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Malaria, Mosquitoes, and Maps: Practices and Articulations of Malaria Control in British India and WWII

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Malaria, Mosquitoes, and Maps:

Practices and Articulations of Malaria Control in British India and WWII

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy,

in

Communication (Science Studies)

by

Monica A. Hoffman

Committee in Charge

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2016

The Dissertation of Monica A. Hoffman is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California, San Diego

2016

DEDICATION

For my Father:

You are greatly missed

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LIST OF ABBREVIATIONS

CB: Construction Battalion (the Seabees)

CDC: Centers for Disease Control

CINCPAC: Commander-in-Chief, Pacific Command

COMSOPAC: Commander-in-Chief, South Pacific Ocean Area

DDT: Dichlorodiphenyltrichloroethane

GIS: Geographic Information System

MAP: Malaria Atlas Project

MECO: Malaria and Epidemic Disease Control Organization

NARA: National Archives and Records Administration

NCB: Naval Construction Battalion

NCO: Non-Commissioned Officer

NIH: National Institutes of Health

NLM: National Library of Medicine

NRC: National Resource Council

SOPAC: South Pacific Area, multinational US-led military command

SOPACBACOM: South Pacific Area Base Command

USAFISPA: United States Forces in the South Pacific Area

WHO: World Health Organization

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VITA

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ABSTRACT OF THE DISSERTATION

Malaria, Mosquitoes, and Maps:

Practices and Articulations of Malaria Control in British India and WWII

by

Monica A. Hoffman

Doctor of Philosophy in Communication (Science Studies)

University of California, San Diego, 2016

Professor Valerie Hartouni, Chair

What is malaria? Ackerknecht wrote malaria was “fundamentally social” (1945); anthropologists Kelly and Beisel believe malaria’s “historical, sociological and political

life . . . exceeds the moment of the parasitological exchange" (2011). In this dissertation, I argue malaria's complexities make it impossible to divorce the ontological question (*What is malaria?*) from the epistemological question of *How do we know what we know about malaria?* To address these questions, I analyze malaria control efforts in British India and in the Allies' Pacific campaign of World War II, tracking the creation and institutionalization of knowledge production and control practices, as well as the infrastructures that were created or adapted to control malaria in ways that became natural and common sense. I focus on the articulations and practices of coordination between humans, landscapes, and non-human agents (parasites, mosquitoes, maps, surveys, DDT, etc.) in the resistances and successes of human malaria control practices.

I begin in British India and trace the stabilization of knowledge around the mosquito as the malaria vector and the development of mapping practices central to creating and standardizing understandings and articulations of malaria, as well as in shaping official control policies. Engaging a neglected era in malaria's history, the rest of the dissertation focuses on the Allies' Pacific malaria control efforts, analyzing the creation of infrastructures and implementation of practices that helped to articulate malaria as a local, multi-species disease, and significantly lowered malaria infection rates. I follow the work of malariologists, entomologists, parasitologists, engineers, cartographers, cartoonists, and enlisted men through their practices of creating reports, catching and dissecting mosquitoes, conducting and analyzing surveys and blood smears, making maps, creating public health campaigns, and engineering projects that relocated populations of people and reduced or eliminated populations of mosquitoes. These practices and objects required coordination and translation to articulate malaria as a legible object across specializations as well as up and down command hierarchies.

Using civilian and military archival sources, and theories from critical geography, science and technology studies, and communication, this dissertation attends to the complex practices, multi-species coordinations, and work of translation needed for effective malaria control strategies.

INTRODUCTION

What is Malaria?

Malaria is not a new disease; it has been traced back over 100,000 years.[1] In 2700 BCE, its symptoms were discussed in the Chinese medical text, *Nei Ching*.[2] Hippocrates cited climate and geography as being probable causes of the disease he identified as marsh fever, and the disease's current moniker originated in Medieval Italy as mal-aria, bad air.[3] Malaria is now colloquially understood as both the name of the disease and the parasite that causes the disease, though that parasite's scientific appellation is *Plasmodium*.[4] The World Health Organization (WHO) "estimates that 214 million cases of malaria occurred worldwide in 2015 (uncertainty range: 149–303 million) and about 438,000 people died from the disease (uncertainty range: 236,000–635,000), mostly children under five years of age in sub-Saharan Africa."[5]

Malaria in the modern context begins with Alfonse Laveran's first identification

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[1]Robert Sallares, Abigail Bouwman and Cecilia Anderung, "The Spread of Malaria to Southern Europe in Antiquity: New Approaches to Old Problems," *Medical History* 48, no. 3 (2004); Sonia Shah, *The Fever: How Malaria Has Ruled Humankind for 500,000 Years* (New York: Farrar, Straus and Giroux, 2010).

[2] E Hempelmann and K Krafts, "Bad Air, Amulets and Mosquitoes: 2,000 Years of Changing Perspectives on Malaria.," *Malar J* 12(2013); Centers for Disease Control and Prevention, "The History of Malaria, an Ancient Disease." (2012): http://www.cdc.gov/malaria/about/history/; Charles M. Poser and George W. Bruyn, *An Illustrated History of Malaria* (New York: The Parthenon Publishing Group, 1999).

[3]Hippocrates, *On Airs, Waters and Places (Dodo Press)* (Dodo Press, 2009); Centers for Disease Control and Prevention, "The History of Malaria."; Williams, Louis Laval, "Malaria at the Making of History." *Clinical Excepts*, 1941. Louis Laval Williams Papers 1927-1970, Box 7 of 12, National Library of Medicine.

[4] There are at least 50 species of *Plasmodium,* but only five infect humans: the least common are *knowlesi, ovale* and *malariae,* while *vivax* and *falciparum* are more widespread. *Vivax* infects the most people, but *falciparum* is the most deadly. K*nowlesi* is a *Plasmodium* species that had only infected monkeys but has recently been found in humans. For more on *Plasmodium knowlesi* see: Janet Cox-Singh*, et al.*, "*Plasmodium Knowlesi* Malaria in Humans is Widely Distributed and Potentially Life-Threatening," *Clinical Infectious Diseases: an official publication of the Infectious Diseases Society of America* 46, no. 2 (2008); Figtree Melanie*, et al.*, "*Plasmodium Knowlesi* in Human, Indonesian Borneo," *Emerging Infectious Disease Journal* 16, no. 4 (2010).

[5] World Health Organization, "Malaria: Information for Travelers." (2015): accessed Nov. 4, 2015, http://www.who.int/malaria/travellers/en/.

of the *Plasmodium* parasite under a microscope in 1881 and the with the recognition of the *Anopheles* mosquito as its vector by Sir Ronald Ross and Giovanni Grassi in 1899.[6] Rather than emanating from marshes and bad air, malaria has since been understood to be comprised of three components: the *Plasmodium* parasite, a mammal/bird/reptile host, and the *Anopheles* mosquito.[7] Malaria infection and transmission are now understood to be tied up with the complicated multi-stage and multi-sited reproduction process of *Plasmodium*: When the female *Anopheles* mosquito bites an infected mammalian/bird/ reptile host, *Plasmodium* parasites get taken up in the mosquito's bite and travel with the blood-meal into the mosquito's gut, where they sexually reproduce. During this incubation period, the *Plasmodium* manipulate the mosquito's behavior to their advantage: While the parasites are gestating in the mosquito's gut, the mosquito becomes less aggressive, more sedate, and feeds less often (and thus less likely to be swatted by

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[6] Ernesto Capanna, "Grassi Versus Ross: Who Solved the Riddle of Malaria?," *International Microbiology* 9(2006); Centers for Disease Control and Prevention, "The History of Malaria."; Francis EG Cox, "History of the Discovery of the Malaria Parasites and Their Vectors," *Parasites & Vectors* 3(2010); M.J. Dobson, "The Malariology Centenary.," *Parassitologia* 41, no. 1-3 (1999); B Fantini, "The Discovery of Transmission Mechanisms and the Fight Against Malaria in Italy.," *Medicina nei secoli* 6, no. 1 (1994); B. Fantini, "The Concept of Specificity and the Italian Contribution to the Discovery of the Malaria Transmission Cycle," *Parassitologia* 41, no. 1-3 (1999); Poser and Bruyn, *Illustrated History of Malaria*; Ronald Ross, *Memoirs, with a Full Account of the Great Malaria Problem and Its Solution* (London: John Murray, 1923); U.S. Department of Health and Human Services, *Understanding Malaria: Fighting an Ancient Scourge* (U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Allergy and Infectious Diseases, NIH Publication No. 07-7139, 2007).

[7] *Plasmodium* can infect most mammals as well as some birds and reptiles, but these infections cannot be traded across species. For more on non-human malarias and the problematic nature of non-human research models as well as of the distinction between human and non-human malarias, see: Loretta A Cormier, *The Ten-Thousand Year Fever: Rethinking Human and Wild-Primate Malarias (New Frontiers in Historical Ecology)* (Left Coast Press, 2011); Jean Langhorne*, et al.*, "The Relevance of Non-Human Primate and Rodent Malaria Models for Humans," *Malaria Journal* 10, no. 1 (2011).

humans or subject to other form of predation).[8] Once gestation is complete, however, the parasite makes the mosquito "bite more often, and more persistently."[9]

When this mosquito then bites a mammal/bird/reptile, hundreds of *Plasmodium* enter the host's bloodstream and immediately take up residence in the liver; within one hour there is no trace of them in the host's blood.[10] Inside the hosts' liver, *Plasmodium* repeatedly asexually reproduce for a period of nine to sixteen days and after this incubation period up to 50,000 new parasites leave the liver and try to invade red blood cells.[11] In a process that is still not well understood, every two to three days the parasites burst through the hemoglobin cells and are released by the thousands into the bloodstream. The emergence of the parasites as well as the waste from the destroyed cells cause the classic relapsing and remitting fever of the malaria patient. Some malariologists hypothesize that the exhaustion people experience during these fevers has similar effects as the lethargy of the infected mosquito: Stationary bodies work in *Plasmodium's* favor as they are easier for *Anopheles* to find and feed on, thus continuing the transmission cycle.[12]

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[8] Lauren J. Cator, *et al.*, "Do Malaria Parasites Manipulate Mosquitoes?," *Trends in Parasitology* 28, no. 11 (2012); Heather M. Ferguson, *et al.*, "The Presence of *Plasmodium Falciparum* Gametocytes in Human Blood Increases the Gravidity of *Anopheles Gambiae* Mosquitoes," *The American Journal of Tropical Medicine and Hygiene* 73, no. 2 (2005); J C Koella, F L Sørensen and R A Anderson, "The Malaria Parasite, *Plasmodium Falciparum*, Increases the Frequency of Multiple Feeding of Its Mosquito Vector, *Anopheles Gambiae*.," *Proceedings of the Royal Society B: Biological Sciences* 265, no. 1398 (1998); Shah, *The Fever*; Joseph W. Wekesa, Robert S. Copeland and Richard W. Mwangi, "Effect of Plasmodium Falciparum on Blood Feeding Behavior of Naturally Infected Anopheles Mosquitoes in Western Kenya," *The American Journal of Tropical Medicine and Hygiene* 47, no. 4 (1992).

[9] Quoted in: Shah, *The Fever.*, p. 18. See also: Cator, *et al.*, "Do Malaria Parasites Manipulate Mosquitoes?"; Ferguson, *et al.*, "Presence of *Plasmodium Falciparum* Gametocytes in Human Blood."; Koella, Sørensen and Anderson, "Malaria Parasite Increases the Frequency of Feeding of Mosquito Vector."; Wekesa, Copeland and Mwangi, "Effect of Plasmodium Falciparum on Blood Feeding."

[10] Bernard Marcus, *Malaria (Deadly Diseases and Epidemics)* (Chelsea House Pub (L), 2009).

[11] Ibid.

[12] Shah, *The Fever*.

Geography and landscapes are still important to malaria transmission: geographic conditions need to sustain both mammalian/bird/reptilian and mosquito life and reproduction as well as have areas where mammals/birds/reptiles and mosquitoes come into contact with each other. Today, malaria infections occur mostly in the Equatorial band, but this was not the case in the mid-nineteenth century when "an estimated 90% of the world's population lived in malarious areas," and into the mid-twentieth century Northern Russia, England, the Netherlands, and much of the United States all had significant malaria infections.[13]

The long history and wide geographic reach of the disease has meant that the malaria parasite, the *Anopheles* mosquitoes, and humans have co-existed for a long time. But co-existed is likely the wrong word — the three do not create a beneficial equilibrium but are literally in a parasitic tension, with *Plasmodium* parasite negatively impacting the health and longevity of humans and mosquitoes alike. In a 2000 article in *Bulletin of the World Health Organization*, malaria was identified as "a killer of human beings . . . [that] historically and still today, has few rivals."[14] Biologists Sallares and Gomzi have written that the "interaction between various parts of the human genome and malaria is a challenge to the neutral theory of molecular evolution. . . . [and] a very

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[13] Quoted in: Kamini Mendis*, et al.*, "From Malaria Control to Eradication: The Who Perspective," *Tropical Medicine & International Health* 14, no. 7 (2009). , p. 803. See also: Randall M. Packard, *The Making of a Tropical Disease: A Short History of Malaria (Johns Hopkins Biographies of Disease)* (The Johns Hopkins University Press, 2007); Reiter Paul, "From Shakespeare to Defoe: Malaria in England in the Little Ice Age," *Emerging Infectious Disease* 6, no. 1 (2000); Richard Paul, Mawlouth Diallo and Paul Brey, "Mosquitoes and Transmission of Malaria Parasites - Not Just Vectors.," *Malaria Journal* 3, no. 1 (2004); "Maps showing areas in England where malaria was endemic in the 19th and 20th centuries." WTI/PGS/8:Box 1, Wellcome Library; Sallares, Bouwman and Anderung, "The Spread of Malaria to Southern Europe in Antiquity."

[14] Richard Carter and Kamini N. Mendis, "Evolutionary and Historical Aspects of the Burden of Malaria," *Clinical Microbiology Reviews* 15, no. 4 (2002). , p. 579

important example of natural selection in action”[15]

Plasmodium's negative population pressure has produced a multitude of genetic adaptations in all three species: in humans, foundational genetic and cultural adaptations have increased immunity to the parasite’s effects, such as the Duffy gene, Sickle-cell anemia, and thalassemia (with its forced dietary changes);[16] the parasite has adapted to survive those human adaptations as well as to the chemotherapeutic agents used by hosts to rid their bodies of the parasites; and *Anopheles* mosquitoes have adapted to resist chemical and biological agents used to control their reproduction and development as well as to the genetic mutations forced by humans as a means of controlling their populations.[17] Geneticist Dominic Kwiatkowski has asserted that malaria is “the strongest known force for evolutionary selection in the recent history of the human genome,” and

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[15] Robert Sallares and Susan Gomzi, “Biomolecular Archaeology of Malaria,” *Ancient Biomolecules* 3, no. 3 (2001), p. 195. The neutral theory of molecular evolution posits that at molecular or genomic levels, evolution is premised on random mutations rather than natural selection. See also: “The Neutral Theory.” *Understanding Evolution* (2015): University of California Museum of Paleontology. http://www.evolution.berkeley.edu/evolibrary/article/0_0_0/misconcep_08. Sallares and Gomzi argue that the “biomolecular archaeology of malaria” settles this longstanding debate in favor of natural selection.

[16] Lawrence S. Greene and Maria Enrica Danubio, *Adaptation to Malaria: The Interaction of Biology and Culture* (CRC Press, 1998).

[17] Sallares and Gomzi, “Biomolecular Archaeology of Malaria.”; Carter and Mendis, “Evolutionary and Historical Aspects of the Burden of Malaria.”; Nina L Etkin, “The Co-Evolution of People, Plants, and Parasites: Biological and Cultural Adaptations to Malaria.,” *Proc Nutr Soc* 62, no. 2 (2003); Greene and Danubio, *Adaptation to Malaria*; SL Hoffman*, et al.*, “Plasmodium, Human and Anopheles Genomics and Malaria,” *Nature* 415(2002). 11832959; Dominic P. Kwiatkowski, “How Malaria Has Affected the Human Genome and What Human Genetics Can Teach Us About Malaria,” *American Journal of Human Genetics* 77, no. 2 (2005); Shah, *The Fever*; D.J. Weatherall and J.B. Clegg, “Inherited Haemoglobin Disorders: An Increasing Global Health Problem,” *Bulletin of the World Health Organization* 79(2001); For more on the particular genetic adaptations of the malaria parasite see: FJ Ayala, AA Escalante and SM Rich, “Evolution of Plasmodium and the Recent Origin of the World Populations of Plasmodium Falciparum.,” *Parassitologia* 41, no. 1-3 (1999); U. D’Alessandro and H. Buttiëns, “History and Importance of Antimalarial Drug Resistance,” *Tropical Medicine & International Health* 6, no. 11 (2001); M.J. Mackinnon and K. Marsh, “The Selection Landscape of Malaria Parasites.,” *Science* 328, no. 5980 (2010); Stephen M Rich*, et al.*, “Malaria’s Eve: Evidence of a Recent Population Bottleneck Throughout the World Populations of *Plasmodium Falciparum*,” *Proceedings of the National Academy of Sciences of the United States of America* 95, no. 8 (1998); Sallares, Bouwman and Anderung, “The Spread of Malaria to Southern Europe in Antiquity.”; Teddi J. Setzer, “Malaria Detection in the Field of Paleopathology: A Meta-Analysis of the State of the Art,” *Acta Tropica* 140(2014); Carol Hopkins Sibley, “Understanding Drug Resistance in Malaria Parasites: Basic Science for Public Health,” *Molecular and Biochemical Parasitology* 195, no. 2 (2014).

Sallares and Gomzi claim "the pressure of natural selection by malaria has made a greater impact on the human genome than any other pathogen."[18] Kwiatkowski estimates that 7% of the world's population has a genetic variation due to malaria.[19]

Aside from genetic adaptation, the most common human strategy for limiting malaria infections historically was geographic — avoid areas known to be malarious. Avoiding malaria is the reason that the US Congress and Supreme Courts had a summer recess to avoid Philadelphia and Washington DC during the months when malaria was most common; similarly, communities of British in Colonial India moved to Hill stations in summer believing them to be healthier than lower elevations.[20] Changing agricultural technologies, practices, and modes of transportation, as well as the relocation of laborers' living quarters away from marshes and swamps began to lower malaria transmission rates in the nineteenth century.[21]

In addition to these geographic remedies, humans (and other mammals) have long made use of pharmacological treatments to prevent and treat malaria. Chimpanzees chew

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[18] Sallares and Gomzi, "Biomolecular Archaeology of Malaria," p. 18; Kwiatkowski, "How Malaria Has Affected the Human Genome," p. 171

[19] Kwiatkowski, "How Malaria Has Affected the Human Genome"; See also:Carter and Mendis, "Evolutionary and Historical Aspects of the Burden of Malaria."; Sallares and Gomzi, "Biomolecular Archaeology of Malaria."; Weatherall and Clegg, "Inherited Haemoglobin Disorders: An Increasing Global Health Problem."

[20] See for example: Nandini Bhattacharya, *Contagion and Enclaves: Tropical Medicine in Colonial India* (Liverpool University Press, 2013); Dane Kennedy, *The Magic Mountains: Hill Stations and the British Raj* (University of California Press, 1996); Judith T Kenny, "Climate, Race, and Imperial Authority: The Symbolic Landscape of the British Hill-Station in India," *Annals of the Association of American Geographers* 85(1995); Poser and Bruyn, *Illustrated History of Malaria*.

[21] George Bradley, "A Review of Malaria Control and Eradication in the United States," *Mosquito News* 26 (1966); J. de Zulueta, "Malaria and Ecosystems: From Prehistory to Posteradication.," *Parassitologia* 36, no. 1-2 (1994); A Enayati and J Hemingway, "Malaria Management: Past, Present, and Future.," *Annu Rev Entomol* 55(2010); SI Hay*, et al.*, "The Global Distribution and Population At Risk of Malaria: Past, Present, and Future," *Lancet Infect Dis* 4(2004); Margaret Humphreys, "Kicking a Dying Dog: DDT and the Demise of Malaria in the American South, 1942-1950," *Isis* 87, no. 1 (1996); Packard, *Making of a Tropical Disease*.

on the M*ululuza* shrub to alleviate malaria symptoms.[22] Used for centuries in a medicinal tea in Peru, the bark of the cinchona tree was brought back to Europe in 1631 where it was widely adopted as for both preventative and curative treatments and came to be called quinine.[23] Quinine and synthetic derivatives were used through the twentieth century until parasitic resistance rendered them all but useless. During the Vietnam War, Chinese scientists 'rediscovered' the anti-malarial properties of Artemisinin (from *Artemisia annua,* the sweet wormwood tree) in a medical text from 168 BCE.[24] Although subsequently used widely in Asia, Artemisinin's roots in Chinese medicine made Western malariologists and pharmaceutical companies wary until 1994 when Novartis bought the manufacturing rights to it and lumetantrine which they combined into an effective

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[22] Shah, *The Fever*.

[23] Centers for Disease Control and Prevention, "The History of Malaria."; Hempelmann and Krafts, "Bad Air, Amulets and Mosquitoes."; Mark Honigsbaum, *The Fever Trail: In Search of the Cure for Malaria* (New York: Farrar, Straus and Giroux, 2001); National Public Radio, "Herbs and Empires: A Brief History of Malaria Drugs." YouTube Video (2012): 2:35, https://youtu.be/IrNL27eWKOI; Poser and Bruyn, *Illustrated History of Malaria*; Fiammetta Rocco, *Quinine: Malaria and the Quest for a Cure That Changed the World* (Harper Perennial, 2004); Shah, *The Fever*.

