkins, director of the entomology division of the Hawaiian Sugar Planters’ Association Experiment Station and an expert in both entomology and ornithology, adopted the more cautious stance that new bird populations should be established only “owing to some extreme necessity,” and even then not without “prolonged and extensive experiments under comparatively natural conditions.” In particular, he warned of the danger that insufficiently discriminating insectivorous species would consume not just undesired pests, but also the introduced insect parasite species brought to the islands at such high expense and effort. From Perkins’ standpoint, ornithologists such as Henry W. Henshaw, chief of the U.S. Department of Agriculture’s Bureau of Biological Survey and author of a widely referenced 1910 report that bird enthusiasts frequently cited to make the case

for admitting new species, too often did not take such concerns into sufficient account until enlightened by entomological experts.⁵²

Based on Bryan's and Perkins' input, the Committee on Entomology reaffirmed the status quo in a manner that upheld the importance of expertise while simultaneously recognizing the limits of available resources. The question of bird introductions, the committee reported, "is a larger one than can be well handled by the individual citizen" due to the risks involved. The lack of funds for research and experimentation, however, meant that the board had no means of determining which "birds are likely to be of use for the purposes required and at the same time guarantee such birds against depredations of the greatest economic importance."⁵³ This position left the BCAF to reject new regulations for lack of means to administer them, but also provided a rationale for the board's subsequent conservatism when faced with new requests for bird importations. For example, when Hilo lawyer William S. Wise pushed for more songbirds and insect feeders in Hawai'i, Giffard could rely on the expert judgment of "the two best ornithologists available in the islands" to convey regrets that the board could not pursue the experiments necessary to ensure safe introductions of new avian fauna.⁵⁴ When Wise and Bryan, along with Walter E. Wall, government surveyor and a leading member of the Hawaiian Fish and Game Association, suggested that a California wren species could help to combat unwanted insect populations, Giffard cited the prospective parasite introductions from the Mediterranean fruit fly expedition and other planned efforts at biological control of insect pests as a major reason to keep the wren out.⁵⁵ In response to Henshaw's suggestion that three species of game birds from Mexico could be strong candidates for Hawai'i, the BCAF's superintendent of forestry, Ralph S. Hosmer, also sounded a note of extreme caution. He admonished, "It is the policy of the Board to be very careful about introducing into Hawaii any birds liable in any way

to disturb the favorable conditions brought about thro' the establishment of beneficial insects.”⁵⁶

In the absence of experimental data beyond the means of the BCAF to provide, the welfare of laboriously established hymenoptera and other insect parasites had to take precedence over new birds in the islands.

By the 1920s, however, the board became more receptive to bird introductions as persistent insect problems opened the possibility for avian countermeasures. On the one hand, agricultural officials remained cautious, and by the late 1910s, federal authority added greater specificity to territorial provisions. As E. W. Nelson, Henshaw's successor at the Bureau of Biological Survey, informed Ehrhorn upon his appointment as a USDA inspector of foreign mammals and birds in 1919, the prohibitions against any bird “likely to prove injurious to agriculture” included no weaver birds or members of the family Fringillidae whatsoever, as well as “no other bird of which there is any doubt.”⁵⁷ On the other hand, however, damage by insects to agriculture and to the forests that maintained Hawai‘ian watersheds began to shift the balance of interests in favor of novel birds.

Discussions about the potential introduction of an Australian flycatcher species, *Rhipidura tricolor* (today reclassified as *Rhipidura leucophrys*), particularly David T. Fullway's position, indicate the recalibrations at work in the 1920s. Following his assistance to Silvestri in the parasite-breeding work, Fullaway accepted a permanent position with the BCAF, and his subsequent collecting ventures included the board's second west African expedition to search for additional Mediterranean fruit fly parasites in 1914-15, and then an expedition to Asia to seek out melon fly parasites in 1915-16. By the 1920s, however, Fullaway increasingly looked to birds for insect pest control potential. As part of the nexus of trans-Pacific agricultural exchange that linked California, Hawai‘i, and Australia, Fullaway wrote to James Franklin Illingworth, a

former entomology professor at the College of Hawaii who left to take a post with the agriculture department in Queensland, Australia, for advice on bird species that might help with insect control in Hawai‘i.⁵⁸ Illingworth suggested *Rhipidura tricolor*, known more commonly as either the willy wagtail or shepherd’s companion, as “a most valuable bird for Hawaii.”⁵⁹ Zoologist Joseph Grinnell of the University of California’s Museum of Vertebrate Zoology warned Fullaway that resorting to introduced birds in order to keep insects in check posed major risks to native species, which made Grinnell “very loath to recommend the introduction of any non-native animal.” Nevertheless, Fullaway’s reading of the scientific literature encouraged him to embrace the willy wagtail as a way to deal with the threat of the horn fly to cattle and other livestock in Hawai‘i.⁶⁰

Frederick A. G. Muir, who as one of the HSPA’s leading entomologists had conducted three successive expeditions in southeast Asia, China, and the south Pacific from 1906 to 1908 that ended with the successful introduction of a tachinid fly parasite to deal with the sugarcane borer, supported Fullaway’s initiative, as did the director of the HSPA’s experiment station, H. P. Agee.⁶¹ Although agricultural professionals always emphasized that avian importations should serve economic purposes only and not aesthetic objectives, birds’ charismatic qualities nonetheless seeped into discussions. For Europeans and Americans accustomed to aural environments rich with birdsong, the relative paucity of avian species in the Hawai‘ian islands disturbed foreign settlers in the mid-nineteenth century, and enthusiasts frequently called for the importation of songbirds as a civic beautification measure.⁶² Territorial agriculture officials, as previously noted, refused the introduction of birds for purely aesthetic purposes. When their admission could be justified economically, however, territorial entomologists and agriculturists proved just as vulnerable to individual species’ particular charms. As Muir tellingly noted, not

only did *Rhipidura tricolor* have the appetite to make inroads on the horn fly population, but in addition, “It is a pretty little bird and spreads its tail out fan-like and wags it from side to side.” It earned its name “shepherd’s companion” in the Australian outback, where “in those lonely places [it] is looked upon with kindly feelings by the shepherd and stock men.”⁶³ Other species with promise to combat insects attracted similar praise, such as the “dainty mincing strut” of Australia’s magpie lark, or the “ornamental plumage, pleasing song, and small size” of the Pekin nightingale.⁶⁴