[24] Carmichael, Mary, "Halting the World's Most Lethal Parasite: Immunizing Mosquitoes and Other 'Crazy' Antimalaria Ideas." *Scientific American*, 2010; Elisabeth Hsu, "Reflections on the 'Discovery' of the Antimalarial Qinghao," *British Journal of Clinical Pharmacology* 61, no. 6 (2006); Lite, Jordan, "What is Artemisinin?" *Scientific American*, 2008; National Public Radio, "Herbs and Empires."; National Public Radio, "The Development of Antimalarial Drugs." Tumblr Essay (2015): http://npr.tumblr.com/post/130575267456/skunkbear-the-development-of-antimalarial-drugs; Shah, *The Fever*.
Despite Artemisinin's discovery being part of a State-run science program, one of the 2015 Nobel Prize in medicine was controversially awarded to a single scientist involved in the project. See: Altman, Lawrence K., "3 Scientists Win Nobel Prize in Medicine for Parasite-Fighting Therapies." *The New York Times*, 10/5/15; Chappell, Bill, "Work on Parasite Diseases Earns Nobel Prize for Medicine." *National Public Radio*, 2015; Fu, Jia-Chen, "The Secret Maoist Chinese Operation That Conquered Malaria—and Won a Nobel." *New Republic*, 2015; Gorman, Christine, "Medicine Nobel Recognizes Fights Against Malaria and River Blindness." *Scientific American*, 2015; National Public Radio, "The Development of Antimalarial Drugs."

combination therapy in 1999.[25] Parasitic resistance has undermined this efficacy and the search continues for new prophylactic and therapeutic remedies.[26]

With Ross and Grassi's identification of the *Anopheles* mosquito as the malaria vector in 1899, control or elimination of mosquito populations also became a strategy to lower malaria transmission.[27] These strategies have included the screening of doors and windows to prevent mosquitoes from entering buildings as well as environmental changes like engineering projects to limit or remove mosquito breeding sites such as draining marshes, swamps, and other areas mosquitoes where laid their eggs (efforts known as species sanitation).[28] Additionally, various chemicals have been used to kill

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[25] Altman, "3 Scientists Win Nobel Prize in Medicine."; Andrea Bosman and Kamini N. Mendis, "A Major Transition in Malaria Treatment: The Adoption and Deployment of Artemisinin-Based Combination Therapies," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Joel G. Breman, Martin S. Alilio and Anne Mills, "Conquering the Intolerable Burden of Malaria: What's New, What's Needed: A Summary," *Am J Trop Med Hyg* 71, no. 2_suppl (2004 August 1); Hellen Gelband and Andreas Seiter, "A Global Subsidy for Antimalarial Drugs," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Gorman, "Medicine Nobel Recognizes Fights Against Malaria."; Victoria Hale*, et al.*, "Microbially Derived Artemisinin: A Biotechnology Solution to the Global Problem of Access to Affordable Antimalarial Drugs," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Hsu, "Reflections on the 'Discovery' of Qinghao."; Lite, "What is Artemisinin?"; Yoel Lubell*, et al.*, "The Cost-Effectiveness of Parasitologic Diagnosis for Malaria-Suspected Patients in an Era of Combination Therapy," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Shah, *The Fever*; Lasse S. Vestergaard and Pascal Ringwald, "Responding to the Challenge of Antimalarial Drug Resistance By Routine Monitoring to Update National Malaria Treatment Policies," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007).

[26] Bosman and Mendis, "A Major Transition in Malaria Treatment."; Breman, Alilio and Mills, "Conquering the Intolerable Burden of Malaria."; Carmichael, "Halting the World's Most Lethal Parasite."; National Public Radio, "Herbs and Empires."; Shah, *The Fever*; Irwin W. Sherman, *The Elusive Malaria Vaccine: Miracle Or Mirage?* (ASM Press, 2009); David Turnbull, "The Push for a Malaria Vaccine," *Social Studies of Science* 19, no. 2 (1989); Vestergaard and Ringwald, "Responding to the Challenge of Antimalarial Drug Resistance."

[27] DJ Bradley, "Watson, Swellengrebel and Species Sanitation: Environmental and Ecological Aspects.," *Parassitologia* 36, no. 1-2 (1994); Gordon Covell, *Malaria Control by Anti-Mosquito Measures* (Calcutta and Simla: W. Thacker & Co., 1931); Fantini, "The Discovery of Transmission Mechanisms and the Fight Against Malaria in Italy."; Fantini, "Concept of Specificity and the Italian Contribution."; Flemming Konradsen*, et al.*, "Engineering and Malaria Control: Learning From the Past 100 Years," *Acta Tropica* 89, no. 2 (2004); Ronald Ross, *The Prevention of Malaria* (Nabu Press, 2010).

[28] See for example: Ann H. Kelly and Javier Lezaun, "Walking Or Waiting? Topologies of the Breeding Ground in Malaria Control," *Science as Culture* 22, no. 1 (2013); Packard, *Making of a Tropical Disease*; The Rockefeller Foundation, *Annual Report 1917* (New York: The Rockefeller Foundation, 1917); Ross, Ronald, "Mosquito Brigades and How to Organise Them." 1902. NLM ID 12011330R, History of Medicine Division of National Library of Medicine; Paul F. Russell, "Automatic Distribution of Paris Green for Malaria Control," *The Journal of Parasitology* 19, no. 3 (1933).

adult mosquitoes or prevent them from reproducing such as diesel oil and Paris Green in early twentieth century, and then "the atomic bomb of insecticides," DDT in the 1930s.[29] More recent attempts have included genetically altering of mosquitoes to stop them from reproducing or to make them resistant to the malaria parasite.[30] The scale of control measures has varied from neighborhood, city, state, and national-level interventions to global initiatives to eradicate malaria such as the Rockefeller Foundations efforts in the early 20th century, the World Health Organization's Global Malaria Eradication Programme which ran from 1955-69, and more recent attempts by the Bill and Melinda Gates Foundation, the President's Malaria Initiative, Roll Back Malaria, and others to "shrink the [global] malaria map."[31]

Malaria is a disease that has been deeply imbricated in global expansion of

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[29] Quoted in: Thomas Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton University Press, 1983). See also: Justin M. Andrews, "North Africa, Italy, and the Islands of the Mediterranean," In *Preventive Medicine in World War II*, Volume 6, edited by Jr. Colonel John Boyd Coates, 249–302. Washington, DC: Office of the Surgeon General, 1963; John Farley, *To Cast Out Disease: A History of the International Health Division of Rockefeller Foundation (1913-1951)* (Oxford University Press, USA, 2003); S Hay, DL Smith and RW Snow. "Measuring Malaria Endemicity From Intense to Interrupted Transmission." *Lancet Infectuous Disease* 8(6), (June 01 2008): 369–78.; Poser and Bruyn, *Illustrated History of Malaria*; Fred Soper, "Paris Green in the Eradication of *Anopheles Gambiae*: Brazil, 1940; Egypt, 1945.," *Mosquito News* 26(1966); Edmund Russell, *War and Nature: Fighting Humans and Insects With Chemicals From World War I to Silent Spring (Studies in Environment and History)* (Cambridge University Press, 2001).

[30] See for example: Uli Beisel and Christophe Boëte, "The Flying Public Health Tool: Genetically Modified Mosquitoes and Malaria Control," *Science as Culture* 22, no. 1 (2013); Carmichael, "Halting the World's Most Lethal Parasite."; Roberts, Michelle, "Scientists Create Infertile Mosquitoes." *BBC News Online*, 2015. http://www.bbc.com/news/health-35024794; U.S. Department of Health and Human Services, *Understanding Malaria*.

[31] Quoted in: Richard GA Feachem*, et al.*, "Shrinking the Malaria Map: Progress and Prospects," *Lancet* 376, no. 9752 (2010). See also: D.J. Bradley, "The Particular and the General. Issues of Specificity and Verticality in the History of Malaria Control," *Parassitologia* 40(1998); Centers for Disease Control and Prevention, "The History of Malaria."; Hay, "Measuring Malaria Endemicity."; Jennifer Keiser, Burton H Singer and Jürg Utzinger, "Reducing the Burden of Malaria in Different Eco-Epidemiological Settings With Environmental Management: A Systematic Review," *The Lancet Infectious Diseases* 5, no. 11 (2005); Ann H Kelly and Uli Beisel, "Neglected Malarias: The Frontlines and Back Alleys of Global Health," *BioSocieties* 6, no. 1 (2011); Ann H Kelly*, et al.*, "'Like Sugar and Honey': The Embedded Ethics of a Larval Control Project in the Gambia," *Social Science & Medicine* 70, no. 12 (2010); Kelly and Lezaun, "Walking Or Waiting?"; Ann H. Kelly and Javier Lezaun, "Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation in Dar Es Salaam," *American Ethnologist* 41, no. 2 (2014); Mendis*, et al.*, "From Malaria Control to Eradication."; Packard, *Making of a Tropical Disease*.

colonial and military interests. British Colonel C. H. Melville noted, “the history of malaria in war might almost be taken to be the history of war itself.”[32] Historians such as Randall Packard have credited the swampy marshland that surrounded Rome with helping that empire to gain and sustain prominence, as malaria infections decimated invading armies.[33] In 1899, Joseph Chamberlain, the British Secretary to the Colonies, stated that “the man who shall . . . find the cure for malaria, . . . and shall make the tropics livable for white men . . . will do more for the world, more for the British Empire, than the man who adds a new province to the wide dominion of the Queen.[34] Similarly, in 1923 Ronald Ross wrote that malaria had “done more than anything else to prevent the settlement and civilisation of the vast areas which would otherwise be most suitable for the human race.”[35] Malaria’s power to limit the easy movement of humans has impacted Allied and American military efforts: In 1942, Major General Biggan, from the Royal Army Medical Corps told US officials that “malaria is by far the most important problem that we have to face in most tropical and sub-tropical countries;”[36] and the US National Institutes of Health (NIH) estimate that during World War II and the Vietnam War, “more personnel time was lost due to malaria than to bullets.”[37]

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[32] C.H. Melville, “The Prevention of Malaria in War,” *In The Prevention of Malaria,* edited by Ronald Ross, 577–99. Miami: HardPress, 2010 (1910)., p. 577

[33] Packard, *Making of a Tropical Disease*; W. H. S. Jones, *Malaria: a Neglected Factor in the History of Greece and Rome* (University of California Libraries, 1907); Robert Sallares, *Malaria and Rome: A History of Malaria in Ancient Italy* (Oxford University Press, 2002); Sallares and Gomzi, “Biomolecular Archaeology of Malaria.”; Shah, *The Fever*.

[34] “Mr Chamberlain and the Colonies.” *The Times*, 1899.

[35] Ross, *Memoirs*., p. 113

[36] “Major General Biggan, Royal Army Medical Corps, Addressing U.S. National Research Council Division of Medical Sciences, Subcommittee on Tropical Diseases.” 1942. Box 5 [Folder 3] National Resource Council, 1942-3, National Archives at College Park, College Park, MD.

[37] U.S. Department of Health and Human Services, *Understanding Malaria*., p. 2

As well as its widespread influence on global history, malaria has also often explicitly been identified as "a local disease."[38] This emphasis on locality has multiple points of articulation. Nandini Bhattacharya has argued that the idea of "locality" in malaria research resulted from particular configurations of colonial governance and tropical medicine in the early twentieth century.[39] But in a literal, biological manner, local geographic conditions matter: The type of malaria, the severity of symptoms, the lethality, and the species of *Anopheles* all can vary within areas of narrow geographic differences. For example, the flight range of different *Anopheles* species can vary by miles, as can elevation tolerances (and thus how large the radius of transmission can be and where control measures need to be).[40] Also, the amount of water needed for an *Anopheles* mosquito to lay her eggs can vary dramatically: some need larger pools of standing water, while others can incubate and hatch in a puddle in a rut on a dirt road. Also, the length of time *Anopheles* eggs need to develop into adult mosquitoes is not uniform for all species.[41] Transmission rates generally vary by season but the variations in mosquito biting patterns and human susceptibility to mosquito bites do not always

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[38] Elfatih Mohamed Malik, Osman Khalafalla, "Malaria in Sudan: Past, Present and the Future (Obstetrical and Gynecological Society of the Sudan, 20th Conference)," *Gezira Journal of Health Sciences* 1, no. supplement (2004); World Health Organization, *Guidelines for Implementation of Roll Back Malaria at District Level* (Regional Office for South-East Asia New Delhi, 2003); Richard Carter, Kamine N. Mendis and Donald Roberts., "Spatial Targeting of Intervention Against Malaria," *Bulletin of the World Health Organization* 78, no. 12 (2000); Halima Abdullah Mwenesi, "Social Science Research in Malaria Prevention, Management and Control in the Last Two Decades: An Overview," *Acta Tropica* 95, no. 3 (2005); Keiser, Singer and Utzinger, "Reducing the Burden of Malaria."; Bradley, "Watson, Swellengrebel and Species Sanitation."; Konradsen*, et al.*, "Engineering and Malaria Control: Learning From the Past 100 Years."; Thomas F McCutchan, "Malaria Control in Africa: A Mirage À Trois," *Future Microbiology* 3(2008); Kelly and Lezaun, "Walking Or Waiting?"; C.W. Daniels and H.B. Newham, *Laboratory Studies in Tropical Medicine* (John Bale, Sons & Danielsson, 1911).

[39] Nandini Bhattacharya, "The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900–30," *Medical History* 55, no. 2 (2011).

[40] Kelly and Beisel, "Neglected Malarias."; Beisel and Boëte, "The Flying Public Health Tool."

[41] Centers for Disease Control and Prevention, "Anopheles Mosquitoes." (2012): http://www.cdc.gov/malaria/about/biology/mosquitoes/index.html.

correlate to mathematical transmission models.[42] These species and transmission variabilities, as I will discuss later, have caused and continues to cause tremendous problems in controlling malaria infection rates.

But beyond the sophistication of the *Anopheles,* other complexities of malaria transmission and infection — the genetic adaptability of *Plasmodium*, human immunology, the effects of local geography and climate — have challenged disciplinary and organizational infrastructures of those governments and groups trying to study it. Erwin Ackerknecht wrote in 1945 of malaria's multiple components presenting problems to structures of specialized knowledge: "The biologist [sees] malaria as an entomological problem, while the health officer [sees] it only from the point of view of treatment or mosquito eradication, . . . but the specialist neither can nor will explain the whole phenomena."[43] Understanding and controlling malaria continues to require knowledge and expertise across a variety of fields, disciplines, sub-disciplines, and across a variety of scales. It is a disease that encompasses parasites and blood cells only visible through microscopes, mosquito larvae, mosquitoes, and has come to include nanotechnology, chemicals like quinine, DDT, Artemisinin cocktails, but also "research networks, charitable foundations, public health programmes, governmental, non-governmental, [and supra-governmental] organizations."[44] As anthropologists Kelly and Beisel note, "The historical, sociological and political life of [malaria] exceeds the moment of the

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[42] Paul, Diallo and Brey, "Mosquitoes and Transmission of Malaria Parasites."

[43] Erwin H Ackerknecht, *Malaria in the Upper Mississippi Valley 1760-1900* (Baltimore: Johns Hopkins Press, 1945). , p. 130

[44] Kelly and Beisel, "Neglected Malarias," p. 72

parasitological exchange."[45]

This multiplicity of malaria returns me to the question I began the introduction with: *What is Malaria?* The multiplicities of malaria make it impossible to divorce this ontological question from the epistemological question: *How do we know what we know about malaria? What is Malaria* can only be answered through analyzing the assemblage and coordinations of non-humans, materialities, spaces, and humans in sociopolitical contexts; *what malaria is* can only known through engaging in an onto-epistemological analysis.

To address malaria's onto-epistemology, I begin with ontology. Following philosopher Jeff Malpas, I see ontology as having two aspects: In one meaning, it is a noun that "refers to the set of basic elements that are presupposed by a particular vocabulary, theory, or descriptive framework"; and in another, it is analytic activity that "aims at exhibiting the underlying presuppositions . . . of the very possibility of meaning, knowledge, or appearance."[46] In the second sense, ontological analysis is not a search for singular explanations or foundations, but instead is an engagement with non-reducible, multiple conditions of possibility. Engaging malaria's ontological multiplicities is important to analyzing the histories of attempts to control it.

Annemarie Mol is similarly interested in ontology and multiplicities, and uses arteriosclerosis as her case.[47] She follows the disease through multiple sites (within

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[45] Ibid.

[46] Jeff Malpas, "Putting Space in Place: Philosophical Topography and Relational Geography," *Environment and Planning D: Society and Space* 30, no. 2 (2012). , p. 230

[47] Annemarie Mol, *The Body Multiple: Ontology in Medical Practice (Science and Cultural Theory)* (Durham: Duke University Press, 2003).

hospitals, surgery suites, doctors' offices, patients' homes, etc.), different groups (patients, doctors, nurses, medical technicians, etc.), and technologies (imaging tools such as angiography and duplex Doppler, surgical interventions. laboratory tests, etc.). Mol asserts that these multiplicities challenge a single ontology of arteriosclerosis and instead insists that there are different arterioscleroses that are "brought into being," (a process Mol identifies as "enacting") through "common, day-to-day, sociomaterial practices."[48] Mol's arterioscleroses are each enacted by different people, practices, and in different spaces, but even with this multiplicity each requires "forms of coordination" to make them "add up, fuse, [and] come together."[49] These coordinations make arteriosclerosis work as a "boundary object" that can legibly travel between these different people, practices, and in these different spaces.[50] In "Neglected Malarias: The Frontlines and Back Alleys of Global Health," Kelly and Beisel extended Mol's analysis to malaria and argued that malaria as a disease would be better understood, and thus more successfully controlled on a global scale, as *malarias*, as many different, geographically specific and local, sub-types of a disease.[51]

While Mol's attention to ontology and practice and Kelly and Beisel's focus in "Neglected Malarias" to the specificities of the local are helpful frames, they do not fully encompass malaria's multiplicities. Mol's foundational work analyzes the multiple daily

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[48] Ibid., pp.6-7

[49] Ibid., p. 55

[50] Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science* 19, no. 3 (1989). For Star and Griesemer, boundary objects are "both adaptable to different viewpoints and robust enough to maintain identity across them." p. 393

[51] Kelly and Beisel, "Neglected Malarias."

practices that enact multiple arterioscleroses, but the question of how those practices came to be "common [and] day-to-day" remains outside the scope of her analysis. Nor does she deeply engage what happens when these multiple diseases cannot be coordinated, reconciled, or made recognizable to the multiple actors (including machines) and practices across the multiple scales of its enactment. For all of the complexities that Mol engages, arteriosclerosis is a disease process within individual bodies; it is not considered infectious, nor does this condition reproduce itself within other species. However, malaria exists and is articulated not just by the practices of humans trying to diagnose and control it.[52] Malaria is not primarily located within a single human body; its multiple components are scattered across landscapes, humans, mosquitoes, and parasites. Malaria's onto-epistemological multiplicities challenge an exclusive focus on human practices as well as an easy reconciliation or remediation into a boundary object. Similarly, while Kelly and Beisel attend in their article to the ontological complexity of malaria and scales of malaria control strategies, they do so by focusing on the practices of humans.

In this dissertation, I analyze the onto-epistemological multiplicities of modern malaria by engaging the practices of coordination between humans, landscapes, and non-human agents (such as parasites, mosquitoes, and maps) in the resistance or success of human practices of controlling malaria. Using the cases of British India and the Allies in

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[52] I am using articulation, following Stuart Hall to mean: "a linkage which is not necessary, determined, absolute and essential for all time. You have to ask under what circumstances can a connection be forged or made? The so-called 'unity' of a discourse is really the articulation of different, distinct elements which can be rearticulated in different ways because they have no necessary 'belongingness.'" from Kuan-Hsing Chen and David Morley, *Stuart Hall: Critical Dialogues in Cultural Studies (Comedia)* (London: Routledge, 1996). , p. 141

World War II, I track the creation and institutionalization of control practices as well as the institutions and infrastructures that were created or adapted to control malaria in ways that became common and day-to-day, even under what may be considered uncommon circumstances such as War World II.[53] I follow the figures of the malariologist, entomologist, parasitologist, engineer, cartographer, cartoonist, as well as enlisted men through their practices of creating reports, catching and dissecting mosquitoes, conducting and analyzing surveys and blood smears, making maps, creating public health campaigns to raise awareness and change human behaviors, and engineering projects that relocated populations of people and reduced or eliminated populations of mosquitoes. But central to my analysis are non-humans — the parasites, the mosquitoes, the landscapes as well as the objects (maps, surveys, DDT, etc.) — that combine and have been combined to enact and articulate particular malarias as well as to aid or resist attempts to control them.

In British India, maps were central to creating and standardizing articulations of malaria and in shaping official control policies. While malaria, as an assemblage of mosquito, parasite, mammals/birds/reptiles, and geography, has historically often resisted becoming a "boundary object," I will also analyze how the Allied efforts incorporated malaria's multiplicities into their control campaigns in the Pacific, and how they created and implemented infrastructures and practices that helped to articulate and reconcile these multiplicities into a legible, coherent, and ultimately, controllable malaria. My

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[53] As the comment from Colonel C. H. Melville above highlights, malaria and war have long been connected, nor is either a rare occurrence. My identification of wartime conditions as uncommon is not to claim an exceptionalism of war, but to signal the more acute motivations for the State to appropriate (or re-appropriate) funds, materials, staff, and other resources during times of war.

attention to these non-human agents helps this dissertation to engage broader questions about the co-production of disease ontology and scales of disease control, and the history and implementation of global health strategies in the 20th and 21st centuries.

Methodological Approaches and Contributions

To address those concerns, this dissertation draws on a wide range of textual sources that include articles published in scientific and medical journals, reports from the League of Nations, WHO, and the Bill and Melinda Gates Foundation, as well as materials physically viewed during archive visits to the National Archives and Records Administration in Morrow, GA and College Park, MD; National Library of Medicine in Bethesda, MD; the Historical Medical Library of The College of Physicians of Philadelphia; Ebling Library for the Health Sciences at University of Wisconsin, Madison; Wisconsin Historical Society in Madison; the British Library; The Library at Wellcome Collection in London; Bodleian and Radcliffe Science Libraries at Oxford University; and the Dr. Seuss Collection at UC San Diego Library. I also utilize materials, particularly images, from online archives including: the CDC's Global Health Chronicles and Public Health Image Library; the National Museum of Health and Medicine's Otis Historical Archives; the National Library of Medicine's Images from the History of Medicine Digital Collection; the Wellcome Library Image Collection; and University of North Texas Digital Library.[54] The sources I use from these archives are both civilian and

[54] Many of the images included in the dissertation are from online sources, but I physically viewed most of these images during archive visits. I have copies of these materials from scanners and my iphone but I generally include the online versions in this dissertation because they have better resolution.

military (often formerly classified) and include correspondence, memorandum, maps, surveys, photographs, reports, scholarly and personal journals, industry advertisements and reports, books, educational pamphlets, posters, films, and calendars.