With the assurances of Muir and Agee, the BCAF authorized the introduction of the willy wagtail, and with HSPA entomologist C. E. Pemberton already in Australia on other business, the board requested Pemberton’s assistance in arranging for the birds’ delivery. Australian officials, however, discouraged the acquisition due to the difficulty of capturing the birds and their likelihood of not surviving the voyage to Hawai‘i. Four years later, the board finally succeeded in gaining Australian permission, and the first shipment of *Rhipidura tricolor* left Sydney in 1926.⁶⁵ In the 1920s, the BCAF also approved other bird introductions in order to deal with the horn fly, the cut-worms that plagued garden crops, and other “injurious insects,” including the straw-necked ibis and magpie lark from Australia, and also the California meadowlark. In addition, the board backed introductions to Maui of two species already established elsewhere in the islands: the Chinese huamei, which colonized O‘ahu following its accidental release during the Honolulu fire of 1900, and the Japanese tom-tit, which had already made a home for itself on Kauai.⁶⁶

Meanwhile, the deterioration of native forest habitats led concerned citizens and anxious officials alike to contemplate admission of bird species that they had previously ruled out as too risky. Richard H. Grove’s path-breaking study of environmental discourses in the early modern

period, *Green Imperialism* (1995), demonstrated the near-constant concerns of European naturalists, growers, and colonial officials in tropical island settings from the seventeenth to the mid-nineteenth century with deforestation and the desiccation induced by watershed damage and the shifts in rainfall patterns that came with forest losses.⁶⁷ Hawai‘i was no different. From the earliest days of U.S. territorial rule in Hawai‘i, agriculture and forestry experts had prioritized forest preservation and health in order to protect the watersheds on which the sugar industry depended.⁶⁸ By the mid-1920s, however, insect attacks on trees had reached alarming proportions on Maui. In late April 1926, Harry A. Baldwin, part of the powerful sugar family that had founded the “Big Five” corporation of Alexander & Baldwin and himself a major figure in business and political circles in the territory, urged the BCAF to bring in insectivorous forest birds to deal with koa forests on Maui beset with caterpillar and spider mite infestations.⁶⁹ Days later, David T. Fleming, a ranch and pineapple plantation manager and nature enthusiast on Maui, echoed those sentiments and pressured the board’s chairman, George I. Brown, to take necessary action “to check the ravages of the various insects now wrecking our native Hawaiian Forests which in some form must be maintained at all costs as a protection for water-sheds.” Woodpeckers, he argued, “are the birds which are most likely to do the greatest good.”⁷⁰

These proposals, which ran against established practices, signaled the seriousness of the problem and the need for extreme—even desperate—measures. Agricultural officials in the territory had always avoided bringing in birds that might adapt to Hawai‘ian forests. As Judd had written to the board a decade earlier, “it would not be desirable to have [introduced birds] retreat to our native forests, which now contain insects almost all of which are beneficial.”⁷¹ Woodpeckers were particularly dangerous. R. C. L. Perkins, by then retired in England, emphasized to Judd in 1922, “I should be very careful in the matter of introducing forest birds,

especially anything of the woodpecker lot....Though these might destroy a good many boring insects, they would be sure to destroy a lot of the beneficial ones.” In particular, Perkins insisted that birds known to feed on any hymenoptera whatsoever needed to be absolutely prohibited, given the importance of parasitic wasps to biological pest control. Such birds, he stressed, “should not be considered at all in making new introductions. It would be too risky.”⁷²

Now, however, with the koa forests of Maui in “very distressing” shape, agricultural officials found themselves contemplating birds that they had always rejected previously.⁷³ Ehrhorn appealed to Henshaw’s 1910 report as a source of authority for suggesting the downy woodpecker and the hairy woodpecker, two California species that fed mainly on caterpillars or wood-boring insects and that posed little threat to fruit or vegetation.⁷⁴ Fleming latched upon Ehrhorn’s recommendation as a source of hope, albeit in a still dire situation: “Our forests are all going so fast that something must be done to protect them.”⁷⁵

The BCAF appears not to have gone so far as to bring in either of the woodpeckers, but it did quickly authorize the introduction of the Chinese thrush, or huamei, since it was already established without apparent ill effects on O‘ahu, and Baldwin soon reported the release of 52 live specimens in the Olinda forest. The board seemed favorably inclined towards the Pekin nightingale (*Leiothrix lutea*, or the red-billed leiothrix) as well.⁷⁶ Discussions of these species, however, prompted some responses at length from HSPA experts that also showed how a new ecological consciousness was beginning to weigh into decisionmaking. Where protection of economic interests had previously defined responses to proposed bird introductions, scientific personnel at the HSPA now began to raise concerns about species protection and the maintenance of existing island ecosystems. As Muir warned Agee, “The addition of every animal to our fauna adds to the complexity of our biological conditions and thereby possibly

adds to the increase of difficulties in biological control. For this reason I would take no risks. Unless this is taken into account no just judgment can be passed upon the introduction of any animal into our islands. In introducing insects this has been fully considered and has guided our actions, and if it should ever be ignored we shall be riding for a bad fall.” Muir contended that all insectivorous birds would threaten injurious and beneficial insects alike, and that Henshaw’s general observations about birds’ habits could not replace direct knowledge about how introduced species would behave in a new Hawaiian habitat. “Nothing,” he insisted, “except a study of the feeding habits of this bird in its native haunts, along with a knowledge of the insects of those haunts compared with the insect fauna of our islands, will allow of the most noted ornithologist forming a judgment of any value.”⁷⁷

To this established defense of experimentation and call to take introduced insect parasites into account, Muir then added an argument from “the sentimental side” that insisted on protecting Hawai‘ian species: “We have, in our islands, the most isolated and endemic fauna and flora in the world. So unique are they that I believe that future naturalists will condemn us if we do not take every care to preserve them intact.” He added that as much as he himself loved birds, “before adding to the complexity of our biological conditions I would ask that the subject be studied from both the economic and sentimental aspects.”⁷⁸