I see all of these materials both as texts to be analyzed for the meanings they make, and as objects that travel and have their own degrees of agency. To engage these text/objects, this interdisciplinary project engages Malpas' ontological analysis of conditions of possibility and uses methods from cultural studies and Foucauldian-inspired genealogical analysis, literary textual analysis, and social and cultural histories of medicine. All of these methods reject ideas of a great, underlying Truth to be discovered, instead seeing "'truth' [as] an effect of the surface — something that is produced in particular times and spaces."[55] What these effects are, how and where they are produced, what their consequences are, and whom those consequences impact thus become the locus of inquiry and possible intervention.

For Ackerknecht, malaria is "fundamentally social": only by "embracing all aspects of the malaria problem," through "epidemiological and historical research" can it begin to be understood and controlled.[56] I believe this was true when Ackerknecht wrote in 1945, and it continues to be so 70 years later. To engage the complexity of malaria's history, I employ Foucauldian genealogy and historical analysis guided by social and cultural historians of medicine. For historian Mary Fissell, the "attention to the making of meaning" is foundational to cultural history of medicine, in which "meaning is not

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[55] Tim Cresswell, *Geographic Thought: A Critical Introduction* (West Sussex: Wiley-Blackwell, 2013). p. 210

[56] Ackerknecht, *Malaria in the Upper Mississippi Valley*. p. 130

uniform or transhistorical or even apparent. It must be made, and 'making' is not an easy or simple process; it admits of struggle, perhaps even of contest. Meanings that are made can be unmade and remade."[57] Cultural historians focus on the struggles and contests of meaning-making. Similarly, genealogical methods attend to the productions of truths and meanings by focusing on what Michel Foucault identifies as "the connections, encounters, supports, blockages, plays of forces, strategies and so on which at a given moment establish what subsequently counts as being self-evident, universal and necessary."[58] With these approaches, I attend to the struggles of meaning through following the connections, encounters, supports, blockages, plays of forces, and strategies of and between human and non-human actors involved in malaria transmission as well as in control efforts that helped to establish what counted as self-evident, universal, and necessary about malaria in British India and for the Allies in World War II.

Investigation into what counts as self-evident, universal, and necessary, and how they came to be so is important and has wide-reaching resonances across methods and disciplines: Analyzing what is self-evident and is "common sense" is the basis of Antonio Gramsci's "hegemony" as well as common to social and cultural history, literary analysis,

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[57] Mary E. Fissell, "Making Meaning From the Margins: The New Cultural History of Medicine," In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 364–89. Baltimore: Johns Hopkins University Press, 2004. p. 365

[58] Quoted in Michel Foucault, "Questions of Method," In *The Foucault Effect: Studies in Governmentality,* edited by Graham Burchell et al., Chicago: University of Chicago Press, 1991. p. 76. See also: Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York: Random House, 1970); Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception,* trans. A. M. Sheridan Smith (New York: Vintage, 2004); Michel Foucault, *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977* (Vintage, 1980); Friedrich Nietzsche, *The Will to Power,* trans. Walter Kaufmann (New York: Vintage, 1968); Friedrich Nietzsche, *The Genealogy of Morals,* trans. Walter Kaufmann & R.J Hollingdale (New York: Vintage, 1989); Hayden White, *Tropics of Discourse: Essays in Cultural Criticism* (Baltimore: Johns Hopkins University Press, 1986).

and anthropology among other fields.[59] To intervene in the assumed and common sense understandings of malaria, I utilized the Russian Formalist method of "defamiliarization" and "making strange."[60] This move created analytical space to critically engage how malaria, as "an object of knowledge attains [its] epistemological coherence" and raised possible alternate constellations of meanings and understandings.[61]

In coordination with defamiliarization, I also engage methods from social constructionism to interrogate how disease (malaria) makes meanings and attains its coherence.[62] For Ludmilla Jordanova,

> Social constructionism is a valuable perspective for historians of health, medicine, and healing. Far from neglecting material life, it is the only approach that integrates this with ideologies, images, ideas. It is effective partly because it eschews the rigid polarities that weaken other approaches: here, theories and archives are totally compatible; here, ideas are not separated from practices; here, an emphasis on process undercuts

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[59] Antonio Gramsci, *Selections from the Prison Notebooks* (International Publishers Co, 1971). See also: Roger Cooter and Claudia Stein. "Visual Imagery and Epidemics in the Twentieth Century," In *Imagining Illness: Public Health and Visual Culture*, edited by David Serlin, 169–92. Minneapolis: University of Minnesota Press, 2010; Clifford Geertz, *Local Knowledge: Further Essays In Interpretive Anthropology* (Basic Books, 1985); Barbara Johnson,"Translator's Introduction," In *J. Derrida*, Dissemination, vii–xxxiii. Chicago: University of Chicago Press, 1981; Patrick Joyce, *The State of Freedom: A Social History of the British State since 1800* (Cambridge: Cambridge University Press, 2013); Tania Murray Li, *The Will to Improve: Governmentality, Development, and the Practice of Politics* (Durham: Duke University Press, 2007); Joan W. Scott, "History-writing as Critique," In *Manifestos for History*, edited by Keith Jenkins, Sue Morgan and Alun Munslow, 19–38. New York: Routledge, 2007; Christiane Sinding, "The Power of Norms: Georges Canguilhem, Michel Foucault, and the History of Medicine," In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 262–84. Baltimore: Johns Hopkins University Press, 2004.

[60] Victor Shklovsky, "Art as Technique," In *Russian Formalist Criticism: Four Essays, Second Edition*, edited by Lee T. Lemon and Marion J. Reis, University of Nebraska Press, 2012 (1917).

[61] Derek Hook, "Genealogy, Discourse, 'Effective History': Foucault and the Work of Critique," *Qualitative Research in Psychology* Qualitative Research in Psychology 2, no. 1 (2005). p. 16

[62] See for example: Erwin H. Ackerknecht, *Medicine at the Paris Hospital 1794-1848* (Baltimore: The Johns Hopkins Press, 1967); Georges Canguilhem, *The Normal and the Pathological* (New York: Zone Books, 1991); Fissell, "Making Meaning From the Margins."; Foucault, *The Birth of the Clinic*; Ludmilla Jordanova, "The Social Construction of Medical Knowledge," In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 338–63. Baltimore: Johns Hopkins University Press, 2004; George Rosen, *A History of Public Health* (Baltimore: The Johns Hopkins University Press, 1993); Charles E Rosenberg, "Disease in History: Frames and Framers," *The Millbank Quarterly* 62(1989); Charles E Rosenberg, *Explaining Epidemics and Other Studies in the History of Medicine* (Cambridge: Cambridge University Press, 1992); Sinding, "The Power of Norms."

> unproductive distinctions between internal and external factors, content and context, good and bad science.[63]

For constructionists, illness and disease are not things that exist as whole or static entities, waiting to be conquered or cured, prior to human medical intervention. Instead, disease and illness are understood to be multiplicities of interactions and forces: biological bodies, disease entities, and processes; constructed concepts of illness; and social, cultural, and institutional spaces. This attention to interactions and forces creates an understanding of disease as an "object of knowledge" produced by a "vector of forces."[64] This focus also illuminates the uneven burdens and access to treatment for different groups of people.[65]

I keep this attention to disease's unequal impacts on human life, while also de-

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[63] Jordanova, "The Social Construction of Medical Knowledge," p. 365

[64] Hook, "Genealogy, Discourse, 'Effective History'," p. 16

[65]See also: Warwick Anderson, *Colonial Pathologies: American Tropical Medicine, Race, and Hygiene in the Philippines* (Durham: Duke University Press, 2006); David Arnold, *Imperial Medicine and Indigenous Societies (Studies in Imperialism)* (Manchester: Manchester University Press, 1989); Charles L. Briggs and Clara Mantini-Briggs, *Stories in the Time of Cholera: Racial Profiling During a Medical Nightmare* (Berkeley: University of California Press, 2004); Cathy Gere and Bronwyn Parry, "The Flesh Made Word: Banking the Body in the Age of Information," *BioSocieties* 1(2006); Mark Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600-1850* (Oxford University Press, USA, 1999); Judith Walzer Leavitt, *Typhoid Mary: Captive to the Public's Health* (Beacon Press, 1997); Maryinez Lyons, *The Colonial Disease: A Social History of Sleeping Sickness in Northern Zaire, 1900-1940 (Cambridge Studies in the History of Medicine)* (Cambridge University Press, 2002); Bronwyn Parry and Cathy Gere, "Contested Bodies: Property Models and the Commodification of Human Biological Artefacts," *Science as Culture* 15, no. 2 (2006); Dorothy Porter, *The History of Public Health and the Modern State* (Editions Rodopi, 1994); Dorothy Porter, *Health, Civilization and the State: A History of Public Health From Ancient to Modern Times* (Routledge, 1999); Roy Porter, *The Greatest Benefit to Mankind: A Medical History of Humanity* (W. W. Norton & Company, 1999); Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (University of Chicago Press, 1987); Rosenberg, Charles E and Janet Golden, eds. *Framing Disease: Studies in Cultural History* New Brunswick: Rutgers University Press, 1992.; David Serlin, *Replaceable You: Engineering the Body in Postwar America* (Chicago: University Of Chicago Press, 2004); Nayan Shah, *Contagious Divides: Epidemics and Race in San Francisco's Chinatown (American Crossroads)* (Berkeley: University of California Press, 2001); Rosemary Stevens, *In Sickness and in Wealth: American Hospitals in the Twentieth Century* (Johns Hopkins University Press, 1999); Rosemary A. Stevens, Charles E. Rosenberg and Lawton R. Burns, *History and Health Policy in the United States: Putting the Past Back In (Critical Issues in Health and Medicine)* (New Brunswick: Rutgers University Press, 2006); Keith Wailoo, *Drawing Blood: Technology and Disease Identity in Twentieth-Century America* (Baltimore: The Johns Hopkins University Press, 1997).

centering humans from my analytic focus and moving beyond ideas of sociality and agency as being human-centered qualities. To do this, I bring critical geography together with theories of practice and non-human agency from both science and technology studies and communication.[66] As I will discuss shortly, these theories help me engage the spaces and agency of material objects, humans, and non-human in malaria, malaria epidemiology, and malaria control. These theories also open up the space to ask onto-epistemological questions with a slightly shifted focus about the multiple possibilities of malaria: What would a history of mosquitoes or of the parasite be or consist of? And how

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[66] I discuss some of these theories in the literature review, but for a general overview, see for example: Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press Books, 2007); Tony Bennett, and Patrick Joyce, eds. *Material Powers: Cultural Studies, History and the Material Turn (Cresc)* (London: Routledge, 2010); Geoffrey C. Bowker, *Memory Practices in the Sciences (Inside Technology)* (The MIT Press, 2008); Nigel Clark, Doreen Massey, and Phillip Sarre, eds. *Material Geographies: A World in the Making* (London: Sage, 2008); Michael Cole, *Cultural Psychology: A Once and Future Discipline* (The Belknap Press, 1998); Jeremy W. Crampton and Stuart Elden, *Space, Knowledge and Power: Foucault and Geography* (Ashgate Publishing, 2007); Marianne de Laet and Annemarie Mol, "The Zimbabwe Bush Pump: Mechanics of a Fluid Technology," *Social Studies of Science* 30, no. 2 (2000); Richard Drayton, *Nature's Government: Science, Imperial Britain, and the "improvement" of the World* (New Haven: Yale University Press, 2000); Thomas F. Gieryn, "City as Truth-Spot: Laboratories and Field-Sites in Urban Studies," *Social Studies of Science* 36, no. 1 (2006); Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge University Press, 1996); Donna J. Haraway, *Simians, Cyborgs, and Women : The Reinvention of Nature* (New York: Routledge, 1991); Donna J. Haraway, "When Species Meet: Staying With the Trouble," *Environment and Planning D: Society and Space* 28(2010); Edwin Hutchins, "How a Cockpit Remembers Its Speeds," *Cognitive Science* 19, no. 3 (1995); Bruno Latour, "Visualization and Cognition: Thinking With the Eyes and Hands," *Knowledge and Society* 6(1986); Pamela Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001); Chandra Mukerji, *Territorial Ambitions and the Gardens of Versailles (Cambridge Cultural Social Studies)* (Cambridge University Press, 1997); Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi (Princeton Studies in Cultural Sociology)* (Princeton University Press, 2009); Chandra Mukerji, "Space and Political Pedagogy At the Gardens of Versailles," *Public Culture* 24, no. 3 (2012); Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (University of California Press, 2007); Miles Ogborn, *Indian Ink: Script and Print in the Making of the English East India Company* (Chicago: University Of Chicago Press, 2007); Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge: MIT Press, 2002); Noémi Tousignant, "Insects-as-infrastructure: Indicating, Project Locustox and the Sahelization of Ecotoxicology," *Science as Culture* 22, no. 1 (2013); Anna Lowenhaupt Tsing, "Unruly Edges: Mushrooms as Companion Species," *Environmental Humanities* 1(2012); L. S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes* (Harvard University Press, 1978); James V. Wertsch, *Vygotsky and the Social Formation of Mind* (Harvard University Press, 1988); James V. Wertsch, *Mind As Action* (Oxford University Press, 1998); Thongchai Winichakul, *Siam Mapped: A History of the Geo-Body of a Nation* (Honolulu: University of Hawaii Press, 1994).

might this non-human centered approach help improve future malaria control strategies to best address the concerns of the humans who most need their malaria burdens lowered?

This dissertation also contributes to the scholarship about the history of modern malaria control specifically. There has been much secondary literature on malaria in British India from historians of colonial medicine and postcolonial scholars, with their foci ranging from political economy (Klein), to the controversies over malaria's causation (Worboys, Harrison), to disputes between political and scientific actors such as those between Ross, Christophers, and Sir Patrick Manson (a figure who looms large in the history of tropical medicine), (Bynum, Worboys), to examinations, evaluations, and re-examinations of particular policies and experiments to control malaria transmission, with the tea plantations of Duars and Mian Mir getting a lot of attention (Arnold, Bhattacharya, Bynum, Harrison, Worboys).[67] I intervene in this literature not by focusing on whether Ross or Manson was right, or whether mosquito control or quinine should

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[67] For work on malaria in British India see e.g. David Arnold, "'An Ancient Race Outworn': Malaria and Race in Colonial India, 1860-1930," In *Race, Science, and Medicine*, edited by Waltraud Ernst and Bernard Harris, 123–43. London: Routledge, 1999; David Arnold, *The Tropics and the Traveling Gaze: India, Landscape, and Science, 1800-1856* (Seattle: University of Washington Press, 2006); Bhattacharya, "The Logic of Location"; Bhattacharya, *Contagion and Enclaves*; WF Bynum, "'Reasons for Contentment': Malaria in India, 1900-1920.," *Parassitologia* 40, no. 1-2 (1998); William F Bynum, "An Experiment That Failed: Malaria Control At Mian Mir.," *Parassitologia* 36, no. 1-2 (1994); Mark Harrison, *Public Health in British India: Anglo-Indian Preventive Medicine 1859-1914 (Cambridge Studies in the History of Medicine)* (Cambridge: Cambridge University Press, 1994); Mark Harrison, "'Hot Beds of Disease': Malaria and Civilization in Nineteenth-Century British India.," *Parassitologia* 40, no. 1-2 (1998); Harrison, *Climates and Constitutions*; Kennedy, *The Magic Mountains;* Ira Klein, "Death in India: 1871-1921," *Journal of Asian Studies* 32(1973); Ira Klein, "Development and Death: Reinterpreting Malaria, Economics and Ecology in British India," *Indian Economic & Social History Review* 38, no. 2 (2001); Rohan Deb Roy, "Quinine, Mosquitoes and Empire: Reassembling Malaria in British India, 1890-1910.," *South Asian Hist Cult* 4, no. 1 (2013); Michael Worboys, "The Emergence of Tropical Medicine: A Study in the Establishment of a Scientific Specialty," In *Perspectives on the Emergence of Scientific Disciplines*, edited by G. Lemain et al., Mouton: The Hague, 1977; Michael Worboys, "Manson, Ross, and Colonial Medical Policy: Tropical Medicine in London and Liverpool, 1899-1914," In *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion*, edited by R.M. MacLeod and M. Lewis, 21–37. London: Routledge, 1988; Michael Worboys, "Germs, Malaria and the Invention of Mansonian Tropical Medicine: From 'Diseases in the Tropics' to 'Tropical Diseases'," In *Warm Climates and Western Medicine*, edited by David Arnold, 181–207. Amsterdam-Atlanta: Rodopi, 1996.

have been the primary intervention for lowering transmission rates, but through attending to the human and non-human actors and practices that "rendered technical" the problems of malaria and shaped both the possible responses to those problems and resistances to them.[68]

Unlike the preponderance of scholarship on malaria control efforts in India in the early 20th century or on more recent campaigns (such as Kelly and Beisel's), malaria in World War II remains less examined. Other than Harrison's article on British medical administration and Sweeney and Presser's work on Australian malaria control, most scholarship has focused on specific aspects of American control efforts: from campaigns in Papua New Guinea (Fenner, Fenner and Sweeney); to comparing strategies between Papua New Guinea and Melanesia (Bennett); to situating American WWII efforts in a longer military medical history (Beadle and Hoffman); from the role of radio and film broadcasts in American military malaria control (Fedunkiw, Hadlow); to the development of particular technological aspects and innovations (Condon-Rall, Hays, Joy, Slater,

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[68] Li, *The Will to Improve*, pp.7-10

Wacks).[69] Outside of Wacks' Master's thesis on malaria protocols at Guadalcanal and books by Sweeney on Australian control efforts and Slater on biomedical research, this scholarship has been limited to article-length engagements. But WWII is an important time in the history of modern malaria control and a deeper analysis is needed because the Allies created and standardized practices that successfully controlled malaria. As Paul Russell[70] noted in 1963, Allied malaria control efforts were "such [a] striking success that civilian authorities were willing after the war to budget large funds for antimalaria programs. There can be no doubt that antimalaria activities of World War II constituted a prime factor in the development of the present move for worldwide malaria eradication." The success of malarial control in WWII also influenced wider public health campaigns such as the prolific use of DDT to lower general insect populations (not just malaria vectors), the establishment of the Centers for Disease Control (which evolved from the

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[69] Christine Beadle and Stephen L. Hoffman, "History of Malaria in the United States Naval Forces At War: World War I Through the Vietnam Conflict," *Clinical Infectious Diseases* 16, no. 2 (1993); Judith A. Bennett, "Malaria, Medicine, and Melanesians: Contested Hybrid Spaces in World War II," *Health and History* 8, no. 1 (2006); Mary Ellen Condon-Rall, "The Army's War Against Malaria: Collaboration in Drug Research During World War II," *Armed Forces & Society* 21, no. 1 (1994); Marianne Fedunkiw. "Malaria Films: Motion Pictures as a Public Health Tool." Am J Public Health 93(7), (2003 Jul): 1046–57; F Fenner, "Malaria Control in Papua New Guinea in the Second World War: From Disaster to Successful Prophylaxis and the Dawn of DDT," *Parassitologia* 40(1998); F. Fenner, A. W. Sweeney, "Malaria in New Guinea During the Second World War: The Land Headquarters Medical Research Unit," *Parassitologia* 40(1998); Martin Hadlow, "The Mosquito Network: American Military Radio in the Solomon Islands During World War II," *Journal of Radio Studies* 11, no. 1 (2004); Mark Harrison, "Medicine and the Culture of Command: The Case of Malaria Control in the British Army During the Two World Wars," *Medical History* 40(1996); C.W. Hays, "Us Army and Malaria Control in World War II," *Parassitologia* 42(2000); R J Joy, "Malaria in American Troops in the South and Southwest Pacific in World War II.," *Medical History* 43, no. 2 (1999); Cherie L Prosser and Ian A Clark, "The War on Malaria and Nora Heysen's Documentation of Australian Medical Research Through Art Between 1943 and 1945," *Medical Journal of Australia* 194, no. 8 (2011); Leo B. Slater, *War and Disease: Biomedical Research on Malaria in the Twentieth Century (Critical Issues in Health and Medicine)* (New Brunswick: Rutgers University Press, 2009); Tony Sweeney, *Malaria Frontline: Australian Army Research During World War II* (Melbourne: Melbourne University Publishing, 2003); Rachel Elise Wacks, ""Don't Strip Tease for Anopheles": A History of Malaria Protocols During World War II," The Florida State University, Master's thesis, 2013.

[70] Russell, Paul F. "Introduction." Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria (1963): John Boyd Coates Jr. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

US-based Malaria Control in War Areas organization), the development of clinical trials in cancer research, and the move to use multiple drugs in chemotherapy regimens to treat cancer.[71]

My aim in this dissertation is not to uncritically extoll what the British in India or Allies got right. Malaria control practices and policies cannot be divorced from the larger socio-political projects of colonialism and war. These contexts shaped the commitments of the governments involved, as well as what kinds of interventions and coordinations they were willing to engage in: As I will discuss, the primary concerns of many Colonial administrators in India centered on lowering malaria rates among Europeans and the workers on tea estates; Many US military commanders identified the people who had inhabited the Pacific Islands prior to the military's occupation, generically as "Natives" and commonly referred to them as "seed beds" of the malaria decimated Allied Forces.[72] Black soldiers were segregated within US forces and homophobic and heteronormative ideologies undergirded and were perpetuated by the anti-malaria propaganda campaigns.[73] These socio-political contexts are important, and impact the infrastructures and strategies developed to control malaria. I analyze the malaria control objectives in British India and the Allies in WWI, foregrounding non-human material agents and their roles shaping the possibilities of malaria and malaria control. In particular, the Allies

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[71] For the influence of WWII malaria strategies on cancer research see: Siddhartha Mukherjee, *The Emperor of All Maladies: A Biography of Cancer* (New York: Scribner, 2011).

[72] Harper, Paul A., *et al.*, "Malaria and Epidemic Control in the South Pacific 1942-1944." 1945. Reproduced by Engineers HQ SOPACBACOM 2379. Container 15, Folder [P2-3] [Malaria and Epidemic Control in South Pacific Area, 1942-1944] Folders 1-6. Entry #P93: Historical Files, 1942-1946, P2-3, Red 183. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD.

[73] See, e.g.: Chuck Jones, "Private Snafu Vs. Malaria Mike," (1944). US Army First Motion Picture Unit. 16mm.

were successful in coordinating and articulating an assemblage of malaria that produced imaginings of a future where malaria could be easily controlled, eliminated, or even one day eradicated. This successful coordination by the Allies of the species and ontological multiplicities of malaria, particularly with non-human agents and landscapes is a central focus of my analysis.

Throughout this dissertation, I pay particular attention to maps and practices of making maps. The mapping of disease is an important sociomaterial practice that has been under-analyzed. Historians of medicine Brody, Stevenson, Jarcho, Martin, and Shannon have written articles looking at early maps of yellow fever and cholera, Tom Koch has published on the history of disease maps broadly, historical geographers Rupke, Brömer, and Camerini have studied early German maps of global diseases, and medical geographers have written about improving the function and accuracy of disease maps (e.g. Meade and Emch).[74] But despite recent work in critical cartography that has re-engaged the material and discursive work of maps such as Wood's *Rethinking the Power of Maps*, Dodge, Kitchin, and Perkins's edited volume *Rethinking Maps*, or even the 60

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[74] Howard Brody*, et al.*, "Map-Making and Myth-Making in Broad Street: The London Cholera Epidemic, 1854," *The Lancet* 356, no. 9223 (2000); Rainer Brömer, "The first Global Map of the Distribution of Human Diseases: Friedrich Schnurrer's 'Charte über die geographische Ausbreitung der Krankheiten', 1827," In *Medical Geography in Historical Perspective (Medical History Supplement)*, edited by Nicolaas A. Rupke, 176–85. London: Wellcome Trust Centre for the History of Medicine at UCL, 2000; J R Camerini, "Heinrich Berghaus's Map of Human Diseases.," *Medical History. Supplement* 20 (2000); Saul Jarcho, "Yellow Fever, Cholera, and the Beginnings of Medical Cartography," *Journal of the History of Medicine and Allied Sciences Journal of the History of Medicine and Allied Sciences* XXV, no. 2 (1970); Tom Koch, *Cartographies of Disease: Maps, Mapping, and Medicine* (ESRI Press, 2005); Tom Koch, *Disease Maps: Epidemics on the Ground* (Chicago: University Of Chicago Press, 2011); Tom Koch and Kenneth Denike, "Certainty, Uncertainty, and the Spatiality of Disease: A West Nile Virus Example," *Stochastic Environmental Research and Risk Assessment* 21, no. 5 (2007); Stacey L. Martin, "Cartography, Discourse, and Disease: How Maps Shape Scientific Thought About Disease," Georgia State University, Masters thesis, 2005; Melinda S. Meade and Michael Emch, *Medical Geography, Third Edition* (New York: The Guilford Press, 2010); Gary W. Shannon, "Disease Mapping and Early Theories of Yellow Fever," *The Professional Geographer* 33, no. 2 (1981); Lloyd Stevenson, "Putting Disease on the Map: The Early Use of Spot Maps in the Study of Yellow Fever," *Journal of the History of Medicine and Allied Sciences* 20, no. 3 (1965).

excerpted readings in *The Map Reader*, none outside of Mark Monmonier's work on disease maps as tools of persuasion, have engaged maps of disease through these critical cartographic analytic frames.[75] Addressing this gap, I analyze maps produced in British India and by the Allies during World War II as "ontological and epistemological" objects that articulated and mediated malaria.[76]

As I will discuss, disease maps help to shape or scaffold what is known about a disease as well as the possibilities of what can be known. Malaria maps visually and spatially represent malaria by coupling malaria incidence and location in a single representational form. The maps I study are physical, material objects, and I follow the historical conditions, techniques, and technologies used their production. How and what was mapped is important to understanding the discourses of malaria at that time. Different maps and the different focus within maps reflect different understandings and configurations of malaria that then have consequences in malaria control.

There were a few maps of malaria prior to 1900 (such as the malaria map in the US 1870 census), but the British medical officers in India helped to create and standardize practices for mapping malaria.[77] Maps of malaria were common and

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[75] Martin Dodge, Rob Kitchin and Chris Perkins, *The Map Reader: Theories of Mapping Practice and Cartographic Representation* (Wiley, 2011); Martin Dodge, Rob Kitchin, and Chris Perkins, eds. *Rethinking Maps: New Frontiers in Cartographic Theory (Routledge Studies in Human Geography)* Routledge, 2011); Mark Monmonier, "Maps as Graphic Propaganda for Public Health," In *Imagining Illness: Public Health and Visual Culture*, edited by David Serlin, 108–25. Minneapolis: University of Minnesota Press, 2010; Denis Wood, *Rethinking the Power of Maps* (The Guilford Press, 2010).

[76] Rob Kitchin, Chris Perkins, and Martin Dodge, "Thinking About Maps," In *Rethinking Maps: New Frontiers in Cartographic Theory*, edited by Rob Kitichen Martin Dodge, and Chris Perkins, 1–25. London: Routledge, 2009.

[77] "Map Showing the Proportions of Deaths From Malarial Diseases," In *Statistical atlas of the United States based on the results of the ninth census 1870 with contributions from many eminent men of science and several departments of the government*, edited by Francis A. Walker, Plate XLII. New York: United States. Census office. 9th census, 1874.

important objects in the Allies' control efforts, particularly in the Pacific and North African campaigns where they were produced in weekly and monthly intervals, circulated within command structures, and were tools that shaped understandings of the progress of control measures.

Theoretical Framing

Donna Haraway has noted that "it matters what stories we tell to tell other stories with; it matters what concepts we think to think other concepts with."[78] In this interdisciplinary dissertation I bring together literatures from critical geography and cartography with scholars from the inter- and multi-disciplines of communication and feminist science and technology studies. From within all of these literatures, I "think with" threads that incorporate a history of things and the agency of non-humans to help me engage with the multi-species, multiple scales, spaces, entanglements, and ontologies of modern malaria. I will also go into more depth with some of these literatures in the individual chapters of the dissertation.

Nature and Spaces: Critical Geography

For Foucault, "the formation of discourses and the genealogy of knowledge need to be analyzed, not in terms of types of consciousness, modes of perception and forms of ideology, but in terms of tactics and strategies of power . . . deployed through . . .

[78] Donna Jeanne Haraway, "Sowing Worlds: A Seed Bag for Terraforming with Earth Others," In *Beyond the Cyborg: Adventures with Donna Haraway*, edited by Margaret Grebowicz and Helen Merrick, 137–46. New York: Columbia University Press, 2013., p. 138

demarcations, control of territories and organizations of domains."[79] These demarcations, territories, and domains are a central concern of cultural and political geographers. They analyze through what practices places and spaces are shaped, by whom, and with what consequences, paying particular attention to the uneven burdens of particular spatial configurations across scales that can include populations, cultures, cities, neighborhoods, communities, countries, genders, sexualities, income levels, and access to resources.[80] These concerns are not exclusive to geographers, having emigrated in the "spatial turn" to the social science and humanities.

Some postcolonial scholars have analyzed the ways imperial powers have articulated places outside of post-Enlightenment Europe as geographic offshoots or outposts of the metropole and as "blank spaces" to be colonized and exploited for resources.[81] Paul Carter has argued for a spatial history of imperial exploration and discovery, one that incorporates the processes, practices, and material objects involved.[82] This kind of spatial history helps him to illuminate the island that existed before settlers

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[79] Foucault, *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*., pp.70-1, 79

[80] See for example: Kay Anderson, ed. *Handbook of Cultural Geography* (London: SAGE, 2003); Tim Cresswell, *Place: A Short Introduction (Short Introductions to Geography)* (Wiley-Blackwell, 2004); Ron Johnston, "Out of the `moribund Backwater': Territory and Territoriality in Political Geography," *Political Geography* 20, no. 6 (2001); Andrew Herod, *Scale (Key Ideas in Geography)* (New York: Routledge, 2010).

[81] Kennedy, Dane. *The Last Blank Spaces: Exploring Africa and Australia*. Cambridge: Harvard University Press, 2013.; See also: Carter, *The Road to Botany Bay*; Edney, Matthew H. Mapping an Empire: The Geographical Construction of British India, 1765-1843. University Of Chicago Press, 1999.; Paul Greenough, and Anna Lowenhaupt Tsing, eds. *Nature in the Global South: Environmental Projects in South and Southeast Asia* Duke University Press Books, 2003); Grove, *Green Imperialism*; Chandra Mukerji, "Dominion, Demonstration, and Domination: Religious Doctrine, Territorial Politics, and French Plant Collection," In *Colonial Botany: Science, Commerce, and Politics in the Early Modern World*, edited by Londa Schiebinger and Claudia Swan, 19–33. Philadelphia: University of Pennsylvania Press, 2004; Conevery Bolton Valenčius, "The Geography of Health and the Making of the American West: Arkansas and Missouri, 1800-1860," In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, 121–45. London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000.

[82] Carter, *The Road to Botany Bay*.

and to decenter narratives of progress and inevitability to analyze discoveries and exploration as deliberate choices that brought Australia into being. Similarly, in *The Last Blank Spaces*, Dane Kennedy analyzes the imaginations and constructions of Africa and Australia as unexplored lands by nineteenth century British explorers. Despite previous exploration and settlement, explorers from the Royal Society articulated a discourse that these continents "were the conceptual equivalents of oceans, vast and empty spaces that could become truly knowable only through the application of scientific methods that seaborne explorers had pioneered . . .. Local knowledge had little if any recognized place in this evidentiary system."[83] Kennedy's focus on the ways African and Australian spaces were imagined and constructed nicely illuminates the limits, contradictions, and frailties of Western scientific knowledge and masculinity, and how both were ultimately dependent upon the local knowledge and people they initially disdained. Miles Ogborn has argued "imperialism is constituted through its arrangements of spaces, places, landscapes, and networks of connection . . .. [And that] imperial history often involves the investigation of small-scale geographies of sites such as trading posts, mercantile offices, imperial and colonial cities, and plantations and slave gardens."[84] I draw on these scholars' attention to imperial spaces and the power of imaginings and constructed-ness on both large and small scales to focus on: the role of the Royal Society in shaping understandings of India as a colonial protectorate, what malaria was in India, for whom it was a problem, and what the possible solutions could be; the US military's constructions of and interactions with the spaces of the Pacific Island and the problems of malaria

[83] Kennedy, *Last Blank Spaces*., p. 2

[84] Ogborn, *Indian Ink*., p. 4

there, the disregard towards any local forms of knowledge, as well as the materials and objects used to control malaria; and building on Ogborn's lists, I include the small-scale geographies of military barracks, laboratories, mess halls, swimming holes, swamps, and roads to trace the networks of connection, processes, and practices the military created and through which they rearranged the spaces of Pacific islands as well as their own structures of command and operations.

Nature, Animals, and Worldings

It is not just the actions of humans that impact spaces; spatial configurations themselves have material effects. Chandra Mukerji notes "built environments exert powers, silently changing the ground on which political struggles take place and defining the conditions of possibility for collective life."[85] In a similar analytic vein, Tim Cresswell has examined the seemingly banal spaces of airports and how they shape choices and mobility in intended and unintended ways, Tom Gieryn has looked at the spaces of science that help to create credibility, and Foucault famously analyzed the effects of prison architecture on the subjectivity of its inmates.[86]

For critical geographers, there is not a 'natural' environment nor a 'natural' fit of people to spaces. In *Nature's Metropolis*, William Cronon talks about a "first nature" and "second nature," with first nature being an ecology with little human impact and second

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[85] Chandra Mukerji, "The Unintended State," In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett and Patrick Joyce, 81–101. New York: Routledge, 2010., pp.81-82

[86] Cresswell, *On The Move*; Gieryn, *Cultural Boundaries of Science: Credibility on the Line*; Gieryn, "City as Truth-Spot: Laboratories and Field-Sites in Urban Studies."; Michel Foucault, *Discipline & Punish: The Birth of the Prison,* trans. Alan Sheridan (New York: Vintage, 1977).

nature being the time after human adapted the environment to their capitalist needs.[87] Anna Tsing has recently added a third nature of "what has managed to live despite capitalism."[88] But even within first nature, a 'static' or 'untouched' nature does not exist — rather, nature is active and includes geologic changes, the alterations that animals, fungi, bacteria, and plants make to landscapes such as beavers changing waterways,[89] the allelopathic changes plants and trees can cause to the soil to inhibit the growth of other species,[90] the presence of wolves improving the ecosystem in Yellowstone,[91] and of otters for kelp beds.[92] Nor are cities and nature exclusionary binaries: The picturesque 'natural' northern California landscapes of rolling hills oak trees were curated for hundreds, if not thousands of years before the Spanish and other settlers arrived,[93] and cities are increasingly acknowledged as spaces that have been and continue to be populated with

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[87] Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton & Company, 1992.

[88] Tsing, Anna Lowenhaupt. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton: Princeton University Press, 2015. p. viii

[89] See e.g. C. J. Westbrook, D. J. Cooper and B. W. Baker, "Beaver Dams and Overbank Floods Influence Groundwater–Surface Water Interactions of a Rocky Mountain Riparian Area," *Water Resources Research* 42, no. 6 (2006).

[90] See e.g. R.J. Willis, *The History of Allelopathy* (Dordrecht: Springer, 2010).

[91] See e.g. Douglas W. Smith, Rolf O. Peterson and Douglas B. Houston, "Yellowstone After Wolves," *BioScience* 53, no. 4 (2003).

[92] See e.g. Christopher C Wilmers*, et al.*, "Do Trophic Cascades Affect the Storage and Flux of Atmospheric Carbon? An Analysis of Sea Otters and Kelp Forests," *Frontiers in Ecology and the Environment* (2012).

[93] Trina Filan. "Boom and Bust: (Hi)stories of Landscape Production and Consumption in the Sierra Nevada Foothills of California." Paper presented at American Association of Geographers Annual Meeting, Chicago, 2015.

domesticated animals as well as with 'wild' animals such as foxes, falcons, and coyotes.[94]

The active role of animals in history and their agency has been an increasing focus of scholarship.[95] Some scholars have discussed the role of animals as research subjects and as stand-ins for humans;[96] Haraway and others have analyzed the ways animals can be understood as "allies," who help co-create scientific knowledge;[97] Callon focused on scallops and their power as actors to resist in networks of knowledge creation;[98] and others see animals themselves as researchers and cartographers.[99] These

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[94] See e.g. Henry Buller, "Reconfiguring Wild Spaces: The porous boundaries of wild animal geographies," In *Routledge Handbook of Human-Animal Studies*, edited by Garry Marvin and Susan McHugh, 233–45. New York: Routledge, 2014; Cook County Urban Coyote Research Project, "Urban Coyote Research: Urban Coyote Ecology and Management, Cook County, Illinois." (2015): accessed Dec. 16, 2015, http://www.urbancoyoteresearch.com/FrontPage; Cronon, *Nature's Metropolis*; The Gotham Coyote Project, "The Gotham Coyote Project: Tracking New York City's Newest Immigrants." accessed Dec. 16, 2015, http://www.gothamcoyote.com; Scott A Miltenberger, "Viewing the Anthrozootic City: Humans, Domesticated Animals, and the Making of Early Nineteenth-Century New York," In *The Historical Animal*, edited by Susan Nance, 261–71. Syracuse: Syracuse University Press, 2015; NYC Department of Environmental Protection, Public Affairs, "Peregrine Falcons in New York City." (2015): accessed Dec. 16, 2015, http://www.nyc.gov/html/dep/html/news/falcon.shtml.

[95] For an overview see: Dorothee Brantz, *Beastly Natures: Animals, Humans, and the Study of History* (Charlottesville: University of Virginia Press, 2010); David Gary Shaw, "A Way With Animals," *History and Theory* 52, no. 4 (2013). See also: Virginia DeJohn Anderson, *Creatures of Empire: How Domestic Animals Transformed Early America* (Oxford: Oxford University Press, 2006); Erica Fudge, "A Left-Handed Blow: Writing the History of Animals," In *Representing Animals*, edited by Nigel Rothfels, 3–18. Bloomington: Indiana University Press, 2002; Donna Jeanne Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (Chicago: Prickly Paradigm Press, 2003); Haraway, "When Species Meet: Staying With the Trouble."; David Gary Shaw, [Ed.], "Does History Need Animals? [Special Issue]," *History and Theory* 52, no. 4 (2013); Susan Nance, ed. *The Historical Animal* (Syracuse: Syracuse University Press, 2015); Kari Weil, *Thinking Animals: Why Animal Studies Now* (New York: Columbia University Press, 2012).

[96] See e.g. Donna Jeanne Haraway, *Modest_Witness@Second_Millennium.FemaleMan_Meets_OncoMouse : feminism and technoscience* (New York: Routledge, 1997); Robert E. Kohler, *Lords of the Fly: Drosophila Genetics and the Experimental Life* (Chicago: University Of Chicago Press, 1994); Karen Rader, *Making Mice: Standardizing Animals for American Biomedical Research, 1900-1955* (Princeton: Princeton University Press, 2004).

[97] See e.g. Uli Beisel, Ann H. Kelly and Noémi Tousignant. "Knowing Insects: Hosts, Vectors and Companions of Science." *Science as Culture* 22(1), (2013): 1–15.; Vinciane Despret, "From Secret Agents to Interagency," *History and Theory* 52, no. 4 (2013); Haraway, "When Species Meet: Staying With the Trouble."; Ann H. Kelly. "The Experimental Hut: Hosting Vectors." *Journal of the Royal Anthropological Institute* 18, (2012): S145–60.

[98] Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay," In *Power, action and belief: a new sociology of knowledge?*, edited by John Law, 196–223. London: Routledge, 1986.

[99] See e.g. Beisel and Boëte, "The Flying Public Health Tool."; Natalie Forssman. "Knowing Waterscapes Through Animal Bodies." Paper delivered at Centre for Research on Socio-Cultural Change, London, 2013.

scholars have de-privileged humans as the sole holders of agency. Some do so to better understand the configurations and effects of the power of humans as well as its limits; others to analyze how humans have always/already been enmeshed in unstable and uneven relationships with the ecologies around them. For Anna Tsing, "human nature is an interspecies relationship."[100] This scholarship has also created a shift in language: These relationships are not understood to be between humans and non-humans, or even between humans and animals, but instead the constituents of "multispecies worlding" also includes all living organisms (such as insects, fungi, viruses, and bacteria), all of whom are "becoming-with" each other.[101] These multispecies worldings are not often symbiotic nor easy, but attending to the processes and practices of becoming-with opens up possibilities of understanding and changing the configurations, constituencies, and consequences of power dynamics. These literatures help me attend to the multispecies relationships of malaria and the shifting dynamics of power among its constituents.

Spaces, Objects, and Materials: STS and Communication

This section engages literatures about the processes and practices of world-making through the interactions and co-constructions of language, spaces, and objects. To continue attending to worlding, I bring together communication theorists with theorists in science and technology studies concerned with objects and material powers.

An attention to objects is not new, nor profound — objects are at the heart of

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[100] Tsing, "Unruly Edges," p. 144

[101] Quoted in Donna Jeanne Haraway. "Awash in Urine: DES and Premarin® in Multispecies Response-ability." *Women's Studies Quarterly* 40 (1), (2012): 301–16. pp.301-02 For a discussion of language see e.g. Fudge, "A Left-Handed Blow: Writing the History of Animals."; Eben Kirksey, ed. *The Multispecies Salon* (Durham: Duke University Press, 2014). PDF e-book.

archeology and art history, and scholars across the social sciences have studied the meanings and values societies and cultures ascribe to objects.[102] Arjun Appadurai has argued that "things" have social lives and that "their meanings are inscribed in their forms, their uses, [and] their trajectories."[103] He follows their circulation because "even though from a theoretical point of view human actors encode things with significance, from a methodological point of view it is the things-in-motion that illuminate their human and social context."[104] Appadurai studies the circulation of commodities to better understand how they gain significance and value, but beyond the scope of his important analysis is an examination of the power of the objects themselves in shaping "their human and social context." Cultural psychology and figured worlds theory do explore the impacts objects and technologies have on their users.

Developed by Holland et al, a figured world "is a politically infused culture that shapes cognition as well as action. The culture consists not only of a constellation of ideas, but also physical forms systematically infused with meaning. It is a physical arrangement of the material environment that intentionally ratifies cultural conceptions of reality."[105] Figured worlds provide architecture and cues for shaping how one learns and organizes the world. These pedagogical architectures can include language: "Once we

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[102] See e.g. Alfred Gell, *Art and Agency: An Anthropological Theory* (Oxford: Oxford University Press, 1998); Karl Marx, *Capital: A Critique of Political Economy, Volume 1,* trans. Ben Fowkes (London: Penguin Classics, 1976); Marcel Mauss, *The Gift: The Form and Reason for Exchange in Archaic Societies* (New York: W. W. Norton & Company, 2000); Georg Simmel, *The Philosophy of Money (Routledge Classics)* (London: Routledge, 2011).

[103] Arjun Appadurai, "Introduction: Commodities and the Politics of Value," In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, 3–63. Cambridge: Cambridge University Press, 1986., p. 5

[104] Ibid.

[105] Quoted in: Chandra Mukerji, "The Territorial State as a Figured World of Power: Strategics, Logistics, and Impersonal Rule," *Sociological Theory* 28, no. 4 (2010). , pp. 406-07 See also: Dorothy Holland*, et al.*, *Identity and Agency in Cultural Worlds* (Cambridge: Harvard University Press, 2001).

start thinking that language might be constitutive rather than reflective, we are drawn to consider how meanings are being conveyed through form as well as content."[106] Form can be linguistic and material, and it can shape the possibilities of knowledge, being, and action. A figured worlds analysis can engage the ways common sense and quotidian configurations of the world are brought into being.

Constituent forms can also be understood more broadly to include built environments and material objects. Cultural psychologist Lev Vygotsky was interested in how artifacts and tools helped to shape individual subjectivity. He articulated objects "as cognitive tools used to 'scaffold' forms of cultural imagination and to shape social practices of thinking and action."[107] Building on Vygotsky's work, Ernest Boesch wrote about the violin's power to physically change and shape the bodies of those learning to play it: learning the violin requires alterations to the musculature of the arm, shoulder, and neck as well as changes to the 'ear,' in order to properly identify which sounds sound best.[108] Objects and their design mediate their uses and the actions of their users. As Madeleine Akrich argues, "technical objects contain and produce a specific geography of responsibilities, or more generally, of causes."[109] Examples of these specific geographies of causes include: chairs shaping how one sits on them;[110] the "QWERTY" universal

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[106] Fissell, "Making Meaning From the Margins," p. 378

[107] Quoted in: Mukerji, "Space and Political Pedagogy At the Gardens of Versailles," p. 512 See also: Vygotsky, *Mind in Society*; Wertsch, *Vygotsky and the Social Formation of Mind*.