This concept of simplified island habitats with natural relationships highly vulnerable to the introduction of new species quickly reframed discussions. Days later, Agee penned a memorandum that echoed Muir’s concerns. Biological control through the introduction of insect parasites, he argued, “has been possible owing to the very simple biologic situation which exists here,” in an island habitat largely free of animals “which prey indiscriminately upon insect life.” Consequently, “Any birds, reptiles, or insects of a predacious nature which we introduce tend to

make this simple biologic relationship more complex and thereby reduce the chances of maintaining the beneficial insects we have introduced.”⁷⁹ Faced with the conundrum of weighing the urgent need to do something about the rapidly weakening koa forests against the risk that novel bird liberations “in these islands might upset the biological complexes which are now comparatively simple,” Charles S. Judd appealed to the Hawaiian Entomological Society for advice.⁸⁰ He also asked the HSPA experiment station for input on how best to address the “two opposing ideas” of watershed conservation versus protection of Hawai‘ian ecosystems, and whether there might be safer options for dealing with the voracious caterpillars that were consuming the koa trees.⁸¹

The archival record that I have managed to consult thus far ends here, but this brief snapshot of deliberations over admission of new bird species to Hawai‘i highlights the intricacies of the biological management of territory as a component of colonial rule. A soundscape devoid of birdsong drove European and American settlers’ desire for a natural order familiar to them, but economic interests took priority over beautification for disciplinary experts concerned with the colonial development of agriculture and forestry. The various candidate species under consideration, especially those from California and Australia, along with possibilities from China and Japan, spoke to the Territory of Hawaii’s place within a trans-Pacific nexus tied not just by perceived similarities of climate and landscape, but also trade routes and geopolitical relations that facilitated environmentally problematic species’ movements in the first place. Finally, by the mid-1920s, novel discourses about the dangers of disrupting simple habitats with new forms of biological complexity foreshadowed what would emerge a generation later as the full-fledged discipline of ecology.

“The goat menace”: Environmental damage and goat eradication efforts on Maui and Hawai‘i in the 1920s

As the BCAF struggled to develop a strategy to protect the wetland koa forests of Maui from devastating insect infestations, territorial forestry experts also had to contend with another animal threat in the form of wild goats that threatened to strip away the dominant plant life in the shrublands and dry forests of Hawai‘i and Maui. As of the early eighteenth century, an already long history of environmental damage from goats and other livestock run wild in colonial settings—for example, in Mexico and other parts of Spanish America, British St. Helena, and Dutch Mauritius—suggested the perils of transferring European expectations of animal-based resources to novel settings, particularly delicate island habitats.⁸² Such well-documented realities, however, did not deter Europeans and Americans from bringing cattle, horses, goats, sheep, and new pig breeds to Hawai‘i from the late eighteenth century onwards, which established novel species of free-ranging livestock as part of the islands’ ecosystems. Goats proliferated all too readily, and by the 1920s, the BCAF monitored “the goat menace” on Hawai‘i and Maui with a growing sense of apprehension. In the early 1920s, ranchers in different parts of the Big Island—the Puuwaawaa Ranch north of Kona, Kapapala Ranch in Pahala and Ainahou Ranch on the other side of Kīlauea—coordinated with the forestry division about how to deal with the thousands of goats on their lands.⁸³ As forestry superintendent Judd informed Hawai‘i’s territorial governor, “Senator Hind’s ranch [at Pu‘uwa‘awa‘a]...is being overrun with from eight to ten thousand wild goats which are destroying the forest growth and eating up his best pastures.”⁸⁴ Other parts of the Big Island, including national park land at Kīlauea and the Pu‘u ‘Ō‘ō Trail, a key cattle-driving route into Hilo, also suffered from goats’ depredations.⁸⁵

Conditions on Maui appeared still more dire, with goat-infested deforestation constituting a direct threat to crucial watersheds. In the mid-1920s, correspondents on Maui reported anxiously about the animals' depredations in multiple regions in and around Haleakalā Crater on the east side of Maui, as goats rapidly consumed Haleakalā silversword and māmane trees, two species that occurred naturally only in the Hawai'ian islands, with the Haleakalā silversword found solely in east Maui. In late 1923, David T. Fleming described at length the alarming effects of goats' endless appetites:

Three weeks ago when passing through the crater of Haleakala for the first time in over twenty years, I was most forcibly struck with the damage being done, both in the crater and along the sides, to all vegetation by goats. In the year 1900 the entire stretch of the side of the crater from Hunter's Cave down to Waiekahia was studded with Silversword plants growing in the open and on the hillsides, as well as on the palis [cliffs]. Today not one remains and even Mamane trees of considerable size—12 or 15 ft. in height—growing on the cones in the floor of the crater, have been killed by the goats stripping off the bark to a height of 4 or 5 ft. from the ground. Washouts of a considerable size have formed in that country since I was last there, and if the depredations of the wild goats are allowed to continue the whole country will suffer.⁸⁶

Another writer described a similarly catastrophic scene of deforestation in the Kula region on Haleakalā's western slopes. For a time, hunting had reduced goats' numbers, and the māmane trees had begun to make a spectacular comeback. With relaxed vigilance, however, goats had returned to prey upon all of the new growth. "Already you can see where they have taken off the bark and tops of the small trees," he lamented. "If we don't keep right after them," he warned,

“in a short time they are going to kill all the young trees.”⁸⁷ In March 1925, John Waterhouse, manager of the “Big Five” company of Alexander & Baldwin, also passed along a grim report from engineer J. H. Foss of the East Maui Irrigation Company on conditions in the Ko‘olau Forest Reserve on the northern side of Haleakalā. Foss observed darkly, “The mauka [mountainside] edge of the forest from the Westerly edge of Keanae Valley (on Koolau Gap) to Pohaku Palaha—the point on the edge of the crater where all of the main lands of East Maui meet—is constantly being attacked by great numbers of goats.”⁸⁸ The need to protect the Territory of Hawaii’s “most productive watershed,” he emphasized, was paramount. Failure to act against the threat of deforestation would cause severe changes in rainfall patterns, and the denuded land itself would become valueless as “the thin soil cover is carried off to the sea.”⁸⁹

The BCAF, in collaboration with ranchers, sugar elites, and government officials, tried out three main strategies for curtailing goats’ numbers. Hunting parties, poisoning experiments, and organized goat drives all showed promise for keeping the goat population in check. On Maui, interested parties tried to sell the BCAF on a bounty system that they hoped would entice young men into killing goats. As Fleming observed, “Apparently the younger generation of boys is taking more to moving pictures and ice cream and less to mountaineering and ice, than they did 25 years ago.” A bounty of 25 to 50 cents a head, he hoped, would encourage youths to abandon trivial pursuits for more vigorous and public-minded activities.⁹⁰ Based on the success of hired hunters on the islands of Moloka‘i and Kaho‘olawe, the BCAF, representatives from the sugar companies, and government officials on Maui decided on specifically appointed hunters as the better option, and they dispatched a team on a goat-killing mission in east Maui in the spring of 1925. Officials at the Maui Agricultural Company, part of the Alexander & Baldwin empire, were so pleased with reports of nearly 1500 wild goats killed in a little under three months that

they paid the hunters' salaries directly with corporate funds and returned the BCAF's checks.⁹¹

Hunting parties continued to cull the goat population in Haleakalā the following fall and winter.⁹²

On the Big Island, a range of efforts allowed the BCAF, ranchers, and territorial officials to compare the efficacy of organized hunts, poisoned bait, and goat drives. When rancher and territorial senator Robert Hind sounded the alarm about the thousands of goats wreaking ecological havoc on his ranch land in Pu'uwa'awa'a, he and Judd coordinated a massive drive that rounded up some 7000 goats for slaughter. An exultant Judd reported on the success of the highly coordinated effort in the July 3, 1922 issue of the *Honolulu Advertiser*. The day's work included the key contribution of a couple hundred Boy Scouts, who "formed the bulk of the battle line which extended on a front of 18 miles." Their participation, combined with the skills of Native Hawai'ian cowboys, put a major dent into the local goat population, although Judd also warned that at least 14,000 goats still remained on Puuwaawaa Ranch alone. "This drive," he intoned, "is only the beginning of an undertaking which should be carried on and continued until the bleat of a wild goat is never again heard."⁹³

Elsewhere, the BCAF requisitioned guns, ammunition, chemicals, and fencing to deal with goats in and around Pahala and Kīlauea, as well as along the Pu'u 'Ō'ō Trail.⁹⁴ At Pu'uwa'awa'a, subsequent drives, along with hunting and poisoning campaigns, continued to put pressure on the goat population.⁹⁵ The BCAF hired Fred R. Giddings, who had worked with C. E. Pemberton of the HSPA on rat poisoning techniques, to study poisoning methods for dealing with goats in the first half of 1925. Giddings found poison-laced salt particularly effective, because it could be used without endangering cattle.⁹⁶ In collaboration with Alapai Kalimu, a Native Hawai'ian skilled in tracking wild goats' habits, Giddings selected poisoning sites,

conducted hunts, and kept tabs on a new goat drive. During his five-month operation, he counted 3549 goats killed through driving or hunting and estimated that about twice as many died from poison.⁹⁷

Such tactics provided means of keeping the goat population at bearable proportions, but only with ceaseless effort. With any relaxation of vigilance, the animals' numbers quickly rebounded. In national park land at Kīlauea (officially renamed Hawai'i Volcanoes National Park in 1961), for example, culling efforts from the late 1920s to the early 1960s never proved effective because neighboring populations simply recolonized the area. The land that now comprises Haleakalā National Park experienced a similar history. Only in the late 1980s did the National Park Service gain the upper hand on the goat problem, through extensive fencing efforts to protect goat-free land, combined with the use of radio-collared female "Judas" goats that park personnel could use to track down the remaining members of increasingly sparse populations.⁹⁸ Although eradication efforts eventually succeeded on the islands of Lana'i in 1981 and Kaho'olawe in 1990, on the Big Island and Maui—the two largest islands of Hawai'i and therefore much more difficult as sites of eradication—management and control remain the only feasible options for the moment.

Conclusion

The three histories discussed here of introduced animal life in early twentieth-century Hawai'i suggest the importance of non-human species as both colonizers and objects of imperial governance. Unwanted insect pests threatened ecological devastation and agricultural ruin. Birds represented colonial desires to reproduce familiar landscapes, possible means of biological pest control, and potential for enormous environmental damage. Wild goats, introduced

originally as sources of food for European and American diets, reproduced a familiar colonial story of environmental degradation. In Hawai‘i, goats constituted not merely a nuisance, but a mortal threat to lowland and forest ecosystems, particularly the watersheds that sustained the territory’s sugar cane fields and, by extension, its economic livelihood as an outpost of global capitalism.

Such conditions boosted the authority of agriculture and forestry experts and underscored their central roles in the governance of territory. The introduction of insect parasites for purposes of biological pest control required skilled entomologists able to navigate both the scientific and social challenges of collecting and handling live specimens in distant parts of the world. Governmental structures also gave territorial experts primary authority to decide whether novel bird introductions would constitute a blessing or a curse for the islands, and their professional relationships with entomologists and ornithologists elsewhere in the territory of around the world also facilitated the disciplinary ties necessary to uphold and extend their purview. Goats may not have given Charles S. Judd much occasion to use his extensive scientific knowledge as a Yale-trained forester. Nonetheless, his position as the key figure in charge of maintaining the health of the islands’ forests made him the BCAF’s point person on goat eradication.

Ecological and professional relationships also helped to define the Territory of Hawaii’s place within the larger framework of global imperial order. Tropical agriculture was a discipline of empire, and notions of shared tropicity or other common environmental conditions created ties between otherwise distant places.⁹⁹ Such conditions facilitated the formation of new, transnational identities among communities of experts. As L. O. Howard observed in 1926, exchanges of insect parasites symbolized “the mutually helpful feeling that exists to an

extraordinary degree among entomologists—an early instance of the true international spirit that is coming.”¹⁰⁰ One should not neglect the inter-imperial lineage of that “international spirit,” which constituted a scientific analogue to the imperial internationalism that Mark Mazower has associated with international organization in the early decades of the twentieth century.¹⁰¹ One must also recognize the material connections that defined global relationships, including the living organisms that established themselves in novel habitats. Hence Filippo Silvestri’s need to follow the Mediterranean fruit fly through multiple imperial spaces, and his forging of new inter-imperial ties as a result. Other inter-imperial networks, such as the trans-Pacific nexus that linked California, Hawai‘i, and Australia, also defined the flows of plants and animals, as well as the scientific and political relationships that went with them. Insects and their parasites, birds with the potential to beautify landscapes or control insect pests, and livestock that liberated themselves from their original purpose as food sources for humans were all living creatures that established roots in new places, and in doing so, joined in and actively shaped the human history of empire.