[108] Boesch, Ernest. "The Sound of the Violin." The Quarterly Newsletter of the Laboratory of Comparative Human Cognition 15 (1), (January, 1993): 6–15. p. 13

[109] Akrich, Madeleine. "The De-Scription of Technical Objects," In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, 205–24. Cambridge: The MIT Press, 1992. p. 207

[110] Jiajie Zhang and Vimla L. Patel, "Distributed Cognition, Representation, and Affordance," *Pragmatics & Cognition* 14, no. 2 (2006). , p. 337

keyboard slowing the fingers of typists to prevent typewriters from jamming;[111] Bruno Latour's analysis of speed bumps, automatic seat belts in cars, and doors (as well as door assisting technologies) shaping the actions and interactions of users;[112] and James Wertsch's arguments about the size and materials that make up pole vaults shaping the techniques and achievements of the humans using them.[113]

These scholars are not advocating a technological determinism. Akrich continues, "To be sure this geography is open to question and may be resisted. . . . [N]ew technologies may not only lead to new arrangements of people and things. They may, in addition, generate and 'naturalize' new forms and orders of causality and, indeed, new forms of knowledge about the world."[114] This idea that technical objects help to "lead to new arrangements of people and things" and "generate and naturalize" "new forms of knowledge about the world" is central to understanding the power of disease maps as well as other technical objects involved with malaria control. I follow these objects and the practices with which they were used and the possibilities of knowledge and worlds that they helped create, the changes to arrangements of people and spaces and institutions, and the understandings of malaria that they help to naturalize.

Paper, files, surveys, and maps are technical objects of particular importance. In *Paper Knowledge*, media scholar Lisa Gitelman argues, "documents are epistemic objects," and "are integral to the ways people think as well as to the social order that they

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[111] Wertsch, *Mind As Action*., pp.60-62

[112] Latour, Bruno. "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts," In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, 225–58. Cambridge: The MIT Press, 1992.

[113] Wertsch, *Mind As Action*., pp.27-8, 41-6

[114] Akrich, "De-Scription of Technical Objects," p. 207.

inhabit."[115] The architectural or scaffolding power of documents comes from their "knowing-showing" qualities: knowledge is shown to the user by the documents and as such "knowing-showing, in short, can never be disentangled from power — or, more properly, control."[116] The situated "knowing-showing" power of documents is especially important to the ways bureaucracies and institutions function.

Similar to Gitelman, Patrick Joyce focuses on documents and their power. He argues that the file "is the central unit by which information is assembled and knowledge produced, knowledge that enabled the institution to know and control itself as well as that which it governed."[117] Documents and files (and their circulation) were central to military malaria control in the Pacific campaign of WWII. Files were technological objects that created new geographies of malaria; they articulated and helped to naturalize those particular articulations of malaria, and they helped create new arrangements of people, objects, and spaces within the military as well as on the Islands they occupied.

Maps: Communication and Critical Cartography

As I've discussed, figured worlds theory engages the productive work of both material and mental architectures on the development of common sense understandings and knowledge about the world. In this section, I bring this scaffolding and pedagogical work of objects as well as cultural and social historians' attention to the constructions of

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[115] Gitelman, Lisa. *Paper Knowledge: Toward a Media History of Documents (Sign, Storage, Transmission)*. Durham: Duke University Press Books, 2014. pp.1, 5

[116] Ibid., p. 5

[117] Patrick Joyce, "Filing the Raj: Political Technologies of the Imperial British State," In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett, Patrick Joyce, 102–23. London: Routledge, 2010. p. 111

disease to maps and critical cartography.

Brian Harley, Denis Wood, Mark Monmonier, Chandra Mukerji and others have shown that the frameworks and assertions of maps are not 'true' reflections of the world, but instead are always political and constructed objects that can bring into being particular knowledges about the world.[118] Building on the work of these scholars, Kitchen, Dodge and Perkins identify the practice of mapping as "epistemological but also deeply ontological — it is both a way of thinking about the world, offering a framework for knowledge, and a set of assertions about the world itself."[119] Maps help to frame what is known and scaffold the possibilities of what can be known. They have productive power: Thongchai Winichakul argues in *Siam Mapped* that the mapping projects helped to bring a 'modern' Thailand into existence.[120]

For Malpas, maps fundamentally create boundaries and boundedness and they do so through the "establishing of a 'here', a 'there', a 'this.'"[121] Maps scaffold thinking and imaginings about each 'here,' 'there,' and 'this.' Presenting a visual representation of boundaries — of 'this' country is 'here,' and this other country is 'there,' — helps viewers to imagine and understand those spaces as well as to naturalize, stabilize, and reify those boundaries. Even if maps are understood to be making conditional or

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[118] Gary Fields, "Imaginative Cartographies: Mappings of Dispossession in Historical Perspective.," In *Conspiracy in the United States and Beyond: Historical and Cultural Foundations*, edited by Larry Portis and Joseph Zitomersky, Montpellier: University Press of the Mediterranean, 2012; J. B. Harley, *The New Nature of Maps: Essays in the History of Cartography* (Baltimore: The Johns Hopkins University Press, 2002); Mark Monmonier, *How to Lie With Maps* (Chicago: University Of Chicago Press, 1996); Chandra Mukerji, *From Graven Images: Patterns of Modern Materialism* (New York: Columbia University Press, 1983); Denis Wood, *The Power of Maps* (The Guilford Press, 1992); Wood, *Rethinking the Power of Maps*.

[119] Rob Kitchin, Martin Dodge and Chris Perkins, "Introductory Essay: Conceptualising Mapping," In *The Map Reader: Theories of Mapping Practice and Cartographic Representation*, edited by Martin Dodge, Rob Kitchen and Chris Perkins, 2–7. Oxford: Wiley-Blackwell, 2011., p. 21

[120] Winichakul, *Siam Mapped*.

[121] Malpas, "Putting Space in Place," p. 238

propositional claims — 'this' is 'here' now, but might not have been so before nor might it be later — maps are still premised on 'this,' 'here,' and 'there' being recognizable and legible. Maps help to create figured worlds of ontological stability and coherence.[122]

This stabilizing work of maps is important for considering the power of disease maps. For Koch, "In maps of disease and health, subject and object are ineluctably joined. They create a subject, this or that disease state."[123] The addition of disease to the proposition of 'this is there' (i.e.,'this *disease* is there') brings the stabilizing ontological work of maps to disease states; making coherent and eliding any uncertainty or lack of knowledge about disease identification and epidemiology. Some of these fundamental uncertainties of epidemiology disease maps can obscure include: What disease is this? What does the disease or disease process entail? What criteria are used to diagnose or identify it? What has been counted, with what methods, by whom, and by what metrics? What are the sample sizes? What conclusions are being extrapolated and distributed? What aspect of disease or transmission is represented — its vector(s), infection rates, death rates, etc.? What time span or time period does the map imply or represent — is the disease's presence temporary, past, or will it continue to be there forever? Where is 'there'? What is 'there'? How is the landscape being located, identified, and represented? What aspects of the landscape is the disease in — the ground, the flora, fauna, humans, a

[122] Kitchin, Dodge and Perkins, "Introductory Essay: Conceptualising Mapping," p. 21
[123] Koch, *Disease Maps*., pp.5-6

subset of humans? What are the scales of representation?[124] In eliding or presenting these questions as resolved, disease maps give the illusion of complete, stable, and precise knowledge. Each component of 'this disease' 'is' 'there' is unconditionally and definitively presented.

Disease maps help to build and scaffold ways of knowing and envisioning disease that become naturalized and common sense. A critical analysis of disease maps opens up for examination the processes, practices, articulations, and consequences of those architectures, as well as of the attempts to resolve the uncertainties and multiplicities of disease ontology. These examinations situate disease in "relation to elements of economic, geographic, social, and political landscapes. The result [of this analysis] is a way of thinking about disease 'on the ground,' not a theoretical construct but a reality experienced, within the science of the day and the politics that defines it in society."[125]

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[124] Some of these questions might be answered in an accompanying articles or inset text, but not always. For example, fundamental problems were known to exist in malaria epidemiology, particularly problems in diagnostic criteria and data collection, but only recently did the WHO even begin to acknowledge these uncertainties in their *World Malaria Reports*. See e.g.: Irene Akua Agyepong and Jane Kangeya-Kayonda, "Providing Practical Estimates of Malaria Burden for Health Planners in Resource-Poor Countries," *Am J Trop Med Hyg* 71, no. 2_suppl (2004); DR Bell*, et al.*, "Malaria Risk: Estimation of the Malaria Burden.," *Nature* 437, no. 7056 (2005); J. G. Breman, "The Ears of the Hippopotamus: Manifestations, Determinants, and Estimates of the Malaria Burden," *Am J Trop Med Hyg* 64, no. 1_suppl (2001); Joel G. Breman, Martin S. Alilio and Nicholas J. White, "Defining and Defeating the Intolerable Burden of Malaria IIi. Progress and Perspectives," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Joel G. Breman and Cherice N. Holloway, "Malaria Surveillance Counts," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Richard E. Cibulskis*, et al.*, "Estimating Trends in the Burden of Malaria At Country Level," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); Hay, "Measuring Malaria Endemicity."; K. A. Koram and M. E. Molyneux, "When is "malaria" Malaria? The Different Burdens of Malaria Infection, Malaria Disease, and Malaria-Like Illnesses," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007); BL Nahlen*, et al.*, "Malaria Risk: Estimating Clinical Episodes of Malaria.," *Nature* 437, no. 7056 (2005); David Smith and McKenzie Ellis, F, "Statics and Dynamics of Malaria Infection in Anopheles Mosquitoes," *Malaria Journal* 3, no. 1 (2004); David L Smith*, et al.*, "Revisiting the Basic Reproductive Number for Malaria and Its Implications for Malaria Control," *PLoS Biol* 5, no. 3 (2007); RW Snow, K Marsh and Sueur le, D, "The Need for Maps of Transmission Intensity to Guide Malaria Control in Africa," *Parasitol Today* 12(1996). 1475-2875-6-17; World Health Organization, *World Malaria Report 2008* (Geneva: World Health Organization, 2008); World Health Organization, *World Malaria Report 2009* (Geneva: World Health Organization, 2009); World Health Organization, *World Malaria Report 2015* (Geneva: World Health Organization, 2015).

[125] Koch, *Disease Maps*., p. 6

Disease maps are archives and evidence of these relations, but they are also tools in the production and articulation of those relations and knowledges.

Disease, particularly malaria, isn’t exclusively social or cultural or material or spatial. Malaria is multi-species and multi-spatial, and maps of malaria have helped to articulate different ontologies of malaria. As materials that circulated alone as well as with files, reports, conference presentations, and books, maps of modern malaria were new technological objects important in creating figured worlds and naturalizing knowledge and ways of understanding of malaria in British India and WWII. Maps of malaria led to new arrangements of entire cities (such as the rebuilding of Quetta by the British Army in 1936), Island villages and their populations as well as military personnel and supplies in the Pacific during WWII, and populations of mosquitoes and landscapes.

As I will show in the chapters of my dissertation, the meanings of “malaria is there” varied by location: In Colonial India, 'malaria is there' conveyed messages of don't build there, that is where the threat is greatest; In Northern Africa, 'malaria is there' explicitly marked areas that were the greatest threats to health and fighting ability and differentiated between areas that should be absolutely avoided, areas that could be modified, and areas that were safe. ‘Malaria is there’ meant the presence of disease in people (soldiers and military personnel), counted through spleen exams and blood tests; In the Pacific Islands, 'malaria is there' identified areas where mosquito populations were or were highest and where more resources and interventions were needed. The persistence of ‘malaria is there’ also indicated that past control efforts such as spraying DDT, malaria discipline among the enlisted men, and the segregation of Island residents had not been as successful as desired.

An Overview of the Chapters

I present my research findings across four chapters. The first chapter focuses on the beginnings of modern malaria control in early twentieth century India. Chapters two and three analyze the Allies' responses to malaria's impacts on the Pacific campaign. In these chapters, I follow Christopher Pinney's call for a "nuanced historicity of *process* and *practice*" in studying the history of technology.[126] Chapter two traces the processes of creating the Malaria and Epidemic Control Organization (MECO) and the institutional spaces, materials, terrains that were allotted and altered. Chapter three focuses on MECO's practices and materials of malaria control and mapping. The fourth chapter takes as its focus the Allies' propaganda campaigns aimed at changing the behavior of enlisted men to reduce malaria transmission.

In chapter one, *Mapping Malaria in British India 1898-1936*, I follow the figure of Samuel Ricketts Christophers and his role in solidifying official British malaria control policies. Christophers was an entomologist initially sent by the Royal Society and Colonial Office to study malaria in Italy with Grassi and Gogli in 1898 and then Africa in 1899.[127] In 1902, Christophers was assigned to India where he would eventually become a powerful administrator in charge of malaria control for India. Two of his books, *The*

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[126] Christopher Pinney, "Camerawork as technical practice in colonial India," In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett and Patrick Joyce, 145–70. London: Routledge, 2010., p. 150 Emphasis in original

[127] H. E. Shortt and P. C. C. Garnham, "Samuel Rickard Christophers. 27 November 1873-19 February 1978," *Biographical Memoirs of Fellows of the Royal Society* 25(1979).

Practical Study of Malaria and other Blood Parasites in 1903 and *How to Do a Malaria Survey* in 1928, went through numerous editions and "up to the time of World War II . . . were the constant companions of most malaria workers in the tropics."[128] His obituary in the *Biographical Memoirs of Fellows of the Royal Society* noted that "the highly scientific approach" of these books "was responsible for leading many [of these malaria workers] into the 'research life.'"[129] He and the maps he created, such as the 1926 *Malaria Map of India,* helped British India to become a "center of calculation" that established a standard way of knowing malaria and malaria transmission which circulated around the world.[130]

I focus on how Christophers rendered malaria technical through his conference presentations, prolific publications, and especially his maps. Tanya Li, borrowing from Nikolas Rose, defines rendering technical as the range "of practices concerned with representing 'the domain to be governed as an intelligible field . . . [and] defining boundaries, rendering that within them visible'"[131] Christophers was a central figure in defining the boundaries of malaria, what problems were caused by malaria, and in what ways malaria could be approached, treated, and controlled. In literally writing the book that instructed and standardized how to survey and map malaria, Christophers and his maps created figured worlds of malaria that scaffolded how malaria was understood as a

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[128] Ibid., p. 187

[129] Ibid.

[130] Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge: Harvard University Press, 1988. pp.215-57

[131] Quoted in Li, *The Will to Improve*., pp.7-10; Nikolas Rose, *Powers of Freedom: Reframing Political Thought* (Cambridge: Cambridge University Press, 1999). See also: Tania Murray Li. "Practices of Assemblage and Community Forest Management." *Economy and Society* 36(2), (2007): 263–93.

problem. He helped to frame malaria as a powerful disease that greatly impacted laborers and business interests, but also as a disease whose environmental factors limited possible human interventions and control strategies. I compare this articulation of malaria in Christophers' 1926 *Malaria Map of India* with Mulligan and Baily's 1936 *Map of Malaria in Quetta*, which presents an alternative configuration of malaria as a disease more amenable to human intervention but uses the practices of surveying and mapping malaria that Christophers established.

In the Pacific campaign of World War II, malaria became a serious problem for Allied military efforts; ultimately 100,000 servicemen were infected and "each had an average of nearly 2 attacks, thus doubling the loss of men days."[132] My second chapter, *Creating Malaria Control in the Pacific Campaign, 1942-5,* tracks the creation of the Malaria and Epidemic Control Organization (MECO) in 1942 through the circulation of formerly classified files, memorandum, orders, correspondence, and requests for supplies and personnel across the Pacific Ocean, between Pacific Islands, and up and down chains of military command. These documents are archives of the Allied military's processes of rendering malaria technical and I analyze two different scales of files and papers: those that created the MECO and the boundaries and parameters of its infrastructure and institutional powers; and those documents produced by the organization that shaped malaria control strategies and efforts. The organizational infrastructure of MECO was an outcome or answer to the technical problem of the malaria epidemic in Pacific, one that changed the command hierarchies and caused the movement of large amounts of

[132] Harper*, et al.*, "Malaria and Epidemic Control." p. 13.

equipment, supplies, and personnel within the military, as well as changes to the geography of thirteen Pacific Island and the relocation of thousands of their residents.

My third chapter, *Coordinated Practices of Malaria Control*, shifts the analytic focus from the processes of creating MECO within the wider military infrastructure to MECO's policies and procedures establishing "common, day-to-day" sociomatieral practices of malaria control. I draw on Mol's discussion of coordination to focus on the entangled practices of malariologists, entomologists, engineers, and parasitologists in creating knowledge about malaria as well as controlling malaria infections within the Allied forces in the South Pacific.

MECO established a Senior Malaria Control Officer on each Island who coordinated the efforts of parasitology, entomology, and engineering units.[133] These efforts involved organizing and integrating practices of surveying, mapping, taking water samples from swamps and marshes to count and measure mosquito populations, reading blood tests, spraying DDT, filling in road ruts, creating drainage ditches, and draining marshes. Much of the Malaria Control Officer's coordination work was done through the creation, standardization, and circulation of weekly and monthly reports, surveys, and maps documenting those practices and activities of malaria control.

The processes and practices of MECO reflected different articulations of malaria than those of Christophers and others in British India. The files of MECO document changing ideas of the relationship between environment, bodies (of mosquitoes, troops, locals), and parasites: Humans were seen as having (and needing to have) greater power

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[133] Ibid.

to influence malaria transmission rates, but the continued power of the environment, parasites, mosquitoes, and their interactions with mammals is evidenced by the intense and continued monitoring of parasite infection rates in troops and local residents, populations of mosquito larvae and adults, and changes in the landscape.

Chapter four, *The Visual Culture Campaigns for Malaria Discipline* analyzes the articulations of malaria within these campaigns. In addition to engineering projects and mosquito population sanitation, MECO attempted to lower malaria rates by having enlisted men change their behavior and relationship to spaces on the islands. These desired behavioral changes were identified as malaria discipline and initially articulated through directives, orders, and punitive regulations. These restrictions included trying to limit access to the spaces where troops and mosquitoes could interact (forbidding visits to "Native Camps" and swimming holes after dark), and to limit the areas on a man's body the mosquito could access (requiring long sleeve shirts and pants, the proper use of bed nets and insect repellent).[134] However, this approach was unsuccessful in changing the bodily practices of enlisted men. MECO then developed widely effective propaganda campaigns that used drawings and cartoons of attractive "pin-up girls" and anthropomorphized mosquitoes portrayed as a militarized enemy more powerful than the Japanese that drew upon mores of patriotism, expectations of loved ones, and heteronormative desire to encourage men to be responsible for their own malaria discipline.[135] These successful control efforts focused solely on the individual behavior

[134] Ibid. pp. 22-30.

[135] Sport Murphy, "Malaria Pinup Calendars, Frank Mack," In *Hidden Treasure: The National Library of Medicine*, edited by Michael Sappol, 240. New York: Blast Books, 2012.

and power of military men, articulating a malaria very different from that of Christophers's fifteen years earlier (as well as other MECO enactments).

Finally, the conclusion moves to consider the present problems of malaria control, attending to Beisel and Kelly's call for an attention to the local. I look to apply what was effective about the organizational infrastructures of the Allies' control strategies to current programs. I argue that the Allies' malaria control in the Pacific was successful because their control programs appropriately coordinated the multiple ontologies of malaria and were flexible enough to accommodate local variation in multi-species entanglements.

Chapter 1: Mapping Malaria in British India, 1898-1936

This chapter engages the early history of modern malaria, a time when knowledges and understandings about the disease were changing, disputed, and not yet stabilized. New understandings of malaria and how it was transmitted presented new opportunities to intervene and lower its impact, and debates about the superiority of focusing on controlling mosquito populations or treating infected humans became deeply divisive. One approach was usually privileged, with more resources devoted to it. In this chapter, I follow Samuel Ricketts Christophers, a foundational figure in both medical entomology and malariology, and I use theories about "little tools of knowledge" and Bruno Latour's "centres of calculation" to explain how Christophers was able to establish his onto-epistemology of malaria as the standard.[1]

Becker and Clark describe "little tools of knowledge" as the "images, graphs, lists, questionnaires, dossiers, tables, and reports" that are the foundational basis of "authoritative or objective knowledge."[2] These tools help ground credibility by seeming neutral and truthful and the prestige of the publications and conferences these representations are published in further help to establish authority. Christophers was an entomologist initially sent by the Royal Society and Colonial Office to study malaria in Italy with Grassi and Gogli in 1898 and then Africa in 1899.[3] In 1902, Christophers was

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[1] M.W. Service, "Sir Rickard Christophers: A Tribute," *Transactions of the Royal Society of Tropical Medicine and Hygiene* 72, no. 6 (1978). , p. 679; Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge: Harvard University Press, 1988).; Peter Becker and William Clark, *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices* (Ann Arbor: University of Michigan Press, 2001).

[2] Becker and Clark, *Little Tools*, p. 1

[3] H. E. Shortt and P. C. C. Garnham, "Samuel Rickard Christophers. 27 November 1873-19 February 1978," *Biographical Memoirs of Fellows of the Royal Society* 25(1979).

assigned to India where he would eventually become a powerful administrator in charge of malaria control for India. In his life, he authored or co-authored over 200 publications on malaria and medical entomology, with the majority written before 1936.[4] Two of his co-authored books, *The Practical Study of Malaria* and *How to Do a Malaria Survey* went through numerous re-printings and were required readings for those interested in tropical malaria.[5] Christophers' prolific publications and conference papers helped to disseminate and circulate his onto-epistemology of malaria and the backing of the Royal Society, Indian Medical Service, British military, and commendations such as Companion to the Indian Empire and Order of the British Empire also helped to establish and further his authority and credibility. His publications helped to circulate and standardize his articulations and "common, day-to-day, sociomaterial practices" of malaria control and surveillance.[6]

Christophers' onto-epistemology rendered malaria technical: Tanya Li, borrowing from Nikolas Rose, defines rendering technical as the range "of practices concerned with representing 'the domain to be governed as an intelligible field . . . [and] defining boundaries, rendering that within them visible'"[7] Christophers was a central figure in defining the boundaries of malaria, what problems were caused by malaria, and in what

[4] *Ibid.*, pp.199-207

[5] *Ibid.*, p. 197. Stephens, J. W. W. and S. R. Christophers. *The Practical Study of Malaria and other Blood Parasites*. Liverpool: University Press of Liverpool, 1903. Third Edition.; Christophers, S.R. "How to Do a Malaria Survey." 1928. Calcutta: 147. Government of India, Central Publication Branch. Medical Collection (Shelfmark: WC750 1958C55h). The Wellcome Library, London.