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1. John Ryan Fischer, *Cattle Colonialism: An Environmental History of the Conquest of California and Hawai‘i* (Chapel Hill: University of North Carolina Press, 2015), 38-39, 55; David A. Chang, *The World and All the Things Upon It: Native Hawaiian Geographies of Exploration* (Minneapolis and London: University of Minnesota Press, 2016), 5; Carol A. MacLennan, *Sovereign Sugar: Industry and Environment in Hawai‘i* (Honolulu: University of Hawai‘i Press, 2014), 16-25. For a more technical account of long distance dispersal of propagules by birds, see Duarte S. Viana, Luis Santamaria, and Jordi Figuerola, “Migratory Birds as Global Dispersal Vectors,” *Trends in Ecology and Evolution* 31 (October 2016): 763-775.
 2. Fischer, *Cattle Colonialism*, 18-22, 30-35; Jeffrey T. Foster, “The History and Impact of Introduced Birds,” in *Conservation Biology of Hawaiian Forest Birds: Implications for Island Avifauna*, ed. Thane K. Pratt, Carter T. Atkinson, Paul C. Banko, James D. Jacobi, and Bethany L. Woodworth (New Haven and London: Yale University Press, 2009), 312-330, on 312 and 325. Prior to the arrival of humans, seals and bats were the only mammals present on the Hawai‘ian islands.
 3. A preliminary effort to evaluate the significance of state-level measures in California, Oregon, and Washington appears in Barrie Ryne Blatchford, “Pest Panic in the American West: The San Jose Scale as Change Agent in American Agriculture, 1880-1900” (M.A. thesis, University of British Columbia, 2017). For measures passed in the Kingdom of Hawai‘i, see *Laws of His Majesty Kalakaua I. King of the Hawaiian Islands, Passed by the Legislative Assembly at Its Session 1888*. (Honolulu: Gazette Publishing Company, 1888), 73; and “An Act Relating to the Suppression of Plant Diseases, Blight, and Insect Pests,” *Laws of His Majesty*

Kalakaua I. King of the Hawaiian Islands, Passed by the Legislative Assembly at Its Session 1890. (Honolulu: Gazette Publishing Company, 1890), 4-7. The origins and implementation of the Plant Quarantine Act of 1912 are discussed in Philip J. Pauly, *Biologists and the Promise of American Life: From Meriwether Lewis to Alfred Kinsey* (Princeton and Oxford: Princeton University Press, 2000), ch. 3.

4. F. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States of North America,” trans. J. Rosenstein, *Hawaiian Forester and Agriculturist* 6 (August 1909): 287-336, on 288-93; M. N. Joly, “Notice sur les ravages que la *Liparis dispar* (*Bombyx dispar*, Latr.) a exercés aux environs de Toulouse, suivie de quelques réflexions sur un nouveau moyen de détruire certains insectes nuisibles,” *Revue Zoologique* 5 (April 1842): 115-19, on 117 and 118. Notably, studies of entomology and responses to insect infestations in the early modern period do not identify parasite introductions as a control method, which lends support to the nineteenth and early twentieth century scientific literature that credited Boisgiraud with the first known attempt. Matthew Mulcahy and Stuart Schwartz, “Nature’s Battalions: Insects as Agricultural Pests in the Early Modern Caribbean,” *William and Mary Quarterly* 75 (July 2018): 433-64; Etienne Stockland, “‘La Guerre aux Insectes’: Pest Control and Agricultural Reform in the French Enlightenment,” *Annals of Science* 70 (2013): 435-60.

5. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 297-98.

6. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 293; Charles V. Riley, *Fourth Annual Report on the Noxious, Beneficial and Other Insects, of the State of Missouri* (Jefferson City, MO: Regan & Edwards, Public Printers, 1872), 38-41.

7. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 298-300; Richard C. Sawyer, “Monopolizing the Insect Trade: Biological Control in the USDA, 1888-1951,” *Agricultural History* 64 (Spring 1990): 271-85, on 273-74.

8. Howard Seftel, “Government Regulation and the Rise of the California Fruit Industry: The Entrepreneurial Attack on Fruit Pests, 1880-1920,” *Business History Review* 59 (Autumn 1985): 369-402, on 386-87; Sawyer, “Monopolizing the Insect Trade,” 273-74; Steven Stoll, “Insects and Institutions: University Science and the Fruit Business in California,” *Agricultural History* 69 (Spring 1995): 216-239, on 227-28.

9. Here I have in mind the first International Sanitary Conference, which convened in Paris in 1851 to attempt to standardize quarantine requirements for containing the spread of infectious disease at the ports of the participating states. The gathering inaugurated an era of international sanitary conferences that defined the formative period of organized international health efforts, and it exemplified new possibilities for professionalized experts in multiple fields of endeavor to form epistemic communities with universalist identities that heralded openness and information exchange as social norms.

10. On this point, see Megan Black’s account of the U.S. Department of Interior: *The Global Interior: Mineral Frontiers and American Power* (Cambridge, MA: Harvard University Press, 2018). I thank Gretchen Heefner for directing me toward Black’s work.

11. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 301-04. For Koebele’s first Australian expedition, the USDA got around Congressional strictures when the State Department agreed to send Koebele as the nation’s delegate for the Melbourne Exposition of 1888. Seftel, “Government Regulation and the Rise of the California Fruit Industry,” 387.