[6] Annemarie Mol. *The Body Multiple: Ontology in Medical Practice (Science and Cultural Theory)*. Durham: Duke University Press, 2003. p7.

[7] Quoted in: Nikolas Rose, *Powers of Freedom: Reframing Political Thought* (Cambridge: Cambridge University Press, 1999).; Tania Murray Li, *The Will to Improve: Governmentality, Development, and the Practice of Politics* (Durham: Duke University Press, 2007). , pp.7-10

ways malaria could be approached, treated, and controlled. In literally writing the books that instructed and standardized how to survey and map malaria, Christophers and his maps created figured worlds of malaria that scaffolded how malaria was understood as a problem.

Christophers and the maps he created, such as the 1926 *Malaria Map of India,* helped British India to become a "centre of calculation" that established a standard way of knowing malaria and malaria transmission which circulated around the world.[8] The practices that Christophers developed and standardized and the figured worlds the maps themselves produced helped to frame malaria as a powerful disease that required diligent epidemiology and surveillance of humans and mosquitoes, greatly impacted laborers and business interests, but also as a disease whose environmental factors limited possible human interventions and control strategies. I compare this articulation of malaria in Christophers' 1926 *Malaria Map of India* with Mulligan and Baily's 1936 *Map of Malaria in Quetta*, which presents an alternative configuration of malaria as a disease more amenable to human intervention, but uses the practices of surveying and mapping malaria that Christophers established. This chapter argues that the "little tools" of publications, graphs, tables, charts, and especially maps anchored Christophers authority to frame and articulate the question "What is malaria?" and that the technologies and techniques he developed became the standard, common practices for answering that question, and remained standards even as the answers to "what is malaria" began to change.

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[8] Latour, *Science in Action*, pp.215-57

Models of Disease Causation and Colonial Malaria

> *Everyone knows that the milieu is the first, the principal and even the only cause of epidemic diseases* - Fournier Choisi[9]

Following a revival in the popularity of Hippocrates' teachings, 18th and 19th century Europeans believed qualities of the landscape worked as a catalyst to create health and disease.[10] Aspects of the environment such as the kind of water and its sources, the seasons, the direction and strength of prevailing winds, the direction a town faced, as well as an area's general temperature and humidity were all considered essential to understanding health and illness.[11] These climatic influences were used to help identify what diseases were common to an area as well as to explain sudden outbreaks of ill health.

There began a radical shift in models of disease causation in the late nineteen hundreds that changed the foundations of medical knowledge: Jospeh Lister developed antiseptic techniques that greatly increased the safety of surgery; Ernst Abbe refined the materials of the microscope, improved its magnification and resolution, and made it easier to mass-produce for researchers; Louis Pasteur found that germs could be killed through heat; Robert Koch developed postulates that diseases are caused by specific agents which can be transferred between people; and Paul Ehrlich created stains needed

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[9] Quoted in James C. Riley, *Eighteenth Century Campaign to Avoid Disease* (New York: St. Martin's Press, 1987). , p. iv

[10] Hippocrates, *On Airs, Waters and Places (Dodo Press)* (Dodo Press, 2009).

[11] Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge University Press, 1996). , pp.304-05; Conevery Bolton Valenčius. "Histories of Medical Geography," In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, London: The Wellcome Trust Centre for the History of Medicine, 2000. , p. 7; Hippocrates, *Airs, Waters and Places*.

to make germs visible under a microscope.[12] The development and growing acceptance of germ theory meant that “experts in both geography and medicine celebrated the potential ‘liberation’ from environmental constraints through the newly discovered technology of chemical processes.”[13] Additionally, with Alfonse Laveran’s first identification of the *Plasmodium* parasite under a microscope in 1881 and Sir Ronald Ross and Giovanni Grassi’s recognition that the *Anopheles* mosquito was its vector in 1899,

> the agents of disease became separable — conceptually and spatially — from their human victims. The spatial extent, and campaigns against their diffusion, could be conceptualized in terms of causes and effects: the mosaic of epidemiological patterns could be metamorphosed — explainable and manipulable — in mechanistic terms.[14]

The stabilization of knowledge about the mosquito as vector in the late 1890s also opened

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[12] Philip D. Curtin, “Medical Knowledge and Urban Planning in Tropical Africa,” *The American Historical Review* 90, no. 3 (1985). , p. 596; John Farley, “Parasites and the Germ Theory of Disease,” *The Milbank Quarterly* 67(1989).; Brian Bracegirdle. “The Microscopical Tradition,” In *Companion Encyclopedia of the History of Medicine, Volume 1*, edited by W.F. Bynum, and Roy Porter, 102–19. London: Routledge Reference, 1993.; Caroline Hannaway. “Environment and Miasmata,” In *Companion Encyclopedia of the History of Medicine, volume 1*, edited by W.F. Bynum and Roy Porter, 292–308. London: Routledge, 1993.; Bruno Latour, *The Pasteurization of France* (Cambridge: Harvard University Press, 1993).; Margaret Pelling. “Contagion/Germ Theory/Specificity,” In *Companion Encyclopedia of the History of Medicine, Volume 1*, edited by W.F. Bynum and Roy Porter, 309–34. London: Routledge Reference, 1993.; Roy Porter, *The Greatest Benefit to Mankind: A Medical History of Humanity* (W. W. Norton & Company, 1999).; Timothy J. J. Inglis, “Principia ætiologica: taking causality beyond Koch’s postulates,” *Journal of Medical Microbiology* 56(2007).; “Germ Theory.” (2016): Contagion: Historical Views of Diseases and Epidemics: The Harvard University Library Open Collections Program. Accessed January 20, 2016. http://ocp.hul.harvard.edu/contagion/germtheory.html.

[13] Anne Buttimer. “Airs, Waters, Places: Perennial Puzzles of Health and Environment,” In *Medical Geography in Historical Perspective*, edited by Nicolaas A. Rupke, London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000. , p. 215

[14] Quoted in: Buttimer, “Airs, Waters, Places” p. 215. See also: Ernesto Capanna, “Grassi Versus Ross: Who Solved the Riddle of Malaria?,” International Microbiology 9(2006); Centers for Disease Control and Prevention, “The History of Malaria.”; Francis EG Cox, “History of the Discovery of the Malaria Parasites and Their Vectors,” Parasites & Vectors 3(2010); M.J. Dobson, “The Malariology Centenary.,” Parassitologia 41, no. 1-3 (1999); B Fantini, “The Discovery of Transmission Mechanisms and the Fight Against Malaria in Italy.,” Medicina nei secoli 6, no. 1 (1994); B. Fantini, “The Concept of Specificity and the Italian Contribution to the Discovery of the Malaria Transmission Cycle,” Parassitologia 41, no. 1-3 (1999); Poser and Bruyn, Illustrated History of Malaria; Ronald Ross, Memoirs, with a Full Account of the Great Malaria Problem and Its Solution (London: John Murray, 1923); U.S. Department of Health and Human Services, Understanding Malaria: Fighting an Ancient Scourge (U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Allergy and Infectious Diseases, NIH Publication No. 07-7139, 2007).

up opportunities to "ascertain at what period in the life-history of the parasite in man and in the mosquito the parasite is the most vulnerable, and how the attack might be delivered."[15] To better make these determinations, "commissions and expeditions were despatched to the tropics" in 1899, including German contingents to East Africa and New Guinea led by Koch, a group sent to West Africa from the Liverpool School of Tropical Medicine that included Ross, and separately a group from the Royal Society that also went to West Africa.[16]

The Royal Society had created a commission to study malaria in 1898 at the behest of Secretary to the Colonial Office, Joseph Chamberlain.[17] Chamberlain's office subsidized the Royal Society's Malaria Committee and its investigations.[18] The Committee was chaired by the Society's president, Lord Lister and was comprised of leading British medical experts, but it did not initially include anyone who specialized in tropical diseases. The Royal Society recruited two scientists, S. Rickard Christophers, a protozoologist working in Liverpool and J.W.W. Stephens from Cambridge, to go to Italy and learn from leading malariologists and then to Africa and India where they would investigation malaria's cause, methods of transmission, and how to keep white Europeans healthy in those areas.[19]

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[15] Annett, H. E., *et al.* "Report of the Malaria Expedition to Nigeria of the Liverpool School of Tropical Medicine and Medical Parasitology." 1901. Liverpool: University Press of Liverpool. Closed stores M22153. Wellcome Library. , p. 2

[16] *Ibid.*

[17] William F Bynum, "An Experiment That Failed: Malaria Control At Mian Mir.," *Parassitologia* 36, no. 1-2 (1994). , p. 107

[18] *Ibid.*, pp.107-08

[19] *Ibid.*, p. 108. See also: Shortt and Garnham, "Christophers' Obituary"; Curtin, "Medical Knowledge and Urban Planning"; Sheldon Watts, *Epidemics & History: Disease, Power & Imperialism* (Yale University Press, 1998).; Sheldon Watts, "British Development Policies and Malaria in India 1897-1929," *Past & Present* 165(1999).; Nandini Bhattacharya, *Contagion and Enclaves: Tropical Medicine in Colonial India* (Liverpool University Press, 2013).

After spending time with Grassi, Gogli, and others in Italy, in 1899 Stephens and Christophers began work in what was then British Central Africa, moving to West Africa later that year. Between 1900-1901, they published fifteen articles over three issues of *Reports to the Malaria Committee of the Royal Society* about malaria in Africa, focusing on transmission and mosquito biology.[20] These reports often included plates of colored drawings of mosquito anatomy, charts of infection rates, and maps of mosquito populations and human malaria infections. Their conclusions provided early and important support for the role of mosquitoes in the malaria transmission cycle theorized

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[20] Christophers, S.R. and J.W.W. Stephens. "Segregation of Europeans." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: Harrison and Sons. 21-24. General Collection, W1 RO875. History of Medicine Division of National Library of Medicine (Hereafter abbreviated NLM); S.R. Christophers and J.W.W. Stephens, "The Native as the Prime Agent in the Malarial Infection of Europeans (With Map)," *Reports to the Malaria Committee of the Royal Society* Second Series(1900). University of Oxford, Radcliffe Science Library; Stephens, J. W. W. and S. R. Christophers. "Destruction of Anopheles in Lagos." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: Harrison and Sons. 14-19. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Malarial and Blackwater Fevers of British Central Africa." *Reports to the Malaria Committee of the Royal Society*, First Series. 1900. London: Harrison and Sons. 12-41. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Note on Certain Bodies found in the Glands of Two Species of Culex." *Reports to the Malaria Committee of the Royal Society*, Second Series. 1900. London: Harrison and Sons. 20. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Malaria of Expeditionary Forces and the Means of its Prevention." *Reports to the Malaria Committee of the Royal Society*, Second Series. 1900. London: Harrison and Sons. 20-22. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Malarial Infection of Native Children." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: Harrison and Sons. 2-13. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Agglutination of Sporozoites." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: Harrison and Sons. 1. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Note of Malarial Fever on Railways under Construction." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: Harrison and Sons. 20. General Collection, W1 RO875. NLM; J. W. W. Stephens and S. R. Christophers, "Distribution of Anopheles in Sierra Leone. Parts I and II.," *Reports to the Malaria Committee of the Royal Society* First Series(1900). University of Oxford, Radcliffe Science Library; Christophers, S.R. and J.W.W. Stephens. "The Anatomy and Histology of the Adult Female Mosquito." *Reports to the Malaria Committee of the Royal Society*, Fourth Series. 1901. London: Harrison and Sons. 1-30. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Proposed Site for European Residences in the Freetown Hills." *Reports to the Malaria Committee of the Royal Society*, Fifth Series. 1901. London: Harrison and Sons. 2-5. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Mononuclear Leucocytes diagnostic of Malaria." *Reports to the Malaria Committee of the Royal Society*, Fifth Series. 1901. London: Harrison and Sons. 5-7. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Malarial Fever without Parasites in the Peripheral Blood." *Reports to the Malaria Committee of the Royal Society*, Fifth Series. 1901. London: Harrison and Sons. 7-10. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Tonicity of the Blood in Malaria and Blackwater Fever." *Reports to the Malaria Committee of the Royal Society*, Fifth Series. 1901. London: Harrison and Sons. 10-27. General Collection, W1 RO875. NLM.

by Ross, Grassi, and other scientists.

While Stephens and Christophers' published findings for the Royal Society were in agreement with Ross about the role of mosquitoes in malaria transmission, they strongly disagreed over the best strategies for lowering those transmission rates. Ross's work in West Africa with the Liverpool School of Tropical Medicine led him to advocate for "mosquito brigades" to "best wage war against mosquitoes."[21] These brigades would consist of a superintendent and a crew of laborers whose initial jobs would be to "collect all the broken bottles, tins, broken flower-pots, old gourds, and such like which they can find either in private premises or in the streets."[22] These crews would subsequently work to eliminate small ground puddles with shovels as well as to do small scale engineering projects to fill in ditches, dig drainage channels, and clearing vegetation.[23] The head-man of the crew was also tasked with convincing residents that mosquito larvae grew in their tubs and pots where water collected and to eliminate these sites of mosquito development.[24] Ross found these techniques to be successful in "the extirpation of mosquitoes to a degree sufficient to abolish malaria" in Sierra Leone as well as in Ismailia, a town in Egypt built by the Suez Canal Company.[25]

Stephens and Christophers were very skeptical that these brigades could be organized and made to work in West Africa, despite Ross's claims. Stephens and

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[21] Ross, Ronald. "Mosquito Brigades and How to Organise Them." 1902. New York: Longmans, Green, and Co. NLM ID 12011330R. NLM, p. viii. See also Annett*, et al.*, "Report of the Liverpool malaria expedition to Nigeria"; Ronald Ross, *The Prevention of Malaria* (Nabu Press, 2010).; Ronald Ross, *Report on the Prevention of Malaria in Mauritius* (Ulan Press, 2012).

[22] Ross, "Mosquito Brigades," p. 21

[23] *Ibid.*, pp.25-29

[24] *Ibid.*, pp.22-23

[25] J.T.W. Leslie. "Malaria in India," In *Proceedings of the Imperial Malaria Conference held at Simla October 1909*, Simla: Government Central Branch Press, 1910. , pp.6-7

Christophers repeatedly argued in their *Reports to the Malaria Committee of the Royal Society* that seasonal changes in weather and climate made locating and eliminating mosquito breeding areas untenable.[26] They noted that in accordance with Ross and the Liverpool recommendations, “the sanitary authorities of Freetown applied tar regularly for a period of some months to these pools,” was effective, but noted that “as soon as the tar applications were discontinued the anopheles reappeared everywhere in their old breeding-places.”[27] The availability of breeding locations, especially during the rainy season, combined with evidence that the work of mosquito brigades would be perpetual caused Stephens and Christophers to doubt the efficacy of this strategy in lowering malaria infection rates long-term. They also argued that Ross’s group underestimated the flying range of mosquitoes, which would neutralize some of the efforts of the mosquito brigades.[28]

But the biggest factor for Stephens and Christophers on why mosquito controls wouldn’t be effective was the presence of chronically malaria-infected Africans:

> So closely associated indeed are malaria and the native in Africa, and so wonderfully constant is the presence of anopheles where natives are collected in numbers, that we doubt whether any operations, now possible, directed against anopheles will do much to diminish the danger of malarial infection.[29]

The presence of a constantly infected population, meant for Stephens and Christophers that mosquito control efforts would have to entirely eliminate all mosquitoes for many

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[26] See e.g. Christophers and Stephens, “Native as the Prime Agent”; Stephens and Christophers, “Distribution of Anopheles in Sierra Leone”; Stephens and Christophers, “Infection of Native Children.”

[27] Stephens and Christophers, “Distribution of Anopheles in Sierra Leone,” p. 43

[28] Christophers and Stephens, “Native as the Prime Agent,” p. 5

[29] Stephens and Christophers, “Destruction of Anopheles,” p. 19

years before the threat of transmission could be assuaged. The high prevalence of malaria infection among the African population also worked against Koch's recommendations, based on his work in New Guinea, for eliminating malaria "by attacking the parasite in its human host through the careful administration of quinine."[30] Stephens and Christophers did not think the "careful administration of quinine" for everyone living in Sierra Leone was a realistic strategy for controlling malaria. Rather than advocating for mosquito control or treating the parasite in the African population, Christophers and Stephens argued for a more spatial solution: "In fact, in Africa the primary aim should be to remove susceptible Europeans from the midst of malaria. To stamp out native malaria is at present chimerical, and every effort should rather be turned to the protection of the European."[31] They suggested building separate towns as well as implementing curfews for Africans living near Europeans as ways to "protect" Europeans from malaria.[32]

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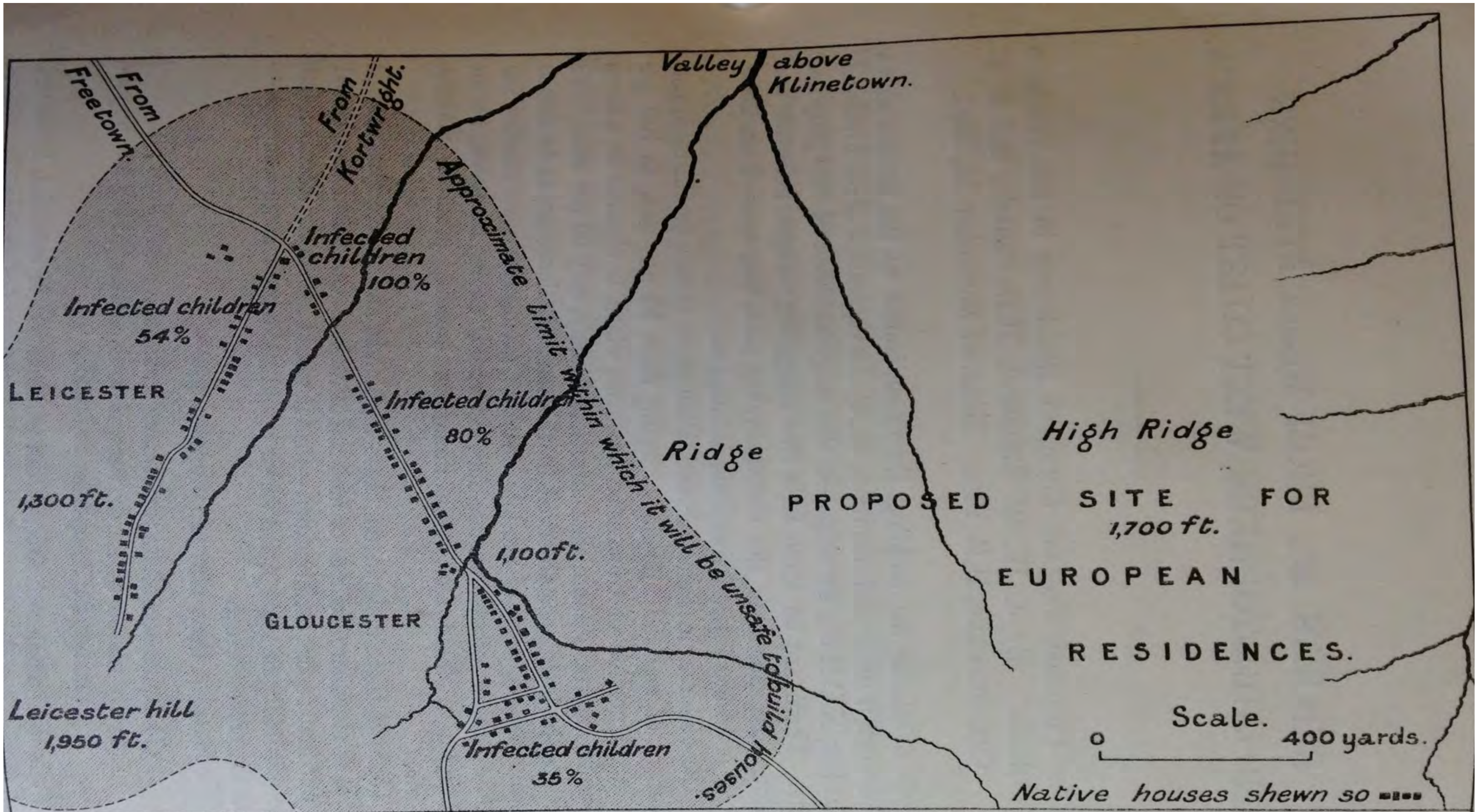
[30] Stephens, J. W. W. and S. R. Christophers. "Malaria in an Indian Cantonment (Mian Mir): an Experimental Application of Anti-malarial Measures — Preliminary Report." *Reports to the Malaria Committee of the Royal Society*, Eighth Series. 1903. London: Harrison and Sons. General Collection, W1 RO875. NLM, p. 13

[31] Stephens and Christophers, "Destruction of Anopheles," p. 19

[32] Christophers and Stephens, "Segregation of Europeans"; Stephens and Christophers, "Infection of Native Children"; Stephens and Christophers, "Proposed Site for European Residences."



Plan of portion of high ground above Freetown, showing area to be avoided in choosing site for European houses.

Image 1.1: Plan of portion of high ground above Freetown, showing area to be avoided in choosing site for European houses. From: J. W. W. Stephens and S. R. Christophers. "The Proposed Site for European Residences in the Freetown Hills." *Reports to the Malaria Committee of the Royal Society*, Fifth Series. 1901. London: Harrison and Sons. General Collection, W1 RO875. NLM. p. 4.

In regards to the "chimerical" nature of eliminating malaria in Africans, Stephens and Christophers noted, "Native malaria is a field of study hitherto completely neglected. Prolonged observation of native children, with post-mortem examinations, cannot fail to throw much light on the life-history of the parasite in the human organism."[33] They addressed this neglect by making "native children" a focus of their attention. In addition to post-mortem examinations, Stephens and Christophers also examined blood samples of children; in one "experiment" they "examined, as far as possible, the blood of every child under 12" which totaled 40 children in the town of Accra and 25 more children in another.[34] The results of these experiments reinforced for Stephens and Christophers that the segregation of Europeans from malaria-carrying Africans, particularly children, was an effective method of limiting malaria transmission.