12. See L. O. Howard, "The Parasite Element of Natural Control of Injurious Insects and Its Control by Man," *Journal of Economic Entomology* 19 (April 1926): 271-82. For historical context, see also James E. McWilliams, "'The Horizon Opened up Very Greatly': Leland O. Howard and the Transition to Chemical Insecticides in the United States, 1894-1927," *Agricultural History* 82 (Fall 2008): 468-95.

13. L. O. Howard, "On the Hawaiian Work in Introducing Beneficial Insects," *Journal of Economic Entomology* 9 (February 1916): 172-79, Perkins quoted on 178.

14. O. H. Swezey, "Biographical Sketch of the Work of Albert Koebele in Hawaii," *The Hawaiian Planters' Record* 29 (October 1925): 364-68, on 364; Sawyer, "Monopolizing the Insect Trade," 274. Other important entomological migrants from California to Hawai'i included Alexander Craw, who left the California State Board of Horticulture in 1904 to become superintendent of entomology for the Board of Commissioners of Agriculture and Forestry, and Edward M. Ehrhorn, Craw's successor, who was deputy state commissioner of horticulture and horticultural quarantine officer in San Francisco prior to joining the BCAF. Jacob Kotinsky, "Alexander Craw," *Journal of Economic Entomology* 1 (December 1908): 410-11; and O. H. Swezey, F. X. Williams, and D. T. Fullaway, "Biographical Sketch: Edward Macfarlane Ehrhorn (1862-1941)," *Proceedings of the Hawaiian Entomological Society* 11 (1942): 135-37, on 135.

15. E. A. Back and C. E. Pemberton, *The Mediterranean Fruit Fly in Hawaii*, U.S. Department of Agriculture Bulletin No. 536 (Washington, DC: Government Printing Office, 1918), 15.

16. F. Silvestri, *Report of an Expedition to Africa in Search of the Natural Enemies of Fruit Flies*, Bulletin no. 3, Division of Entomology, Board of Agriculture and Forestry, Territory of Hawaii (Honolulu, 1914), 11; Back and Pemberton, *The Mediterranean Fruit Fly*, 8-9.

17. Back and Pemberton, *The Mediterranean Fruit Fly*, 7, 15, 21-23, 40-43 (on the Mediterranean fruit fly and conditions in Hawai‘i; and Pauly, *Biologists and the Promise of American Life*, 84-88 (on the passage of the 1912 act). For the text of the act, see *The Statutes at Large of the United States of America*, vol. 37, part I (Washington, DC, 1913), 315-19.

18. Back and Pemberton, *The Mediterranean Fruit Fly*, 3-7.

19. [Editor’s introduction], *Hawaiian Forester and Agriculturist* 6 (August 1909): 279-81; Howard, “On the Hawaiian Work in Introducing Beneficial Insects,” 172; Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 302, 307, 311, 325. [more sources on Silvestri’s background? also check BCAF minutes for more on the background and lead-up to the expedition]

20. F. Silvestri to W. M. Giffard, 2 March 1912 (translated copy), Board of Commissioners of Agriculture and Forestry, Box 31, Records of the Division of Entomology, Office of Fruitfly Control, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913,” Hawai‘i State Archives, Honolulu, HI. Collection cited hereafter as BCAF.

21. *Ibid.*; W. M. Giffard to F. Silvestri, 15 April 1912, BCAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.” Further down in the letter, Giffard also mused that perhaps a breeding site in the West Indies would be necessary.

22. W. M. Giffard to F. Silvestri, 15 April 1912, BCAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”

23. F. Silvestri to W. M. Giffard, 10 August 1912 (translated copy), and W. M. Giffard to F. Silvestri, 4 October 1912, both in BCAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”

24. F. Silvestri to W. M. Giffard, 24 December 1912 (translation), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913." Giffard responded with surprise and irritation: "It is most extraordinary that you should have had difficulty in cashing negotiable Bank Bills on London. The British West African Bank which you mention refused to cash such drafts must be either a most extraordinary banking institution or else is managed by an incompetent. I never heard of such a thing in all my thirty-five years of business experience." W. M. Giffard to F. Silvestri, 7 February 1913, BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913."

25. W. M. Giffard to F. Silvestri, 15 April 1912 (second letter with same date), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913."

26. F. Silvestri, *Report of an Expedition to Africa*, 14. *Chrysobalanus* is a particular genus of evergreen shrubs and small trees.

27. F. Silvestri to W. M. Giffard, 10 August 1912 (translated copy), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913."

28. Silvestri, *Report of an Expedition to Africa*, 16; F. Silvestri to W. M. Giffard, 10 August 1912 (translated copy), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913."

29. F. Silvestri to W. M. Giffard, 1 October 1912 (translation), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913."

30. Silvestri, *Report of an Expedition to Africa*, 21-22; F. Silvestri to W. M. Giffard, 5 November 1912 (translation), BCAF, Box 31, Folder "Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913" (for the quotation).

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31. Silvestri, *Report of an Expedition to Africa*, 22-26; F. Silvestri to W. M. Giffardi, 30 November 1912 (translation), BCAAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”
 32. Silvestri, *Report of an Expedition to Africa*, 26-27.
 33. F. Silvestri to W. M. Giffard, 30 November 1912 (translation), BCAAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”
 34. Silvestri, *Report of an Expedition to Africa*, 27-28; F. Silvestri to W. M. Giffard, 24 December 1912, BCAAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”
 35. F. Silvestri to W. M. Giffard, 30 November 1912 (translation), BCAAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913.”
 36. F. Silvestri to W. M. Giffard, 30 November 1912 (translation), BCAAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913”; Silvestri, *Report of an Expedition to Africa*, 28 (for the quotation).
 37. Silvestri, *Report of an Expedition to Africa*, 33, 35.
 38. Karen Brown, “Political Entomology: The Insectile Challenge to Agricultural Development in the Cape Colony, 1895-1910,” *Journal of Southern African Studies* 29 (June 2003): 529-49, on 534-35 and 537; “Lounsbury, Charles Pugsley (entomology),” “S2A3 Biographical Database of Southern African Science,” Southern African Association for the Advancement of Science, available online at https://www.s2a3.org.za/bio/Biograph_final.php?serial=1719 (February 2019).
 39. Brown, “Political Entomology,” 530 and 538.
 40. Silvestri, *Report of an Expedition to Africa*, 35-36.

41. Silvestri, *Report of an Expedition to Africa*, 37.

42. F. Silvestri to W. M. Giffard, 9 March 1913, BCAF, Box 31, Folder “Search for Parasites—Silvestri Expedition, Dr. F. Silvestri January 1912-April 1913” (for the first quotation); Silvestri, *Report of an Expedition to Africa*, 37 (for the second quotation).

43. Silvestri, *Report of an Expedition to Africa*, 37.

44. Ian Tyrrell, *True Gardens of the Gods: Californian-Australian Environmental Reform, 1860-1930* (Berkeley and Los Angeles: University of California Press, 1999). On p. 15, Tyrrell notes the broader trans-Pacific connections at work beyond California and Australia, a topic that he identified at the time as in need of more study.

45. Silvestri, *Report of an Expedition to Africa*, 37-38.

46. Howard, “On the Hawaiian Work in Introducing Beneficial Insects,” 176-77; C. E. Pemberton and H. F. Willard, “Interrelations of Fruit-fly Parasites in Hawaii,” *Journal of Agricultural Research* 12 (4 February 1918): 285-95. For L. O. Howard writing in 1926, the case of *Opius humilis* and its interactions with *Diachasma tryoni* demonstrated the need for close study of insect life cycles in future biological control efforts. As he observed, “It is true that some admirable results have been obtained in the old, more or less haphazard way, and we have nothing but praise for Koebele and his Novius work and for the Hawaiian explorers. But it is now very evident that, in order thoroughly to exhaust the possibilities of success in the majority of cases, especially where continental areas are concerned, detailed studies, which may in general be called ecological (for want of a better term), must be made both in the importing and exporting regions.” Howard, “The Parasite Element of Natural Control of Injurious Insects,” 281.

47. Silvestri, “A Survey of the Actual State of Agricultural Entomology in the United States,” 328-31.

48. “(Copy) Rule and Regulation by the Board of Commissioners of Agriculture and Forestry, Concerning the Importation or Introduction into the Territory of Hawaii of Birds, Reptiles, and Insects Injurious or Detrimental to Agriculture, Horticulture, or Forestry,” approved 19 October 1904, copy in BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913,” Hawai‘i State Archives, Honolulu, HI.

49. E. M. Ehrhorn to W. M. Giffard, 20 May 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

50. W. M. Giffard to R. C. L. Perkins, 25 May 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

51. W. A. Bryan to W. M. Giffard, 31 May 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

52. R. C. L. Perkins to W. M. Giffard, 4 June 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

53. Committee on Entomology (W. M. Giffard, chairman) to Commissioners of the Board of Agriculture and Forestry, 3 July 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

54. W. M. Giffard to W. S. Wise, 5 July 1912, BCAAF, President, Box 11, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

55. William E. Wall to Walter M. Giffard, 17 February 1913, Wm. A. Bryan to W. M. Giffard, 3 March 1913, and W. M. Giffard to Wm. S. Wise, 1 April 1913, all in Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

56. R. S. Hosmer to H. W. Henshaw, 29 April 1913, Folder “W. M. Giffard: re. Importation of Birds, May 20, 1912-April 1, 1913.”

57. E. W. Nelson to Edward M. Ehrhorn, 20 August 1919, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—General, June 12, 1917 – April 28, 1927.”

58. On Illingworth, see Wallace C. Mitchell, “History of the Department of Entomology University of Hawaii, College of Tropical Agriculture,” *Proceedings of the Hawaiian Entomological Society* 19 (September 1966), 251-79, on 254-55.

59. J. F. Illingworth to David T. Fullaway, 6 June 1921, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

60. Copy, J. Grinvell [sic] to D. T. Fullaway, 7 July 1921 (for the quotation) and D. T. Fullaway to Commissioners of Agriculture and Forestry, 15 July 1921, both in BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

61. Fred Muir to the Director, Experiment Station, HSPA, 10 November 1921, and H. P. Agee to J. N. S. Williams, 21 November 1921, both in BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927”; and, on Muir, Emmett R. Easton, “Exploits of Some Famous Entomologists of the Hawaiian Entomological Society,” *Proceedings of the Hawaiian Entomological Society* 39 (2007): 153-56. [see also Muir, 1910, Hawaiian Planters Record, Appendix G, 94-102, and whatever else I have on the cane borer parasite—BCAF, BCAF minutes?]

62. Foster, “The History and Impact of Introduced Birds,” 312.

63. Fred Muir to the Director, Experiment Station, HSPA, 10 November 1921, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

64. In recommending the magpie lark (*Grallina cyanoleuca*, a.k.a. the peewee lark) as a means of dealing with grassland insects that threatened livestock, Fullaway also cited the reference of A. J. North of the Sydney Museum to “the courage displayed by these plucky little birds.” “The Magpie Lark” (two separate documents with this heading), attached to D. T. Fullaway to BCAF, 11 May 1922, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.” Edward M. Ehrhorn’s comment about the Pekin nightingale (*Leiothrix lutea*) followed a discussion of its economic worth. Edw. M. Ehrhorn to Chas. S. Judd, 10 September 1924, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

65. C. S. Judd to HSPA Experiment Station, 6 February 1922; Cablegram, C. E. Pemberton to HSPA Experiment Station, 20 February 1922; George C. Fuller, Premier, New South Wales, to W. R. Farrington, Governor, Territory of Hawaii, 30 May 1922; Edward M. Ehrhorn to George I. Brown, 11 March 1926; all in BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

66. C. S. Judd to E. M. Ehrhorn, 25 August 1922 and C. S. Judd to H. A. Baldwin, 11 May 1926, both in BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

67. Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens, and the Origins of Environmentalism, 1600-1860* (Cambridge and New York: Cambridge University Press, 1995).

68. See, for example, Territory of Hawaii, *Report of the Commissioner of Agriculture and Forestry for the Year Ending December 31st 1900* (Honolulu: Hawaiian Gazette Co., Ltd., 1901), 14-15. It should also be noted that tree species such as koa or māmane are found only in

the Hawai‘ian islands, although species preservation for its own sake was not the foremost concern in the BCAF’s approach to forest management.