Malaria in India

In 1901, Christophers was sent to India where the British governments' development practices and projects had helped to expand and intensify malaria epidemics.[35] The removal of forests for the expansion of rice cultivation and the establishment of tea plantations, as well as the building of railroads and canals for transporting goods and people greatly altered the Indian landscape and created environments for malaria carrying mosquitoes to thrive. The Colonial Office's concerns about malaria in India were twofold: a) malaria was a serious danger for British citizens

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[33] Christophers and Stephens, "Native as the Prime Agent," p. 10

[34] *Ibid.*, pp.11-3, 14

[35] Subhrendu K. Pattanayak*, et al.* "Deforestation and Malaria: Revisiting the Human Ecology Perspective," In *Human Health and Forests: A Global Overview of Issues, Practice, and Policy*, edited by Carol J. Pierce Colfer, Earthscan, 2012. (See also note 18 above)

who traveled or settled in India, soldiers stationed there, and to a smaller degree, the domestic population who could be infected when these other groups returned to Britain; and b) malaria severely impacted the health and productivity of Indians working in British-owned business endeavors such as tea plantations.[36]

The debates between Ross and mosquito control advocates, Christophers' segregation of Europeans, and Koch's quinine treatments over the best strategies for lowering malaria rates continued in India. In 1902, the Royal Society's Malaria Commission set up an experiment to test mosquito control on a wider scale, although the studies of Christophers and Stephens in Africa had led them to be skeptical about "the practical value of operations against mosquitoes in moister regions of the world."[37] The Commission chose Mian Mir, a cantonment in semi-arid Northern India because of its high malaria rates and "favourable" potential for mosquito elimination.[38] Christophers was put in charge in the second year (1903) and his doubts were confirmed: The area involved was too vast, the geological and climatic conditions as well as the variances of behavior between mosquito species, undermined the ability to limit breeding areas of

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[36] Leslie, "Malaria in India"; J.A. Sinton, "What Malaria Costs India, Nationally, Socially, Economically," *Records of the Malaria Survey of India* V, no. 3 (1935). NLM; Ira Klein, "Death in India: 1871-1921," *Journal of Asian Studies* 32(1973).; Watts, "British Development Policies and Malaria in India 1897-1929"; Ira Klein, "Development and Death: Reinterpreting Malaria, Economics and Ecology in British India," *Indian Economic & Social History Review* 38, no. 2 (2001).; Nandini Bhattacharya, "The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900–30," *Medical History* 55, no. 2 (2011).

[37] Christophers, S.R. "Second Report of the Anti-Malarial Operations At Mian Mir, 1901-1903." *Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India*, 1904. The British Library, p. 1 See also James, S. P. "A Report of the Anti-Malarial Operations at Mian Mir (1901-1902)." *Reports to the Malaria Committee of the Royal Society*, Eighth Series. 1903. London: Harrison and Sons. 27-77. General Collection, W1 RO875. NLM.; James, Sidney Price. "First Report of the Anti-malarial Operations at Mian Mir, 1901-1903." *Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India*, 6. 1903. Calcutta: Govt. Printing. System No. 011833883. British Library.; Stephens and Christophers, "Malaria in Mian Mir"; S. P. James. "Malaria in Mian Mir," In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, 84–93. Bombay: Bennett, Coleman & Co., 1909.

[38] Christophers, "2nd Report of Operations at Mian Mir," p. 1

mosquitoes.[39] Christophers and his allies involved in the administration of Mian Mir advocated their positions and beliefs at tropical medicine conferences (such as those held in Simla and Bombay) and meetings as well as articles in the *Reports to the Malaria Committee of the Royal Society* and Indian government reports such as *Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India.* The Mian Mir experiment continued until 1909 but was widely considered a failure of malaria control and detrimental to future possibilities of control plans that focused on mosquitoes.[40]

In the midst of the Mian Mir experiment, Christophers' commission with the Royal Society ended and he enlisted in the Indian Medical Service, a military position that allowed him to continue to study malaria in India.[41] Continuing work he began with Stephens in Africa, Christophers focused on the *Anopheles* from an entomological perspective, working to differentiate between species, identifying which species were

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[39] See: *Ibid.*; James, "Report of Operations at Mian Mir"; James, "First Report Mian Mir"; Stephens and Christophers, "Malaria in Mian Mir."

[40] Malcolm Watson, "Observations of Malaria Control, with Special Reference to the Assam Tea Gardens, and Some Remarks on Mian Mir, Lahore Cantonment," *Trans R Soc Trop Med Hyg* XVIII, no. 4 (1924).; Malcolm Watson, "Malaria and Mosquitoes: Forty Years on," *Journal of the Royal Society of Arts* 87(1939).; Klein, "Death in India"; Bynum, "Experiment That Failed"; WF Bynum, ""Reasons for Contentment": Malaria in India, 1900-1920.," *Parassitologia* 40, no. 1-2 (1998).

[41] Shortt and Garnham, "Christophers' Obituary," pp.180-81

malaria vectors, and locating breeding sites to improve control efforts.[42] This approach is why he is credited with being "one of the founders of medical entomology."[43] While Ross was the well-known advocate of mosquito control strategies (and won the Nobel Prize in Medicine for his discovery of malaria in mosquitoes), Christophers advocated for more precise and specific knowledge about the anatomy, behavior, locations, and life-cycles of mosquitoes.

In 1903, Stephens and Christophers published *The Practical Study of Malaria and other Blood Parasites.* In the "Preface to the First Edition," they discuss the need for textbooks and manuals for those not working in pristine laboratories and provide

> only that which we have found the best, the simplest, and the most generally useful. In reality, the necessary methods required to undertake research of the highest value in Malaria are very simple, yet most of these cannot be found in books, and they are with considerable difficulty learnt except by the personal direction of those who are familiar with the small details which go to make success.[44]

These details for success were explained and illustrated. The first edition contained two color plates and many black and white maps and illustrations of blood cells, mosquito

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[42] Stephens and Christophers, "Destruction of Anopheles"; Stephens and Christophers, "Note on Certain Bodies"; Stephens and Christophers, "Distribution of Anopheles in Sierra Leone"; Christophers and Stephens, "Anatomy and Histology"; Stephens, J. W. W. and S. R. Christophers. "The Relation of Malaria Endemicity to '*Species*' of Anopheles." *Reports to the Malaria Committee of the Royal Society*, Sixth Series. 1902. London: Harrison and Sons. 3-10. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Some Points in the Biology of the Species of Anopheles found in Bengal." *Reports to the Malaria Committee of the Royal Society*, Sixth Series. 1902. London: Harrison and Sons. 11-19. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Classification of Indian Anopheles into Natural Groups." *Reports to the Malaria Committee of the Royal Society*, Seventh Series. 1902. London: Harrison and Sons. 3-14. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "The Relation of Species of Anopheles to Malarial Endemicity — Further Report." *Reports to the Malaria Committee of the Royal Society*, Seventh Series. 1902. London: Harrison and Sons. 20-23. General Collection, W1 RO875. NLM; Stephens, J. W. W. and S. R. Christophers. "Notes on Bodies in Salivary Glands of Anopheles, etc." *Reports to the Malaria Committee of the Royal Society*, Seventh Series. 1902. London: Harrison and Sons. 45-46. General Collection, W1 RO875. NLM; J. Stephens and Christophers, *Practical Study of Malaria.*

[43] Service, "Sir Rickard Christophers," p. 679

[44] Stephens and Christophers, *Practical Study of Malaria*, p. xi

anatomy, the malaria cycle, and equipment for testing and analyzing blood as well as breeding, raising, catching, and dissecting mosquitoes.[45] Subsequent editions increased the number of plates and illustrations and continued their commitment to simplicity and pedagogical utility.

The wide circulation of *The Practical Study of Malaria* helped to solidify Christophers and Stephens' as the accepted and standard ontology. The authors of Christophers' obituary for the Royal Society credits *The Practical Study of Malaria*, along with his 1928 book, *How to Do a Malaria Survey,* with being "the constant companions of most malaria workers in the tropics. Their highly scientific approach was responsible for leading many of the latter into the 'research life.'"[46] In all three editions of *The Practical Study of Malaria*, Christophers and Stephens established the parameters of how to study what they term "the rationale of infection," which involved attending to "the form of the parasite present; the percentage of adults and children infected; the species of Anopheline; where each species was found and where it bred; the percentage of each [Anopheles] species" that contained the malaria parasite in each stage of its reproductive cycle.[47] Stephens and Christophers articulated the limits and conditions of what malaria *is*, what qualities and aspects constituted malaria and malaria infections. They helped to establish the methods and practices of malaria's onto-epistemology.

The techniques and technologies for engaging "the rationale of infection" that Stephens and Christophers explicate in *The Practical Study of Malaria* did not require

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[45] *Ibid.*
[46] Shortt and Garnham, "Christophers' Obituary," p. 187
[47] Stephens and Christophers, *Practical Study of Malaria*, p. xii

complicated methods or uncommon materials. They proffered that, "with very little apparatus it is possible to undertake many most [sic] important researchers. . . . In fact nearly the whole technique of Malaria can be conducted with a microscope, a few slides and coverglasses, a needle, a stain, some tubes, pins, and cardboard."[48] Some of these techniques are elucidated in chapter twenty-three, "To Make a Malarial Survey," in order to "investigate the endemic malaria of a district."[49] This investigation entailed determining the "Breeding-Places of Anophelines," through examining "all collections of water within half-a-mile," taking larval specimens, putting those specimens in tubes, labelling those tubes, and then identifying the species.[50] This collection and identification is followed by "mak[ing] a map of the neighbourhood, noting — (a) All breeding grounds. (b) What species are found breeding in those examined."[51] They include a map to model what a malaria survey should contain and how it should appear:

[48] *Ibid.*

[49] *Ibid.*, p. 260

[50] *Ibid.*, pp.260-61

[51] *Ibid.*, p. 261

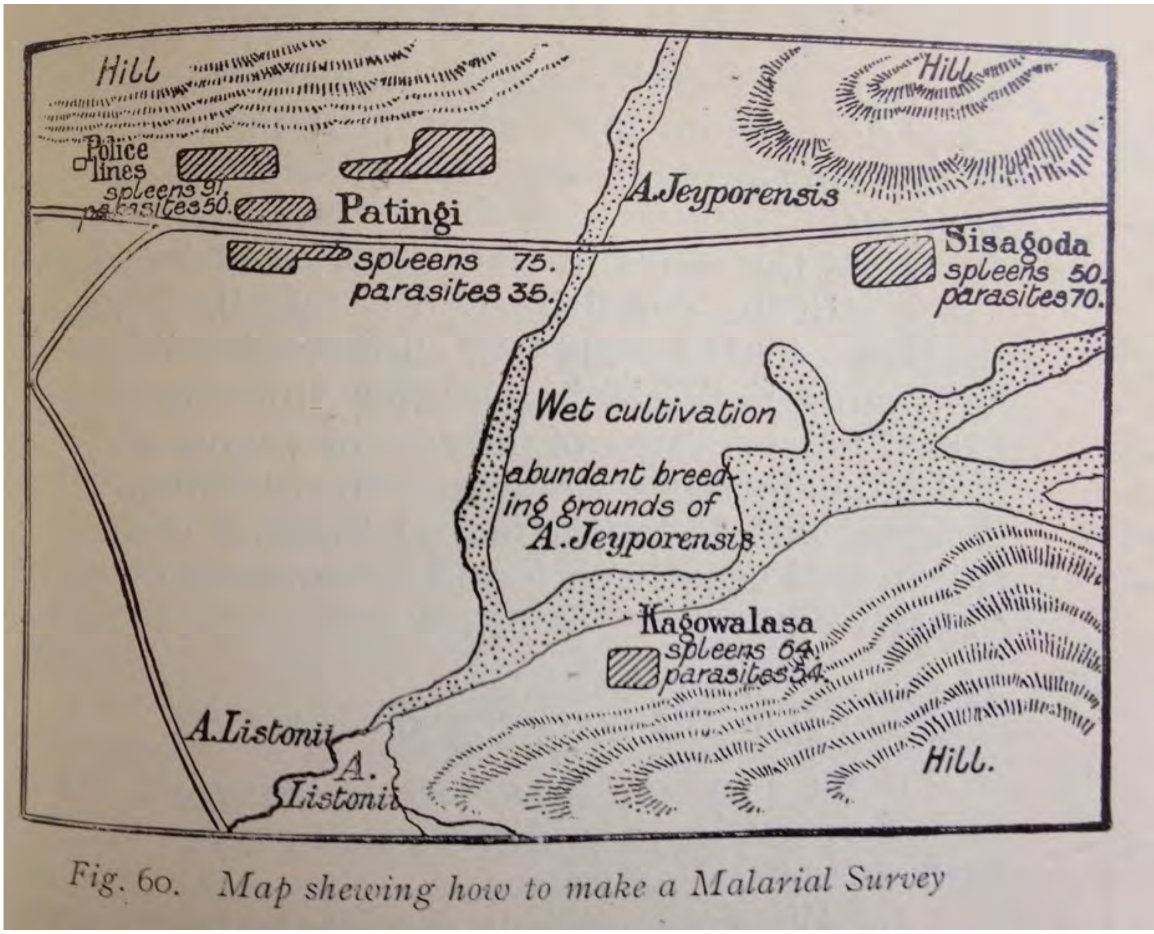

Image 1.2: Map shewing how to make a Malarial Survey. From Stephens, J. W. W. and S. R. Christophers. *The Practical Study of Malaria and other Blood Parasites*. Liverpool: University Press of Liverpool, 1903. Third Edition. p. 261.

In 1906, the Indian government assigned Christophers and C.A. Bentley to study malaria on tea plantations in Duars, where Christophers' criticisms of mosquito-based anti-malarial strategies were fortified further.[52] Bentley and Christophers found that the geography and variety of mosquito species in Duars were not conducive for mosquito-focused malaria control efforts and instead focused on human causes for the severe

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[52] Bentley, Charles and S.R. Christophers. *The Causes of Blackwater Fever in the Duars*. Simla: Government of India Press, 1908.; Christophers, S.R. and C.A. Bentley. "The Human Factor: An Extension of our Knowledge Regarding the Epidemiology of Malarial Disease," In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, 78–83. Bombay: Bennett, Coleman & Co., 1909.; Christophers, S.R. and C.A. Bentley. "Malaria in the Duars: Being the Second Report to the Advisory Committee Appointed By the Government of India to Conduct an Enquiry Regarding Blackwater and Other Fevers Prevalent in the Duars." 1911. Simla: Government of India Press. Medical Heritage Library. Wellcome Library.

malaria epidemics in the tea plantations. They linked the political economy of the tea plantations and subsequent movement of migrant labor as the primary reasons malaria was seemingly impossible to ameliorate in these areas.[53] Unlike local laborers who had built up a tolerance to malaria such that their blood showed a constant malaria infection but who remained un-symptomatic, workers imported from areas with low or no malaria infections had no such tolerance or resistance and were especially vulnerable to becoming severely ill when they contracted malaria (which they were assured of doing) once at Duars.[54]

Christophers and Bentley called for greater government oversight and intervention into the labor practices involved in the growing and exporting of tea. They argued that plantation owners were not providing proper sanitation, water, housing, and qualified medical care, which when combined with low pay, caused workers to be "reservoirs of infection ever ready to involve their neighbourhood in epidemic disease, and capable on the migration of their members of diffusing infection far and wide."[55] The conditions at Duars and Mian Mir shaped Christophers belief in the "theory of non-immune immigration into industrial locations as a principal cause of malaria" and the importance of understanding the epidemiology of a region.[56]

Two 1909 conferences addressing control strategies and debates about mosquito or quinine interventions helped to increase Christophers' reputation. At each conference

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[53] Christophers and Bentley, "Malaria in the Duars," pp.5-6; See also: Bhattacharya, "The Logic of Location," pp.107-08

[54] Christophers and Bentley, "Malaria in the Duars," pp.5-6, 22-3

[55] *Ibid.*, p. 5

[56] Bhattacharya, "The Logic of Location," pp.109, note 35

he argued against the efficacy of mosquito-based strategies of control and supplemented his papers with maps. At the Imperial Malaria Conference in Simla he presented "A New Statistical Method of Mapping Epidemic Disease in India, with Special Reference to the Mapping of Epidemic Malaria," and "Malaria in the Punjab," At the Bombay Medical Conference he co-presented with C.A. Bentley: "The Human Factor: An Extension of Our Knowledge Regarding the Epidemiology of Malarial Disease," and "The Intimate Pathology of Malaria in Relation to Black-Water Fever."

Christophers was rapidly becoming the "star figure in the constellation" of British malaria researchers and he gained power, prestige, and positions of authority.[57] In 1904, he was appointed Director of the newly created King Institute of Preventative Medicine, and in 1910 he was again put in charge of a new institution, this time the Central Malaria Bureau a position which included laboratory space, personnel, a library, and collections.[58] This position made him "responsible for all matters relating to malaria in the whole of India and especially for the operation of 'malaria surveys' in order to gain an idea of the distribution and severity of the disease nation wide."[59] In 1915, Christophers was appointed a Companion to the Indian Empire (C.I.E.), and during World War I he served as Deputy Assistant Director of Medical Services and Malaria Officer to the Mesopotamian Expeditionary Force, for which he was awarded the Order of the British Empire (O.B.E.) in 1918. After the war, he returned to India to become director of India's Malaria Research Center (which became the Malaria Survey of India) from 1920-1932.

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[57] Watts, "British Development Policies and Malaria in India 1897-1929," p. 174, quoting Maj. John A. Sinton *Bibliography of Malaria in India*, (Records of the Malaria Survey of India, I, Calcutta, 1930) 34-35.

[58] Service, "Sir Rickard Christophers," p. 679; Shortt and Garnham, "Christophers' Obituary," p. 181

[59] Shortt and Garnham, "Christophers' Obituary," p. 181

The attention to what Christophers and Bentley termed "the tropical aggregation of labor" and to the importance of understanding the epidemiology and endemicity of a local population first, was a foundational focus for Christophers' work.[60] It was one that he would make the standard and official policy, so that "by 1927, the factor of the tropical aggregation of labour, or the human factor in malarial infection was an accepted scientific theory through reiteration in published work on malaria in India."[61] All of his published works included little tools of knowledge like "images, lists, charts, schemata, tables, and graphs" as "devices" that helped "unite science and academia seamlessly with bureaucracy."[62] This bringing together of different realms was a core component to both of his instructional books *The Practical Study of Malaria* and *How to do a Malaria Survey.*

First published in 1928, *How to do a Malaria Survey* was required reading for "students of malaria in India," especially those attending Course for Medical Officers held annually at the Malaria Institute of India.[63] The local and international demand for the book necessitated six editions.[64] For Christophers, performing a malaria survey was a foundational and necessary first step to understanding malaria in a location: "'Surveys' are the eyes and ears of malaria work and should be so regarded."[65] Included within the survey was "not only a most detailed investigation of the habits of the human and insects

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[60] Christophers and Bentley, "Malaria in the Duars," p. 2

[61] Bhattacharya, "The Logic of Location," pp.109, note 35

[62] Becker and Clark, *Little Tools*, p. 18

[63] Christophers, S.R. "How to Do a Malaria Survey." 1928. Calcutta: Government of India, Central Publication Branch. Medical Collection (Shelfmark: WC750 1958C55h). Wellcome Library, p. ii

[64] Shortt and Garnham, "Christophers' Obituary," p. 187

[65] Christophers, "Malaria Survey," p. 4

hosts of the disease, but also of their environmental conditions."[66] But rather than considering these investigations "merely routine or mechanical," Christophers felt that "a malaria survey is frequently a true piece of research work," that helped to increase knowledge about the "varied … circumstances affecting malaria with its triple-linked chain of man, the parasite, and the mosquito, as well as all the various factors influencing this chain."[67] This research work was done in service of "guiding policy and action," even if no actions could be taken.[68]

The steps involved in making a malaria survey included notifying local authorities of the survey workers; walking "over every part of your area," collecting larvae and adult Anopheles, and dissecting several hundred different species of adult Anopheles; "abstract in the evenings information likely to be worth studying" about seasonal prevalence of malaria in an area and "actual" morbidity and mortality numbers; collecting meteorological data, and "as much information as possible" about the history of malaria and economic conditions that might influence transmission rates such as canal and railroad construction, and "any other human factors" of new immigrants for labor; and lastly "carefully consider all the facts, and what the condition in the main appears to be. Considering the physical conditions, the nature of the communities and their habits and other matters, decide what, if any, measures of prevention seem urgently called for, and are reasonable and possible."[69] Similar to *The Practical Study of Malaria*, descriptions of techniques and technologies for malaria surveillance were central to *How to do a Malaria*

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[66] *Ibid.*, p. 1
[67] *Ibid.*
[68] *Ibid.*, p. 2
[69] *Ibid.*, pp.11-14

Survey. The practices for collecting and dissecting mosquitoes, how to send live samples through the mail, perform spleen surveys, determine infections rates, and create maps were just some of the techniques described in detail with charts, graphs, tables, drawings, and maps. These little tools effectively brought together science practice and bureaucratic policy into authoritative and objective knowledge.

Maps and Centers of Calculation

In *Science in Action*, Bruno Latour analyzes eighteenth century European cartography to discuss how science creates knowledge that becomes usable and recognizable for those within a discipline and beyond.[70] Scientists assemble authority through developing and deploying models and/or maps that travel and bring back 'new' understandings; that is, maps helped the French King, government officials, and other explorers in Europe to know territories and spaces from across an ocean.[71] The ability to create authoritative standards for the formal elements of maps such as scale of representation, icons used, insets and legends, etc. helped to establish "centers of calculation (key sites of cartographic practice) that came to dominate the world."[72] The concept of centers of calculation is helpful to frame the work of the Royal Society's Malaria Committee: Their emissaries became high-ranking officials with prestige, authority, and power in India and helped to establish a standard way of knowing malaria

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[70] Latour, *Science in Action*, pp.215-57

[71] Similarly, Latour discusses how arranging chemical elements in a table helped to create or make visible new relationships between elements or 'families' of elements. *Ibid.*, pp.235-36

[72] Latour, *Science in Action*, pp.215-57; Rob Kitchin, Chris Perkins, and Martin Dodge. "Thinking About Maps," In *Rethinking Maps: New Frontiers in Cartographic Theory*, edited by Rob Kitichen Martin Dodge, and Chris Perkins, London: Routledge, 2009. , p. 15

and malaria transmission which circulated around the world.