69. Harry A. Baldwin to Chas. S. Judd, 27 April 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

70. D. T. Fleming to George I. Brown, 5 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

71. C. S. Judd to BCAF, 15 February 1915, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

72. R. C. L. Perkins to C. S. Judd, 14 July 1922, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

73. C. S. Judd to Harry A. Baldwin, 30 April 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

74. Edw. M. Ehrhorn to Geo. I. Brown, 7 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

75. D. T. Fleming to George I. Brown, 11 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

76. C. S. Judd to H. P. Agee, 11 May 1926 and Harry A. Baldwin to C. S. Judd, 15 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

77. F. Muir to the Director, 20 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder “Birds—Importation of, May 25, 1915 – July 11, 1927.”

78. *Ibid.*

79. H. P. Agee, "Memorandum Regarding Bird Introductions," 26 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder "Birds—Importation of, May 25, 1915 – July 11, 1927."

80. C. S. Judd to Hawaiian Entomological Society, 28 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder "Birds—Importation of, May 25, 1915 – July 11, 1927."

81. C. S. Judd to Experiment Station, HSPA, 29 May 1926, BCAF, Administration, Executive Officer, Box 14, Folder "Birds—Importation of, May 25, 1915 – July 11, 1927."

82. Grove, *Green Imperialism*, 63, 108, 120, and 150.

83. See, for example, C. S. Judd to W. R. Farrington, Governor of Hawaii, 5 June 1922; C. S. Judd to Thomas Boles, Hawaii National Park, 25 April 1924; C. S. Judd to Bradford Sumner, Manager, Kapapala Ranch, 8 September 1924; Frank B. Dodge to C. S. Judd, 22 January 1925, all in BCAF, Division of Forestry, Box 34, Folder "Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934." The phrase "the goat menace" appears in Judd's letter to Farrington.

84. C. S. Judd to W. R. Farrington, Governor of Hawaii, 5 June 1922, BCAF, Division of Forestry, Box 34, Folder "Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934."

85. Thomas Boles to C. S. Judd, 26 September 1924; C. S. Judd to L. W. Bryan, 1 December 1924; C. S. Judd to Frank B. Dodge, 29 January 1925, all in BCAF, Division of Forestry, Box 34, Folder "Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934."

86. D. T. Fleming to C. S. Judd, 26 November 1923, BCAF, Division of Forestry, Box 34, Folder "Charles S. Judd, Eradication of Goats—Maui, 1922-1926."

87. Richard Walker to C. S. Judd, 30 January 1924, BCAF, Division of Forestry, Box 34, Folder "Charles S. Judd, Eradication of Goats—Maui, 1922-1926."

88. J. H. Foss to Alexander & Baldwin, Ltd., memorandum on “Forestry—Proposed Legislation,” 5 March 1925, attached to J. Waterhouse to C. S. Judd, 11 March 1925, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.” In Native Hawai‘ian usage, in which directional indicators use geographical reference points, mauka refers to the direction towards the mountain, in contrast to makai, which gestures toward the ocean.

89. J. H. Foss to Alexander & Baldwin, Ltd., memorandum on “Forestry—Proposed Legislation,” 5 March 1925, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.”

90. D. T. Fleming to C. S. Judd, 26 November 1923, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.” Territorial senator and rancher H. W. Rice also supported the idea of a goat bounty on Maui. See H. W. Rice to C. S. Judd, 13 March 1924, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.” I have written elsewhere on the history of bounty systems, animal control, and American governance, in the context of dog-catching and the mixed public-private relationship in nineteenth-century New York City: Jessica Wang, “Dogs and the Making of the American State: Voluntary Association, State Power, and the Politics of Animal Control in New York City, 1850-1920,” *Journal of American History* 98 (March 2012): 998-1024.

91. C. S. Judd to H. W. Rice, 8 August 1924; J. Waterhouse to C. S. Judd, 27 March 1925; J. Waterhouse to Board of Agriculture and Forestry, 29 June 1925, all in BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.”

92. C. R. [Charles Reed] Hemenway to C. S. Judd, 9 November 1925; C. R. Hemenway to C. S. Judd, 6 January 1926; and J. Waterhouse to C. S. Judd, 5 February 1926, all in BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Maui, 1922-1926.”

93. C. S. Judd, “Thousands of Goats Driven Seaward from Parker Ranch,” *Honolulu Advertiser*, 3 July 1922, p. 1, copy in BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934.”

94. A. M. Brown to C. S. Judd, 2 April 1924; C. S. Judd to Bradford Sumner, 8 September 1924; C. S. Judd to L. W. Bryan, 1 December 1924; B. M. Sumner to C. S. Judd, 27 June 1925; and George R. Clark to C. S. Judd, 15 January 1927, all in BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934.”

95. A. C. Goweial [sp?] to C. S. Judd, 27 December 1924, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Hawaii, 1922-1934.”

96. Fred R. Giddings to C. S. Judd, 16 February 1925, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Poison Bait Experiment 1925.”

97. Fred R. Giddings to BCAF, typewritten “report on Goat Destruction,” 2 July 1925, BCAF, Division of Forestry, Box 34, Folder “Charles S. Judd, Eradication of Goats—Poison Bait Experiment 1925.”

98. Steven C. Hess, Drik H. Van Vuren, and Gary W. Witmer, “Feral Goats and Sheep,” in *Ecology and Management of Terrestrial Vertebrate Invasive Species in the United States*, ed. W. C. Pitt, J. C. Beasley, and G. W. Witmer (Boca Raton, FL: CRC Press, 2018), 289-309, on 295-97.

99. On this notion, see Deborah J. Neill, *Networks in Tropical Medicine: Internationalism, Colonialism, and the Rise of a Medical Specialty, 1890-1930* (Stanford, CA:

Stanford University Press, 2012), 64. One might also think about a “global Mediterranean” at work in the ecological relationships that linked California, Hawai‘i, Australia, South Africa, and parts of southern Europe.

100. Howard, “The Parasite Element of Natural Control of Injurious Insects,” 275.

101. Mark Mazower, *No Enchanted Palace: The End of Empire and the Ideological Origins of the United Nations* (Princeton, NJ: Princeton University Press, 2009), intro. and ch. 1.