It wasn't just the formal elements of cartography that established a dominant world view, but also the work those elements help maps do in the world: "Mapping is epistemological but also deeply ontological - it is both a way of thinking about the world, offering a framework for knowledge, and a set of assertion about the world itself."[73] Maps create knowledge and they can set parameters on what is know-able. As I discussed in the introduction to the dissertation, disease maps stabilize what is known and know-able about territory and a disease entity. If maps are assertions that 'This is there,' then disease maps state 'This disease is there.'[74] In identifying a location that a disease has been diagnosed, disease maps stabilize understandings and constructions of what that disease is. Disease maps are made using already existing epidemiological data and assert that disease is an feature that can be located in particular spaces. The practices and epistemological work of production are not visible and any uncertainty and controversies are stabilized and made static on the map. This way of knowing a disease becomes "immutable" and can circulate through different users.[75]

Christophers commonly used maps in his conference presentations.[76] In his 1909 presentation on malaria in the Punjab region of India, he advocated for using maps to improve knowledge about malaria epidemiology:

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[73] Kitchin, "Thinking About Maps," p. 1

[74] Tom Koch, *Disease Maps: Epidemics on the Ground* (Chicago: University Of Chicago Press, 2011).

[75] Latour, *Science in Action*, pp.236-37

[76] Although maps were discussed and included in his talks none of the maps he presented were reproduced in the subsequent publications of the conference proceedings. See for example: S.R. Christophers. "A New Statistical Method of Mapping Epidemic Disease in India, With Special Reference to the Mapping of Epidemic Malaria," In *Proceedings of the Imperial Malaria Conference held at Simla In October 1909*, 16–22. Simla: Government Central Branch Press, 1910.

> If we colour a map of the Punjab according to these district figures we get . . . a more detailed and much more instructive picture of the distribution of the mortality is that obtained by [traditional methods]. . . . The map shows us conclusively that there is some general determining factors over and above local conditions which acts over these epidemic areas and with increasing intensity as we approach their focus.[77]

Christophers' publications, even in his earliest reports from Africa and Mian Mir, usually included maps. Some were seemingly simple such as this map reproduced in his 1925 book *Two Malarial Surveys Connected with Industrial Projects in Certain Very Highly Malarious Localities in India*[78]:

[77] S.R. Christophers. "Malaria in the Punjab," In *Proceedings of the Imperial Malaria Conference Held at Simla in October 1909*, Simla: Government Central Branch Press, 1910. , pp.31-32

[78] Christophers, S.R. "Two Malarial Surveys Connected With Industrial Projects in Certain Very Highly Malarious Localities in India." 1925. Calcutta: Thacker, Spink & Co. Closed stores Med. pam. (Shelfmark: WC750 1925C55t). Wellcome Library.

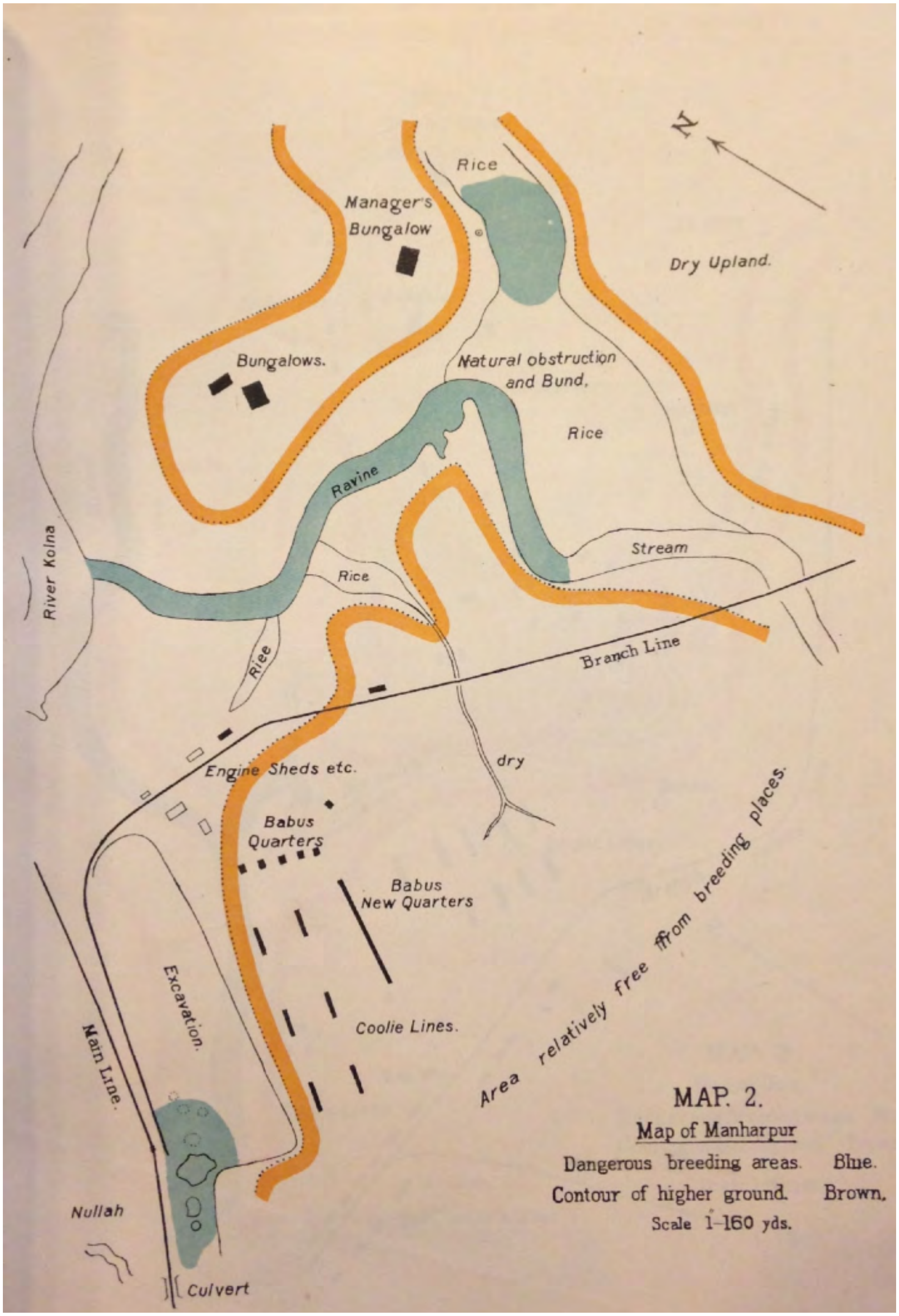

Image 1.3: "Map II. Map of Manharpur." Christophers, S.R. *Two Malarial Surveys Connected with Industrial Projects in Certain Very Highly Malarious Localities in India*, Calcutta: Thacker, Spink & Co. 1925. Set between 366-7. 1-160 yards. The Wellcome Library, London.

Other maps had more details:

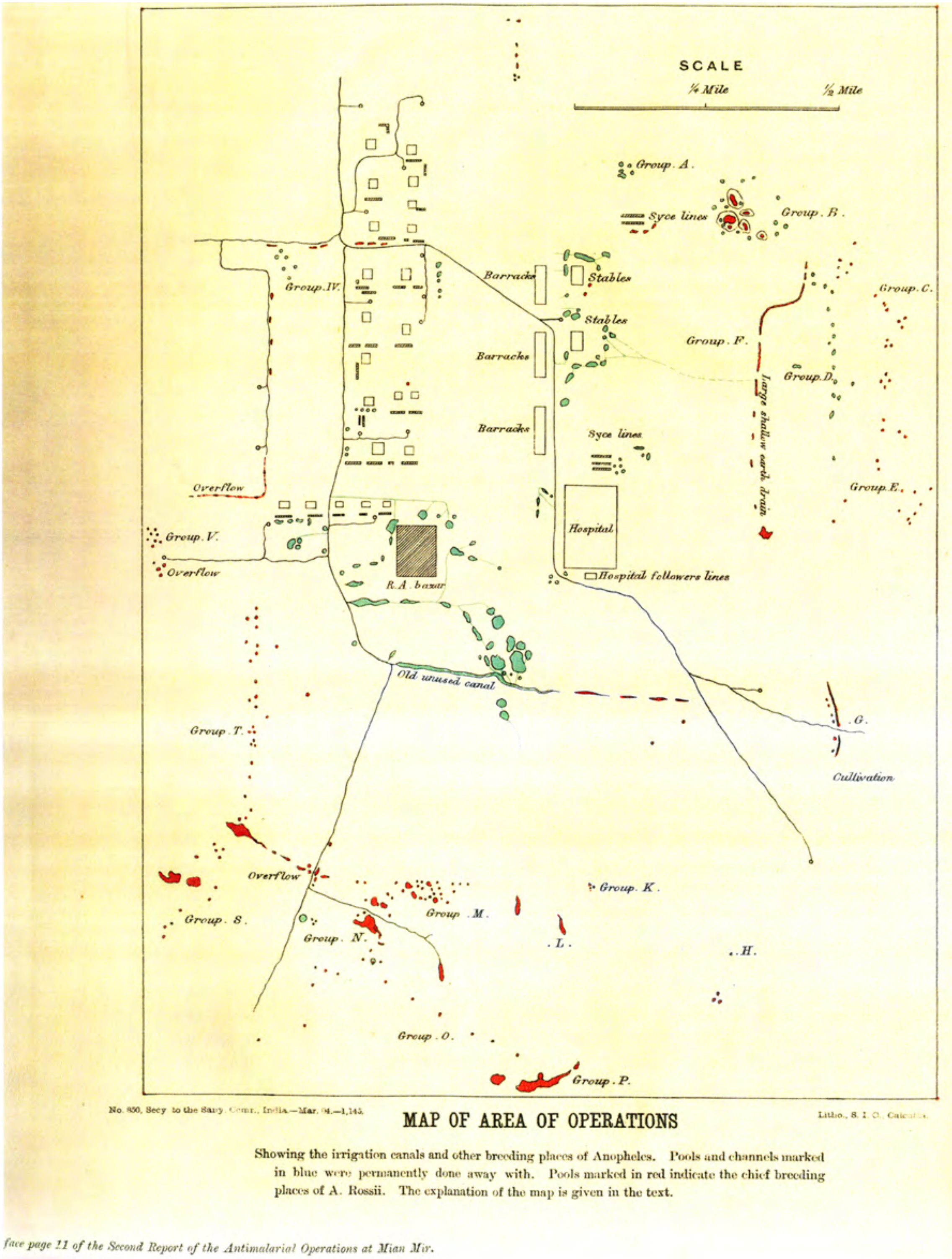

Image 1.4: Map. Christophers, S.R. "Map of Area of Operation Mian Mir," In Second Report of the Anti-malarial Operations at Mian Mir, 1901-1903, 11. Government of India, 1904. The British Library.

Both of these maps detailed areas of high malaria rates and mosquito populations. In contrast, Ross's reports and books, only included travel maps of where the mosquito crews or investigators began their work and where they went.

Christophers' Malaria Map of India

Christophers' maps helped to define and authorize his views of malaria and malaria causation: "What is mapped, how it is mapped, and the power of maps is the result of Western science's ability to set the parameters and to dominate the debate about legitimate forms of knowledge."[79] Christophers dominated debates about "legitimate" knowledge of malaria as well as the "legitimate" strategies for malaria control. Christophers made his most famous map, the *Malaria Map of India*, in 1924. Included in his influential, *Malaria in India*, Sir Patrick Hehir credits Christophers' map as "the first of its kind constructed."[80] The map also accompanies an article in the July 1926 issue of *The Indian Journal of Medical Research* which was co-authored Christophers and Major Sinton, and was included in Sinton's much cited (then and now) 1935 article "What Malaria Costs India, Nationally, Socially, Economically."[81] R. Akhtar recently noted this map "was the reflection of Christophers' holistic approach to understanding the spatial distribution of malaria."[82]

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[79] Kitchin, "Thinking About Maps," p. 15

[80] Patrick Hehir, *Malaria in India* (Oxford: Oxford University Press, 1927). , p. viii. Hehir also noted that "The block of the Map, as it appears in this book, was prepared by the Oxford Medical Publications Press from the original sent to the author by Lt.-Col. Christophers in 1924" 441.

[81] *Ibid.*; Sinton, "What Malaria Costs India," p. 227

[82] Rais Akhtar. "Geoecology of Malaria in India: Historical Perspective and a Case Study of Western Rajasthan," In *Environmental Deterioration and Human Health: Natural and Anthropogenic Determinants*, edited by Abdul Malik, Elisabeth Grohmann, and Rais Akhtar, Springer, 2014. , p. 338

Image 1.5: Malaria Map of India. Christophers, SR. 1926. The Historical Medical Library of The College of Physicians of Philadelphia.

Christophers' map used to color to identify areas where malaria was endemic. It asserted that climate and environment were important and determining factors in health and that landscapes weren't under human control.

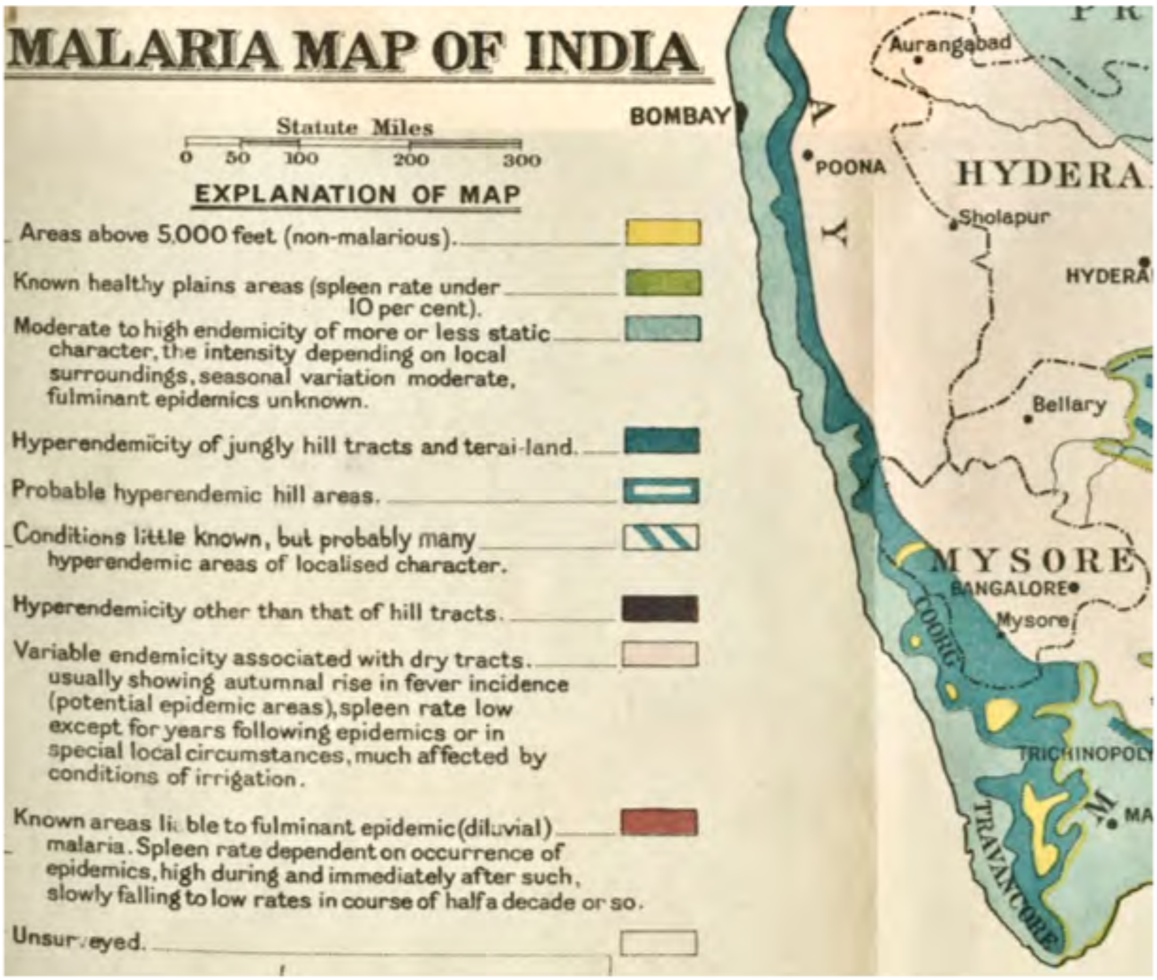

Image 1.6: "Explanation of Map" for Malaria Map of India. 1926.

The map identifies territories of human vulnerability, and the key explains the variations of power. In the 1926 *Indian Journal of Medical Research* article that accompanied the map, Christophers and Sinton provided explanation of the color scheme (and which Hehir included in an Appendix in *Malaria in India*).[83] Even as this legend

[83] S.R. Christophers and J.A. Sinton, "A Malaria Map of India," *The Indian Journal of Medical Research* XIV(1926). NLM; Hehir, *Malaria in India*, pp.441-43

acknowledges uncertainties, — the white within the blue box and the blue and white striped boxes use “probable” and “conditions little known” — these uncertainties only further Christophers’ construction of malaria as a disease fixed in the landscape and more powerful than the colonial humans trying to occupy and govern it. The landscape has the power over the health of humans, with humans seemingly having little recompense other than relocation. In 1926, Christophers’ representation of malaria control continues to align with a statement from H. Hamilton’s 1909 Presidential Address at the Bombay Medical Conference: “In the matter of the prophylaxis of malaria, the most potent method is to keep out of its way, — to run away from it.”[84] These are areas where it is probable that human bodies would become infected with the malaria parasite, though causation is not directly assigned and control methods are unknown.

In describing the color scheme, Christophers and Sinton’s language gives agency to natural elements like rainfall and flooding. They state that in the light blue areas “Malaria here is largely a reflex of a multiplicity of natural features of the country. Rainwater collections, streams and rivers, swamps, ponds and lakes (tanks) and in addition rice-fields and irrigation all play their part.”[85] Rice fields are included in the “natural features” of India and they actively produce malaria.

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[84] H Hamilton. “Presidential Address By Surgeon-General H. Hamilton, C.C., M.D., V.H.S. I.M.S., President of the Section,” In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, Bombay: Bennett, Coleman and Co., 1909. , p. 66

[85] Christophers and Sinton, “Malaria Map of India,” p. 175

Image 1.7: Closeup of Malaria Map of India. 1926

In this section from the Northwest quadrant, the threat is variable, dependent upon season and rainfall. Christophers and Sinton attribute malaria epidemics in the light pink areas to "unusually heavy rainfall…upon river drainage systems normally unaccustomed to cope with such precipitation."[86] This variability is caused both by conditions outside human control (rainfall) but also those that humans can influence (irrigation), though this remedy would probably be prohibitively expensive. Elsewhere they connect higher malaria rates in the pink areas "with irrigation, more especially with old defective

[86] *Ibid.*, p. 174; Hehir, *Malaria in India*, p. 442

systems where leakage and water-logging are a feature."[87] However, they do not suggest engineering projects to repair or improve the river or irrigation systems' drainage. Instead, Christophers and Sinton laud that with the "aid of prompt report of the meteorological data Gill has been able to make very accurate annual forecasts…thus enabling early steps to be taken in respect to quinine distribution."[88] The map indicates that areas can be avoided at particular times to avoid or lower one's chances of contracting malaria.

Christophers was not an advocate of malaria control through large-scale, expensive public works to build, repair, or improve irrigation systems which would be appropriate to local needs and effective in lowering mosquito populations and thus malaria transmission. These possibilities are not present in this map; there is no suggestion of them or how they might or might not be effective. The parameters of the landscape in the map's inset obscure variances and potential points of intervention: The effects of that rainfall on the different regions and elevations represented , but is flooding the same in all areas? Do some areas have better (or worse) engineering projects? Are higher or lower malaria rates linked to specific changes to the landscape or built environment? These are not questions about malaria control that this map evokes (or its creators want to evoke).

Christophers' map was made based on spleen surveys, the physical manipulation

[87] Christophers and Sinton, "Malaria Map of India," p. 175

[88] *Ibid.*, p. 174; Hehir, *Malaria in India*, p. 442 The lack of consideration given to engineering remedies might be attributed to many factors: the expense which contradicted the interests of English investors, but also the due to English engineers in India who generally applied their understandings of British rivers to those in India without consideration for seasonal flooding. See Watts.

of human bodies and implementing statistical methods. There is no indication that malaria might affect some populations of people more than others; that Indians or the British might be more vulnerable. In addition, mosquitoes are entirely absent here; they are not counted and their relationship to malaria, standing water, and the landscape are not present. Transmission is absent altogether in this map. Malaria is connected to rainfall but not explicitly to the increase in mosquito populations that the rainfall causes. If malaria were associated with mosquitoes, perhaps then there would be more humans (and especially governments) could do to lower their populations. The presence of mosquitoes would have perhaps provoked thoughts about landscape alteration, the effective large-scale actions of humans in changing environmental conditions conducive to controlling mosquito populations like eliminating areas where standing water collected and improved irrigation and drainage.

Hehir supported Christophers' characterizations of malaria as being caused by the uncertain and variable powers of nature. In describing the various geographic sections of the malaria map, Hehir stated that the North-West Frontier Provence contains the Indus river and its "branches [which] are subject to serious flooding and inundations, which are periodically associated with widespread epidemics of malaria."[89] In describing what he calls "Middle India, [which includes] the plains of Northern India, a widespread alluvial tract under 1,000 feet above sea level," Hehir characterized the malaria epidemics as "periodical outbursts" in Sind; East and North Punjab as "a heavily populated wheat-growing area, usually with moderately severe endemicity, [and] subject to overwhelming

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[89] Hehir, *Malaria in India*, p. 16

and appalling outbursts of epidemic malaria — *it is the home of this latter form of the disease*."[90] Malaria, the rivers, and the landscapes a have the agency here; Malaria bursts forth, with "overwhelming and appalling" force to affect a region. There is no indication of human power, only vulnerability. There is no possibility given to the utility of engineering or irrigation projects in lowering malaria epidemics, to taming the unruly "outbursts" of nature and malaria. Christophers' position had become hegemonic in India, and his maps helped solidify his influence about which control methods could be possible.

The Malaria Map of Quetta

The Malaria Map of Quetta was created by H.W. Mullian and J.D. Baily as in inset to the article of the same name in the June 1936 *Records of the Malaria Survey of India*.[91] Also in that issue is another article about malaria in Quetta by Molony and Gorman: "Malaria in Quetta. An Analysis of the Statistics of Admissions to Military Hospitals and Their Correlation with Temperature, Humidity and Rainfall."

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[90] *Ibid.* Emphasis in the original

[91] Mulligan, H.W. and Baily, J.D., "Map of Malaria in Quetta." *Records of the Malaria Survey of India*, 1936. NLM.

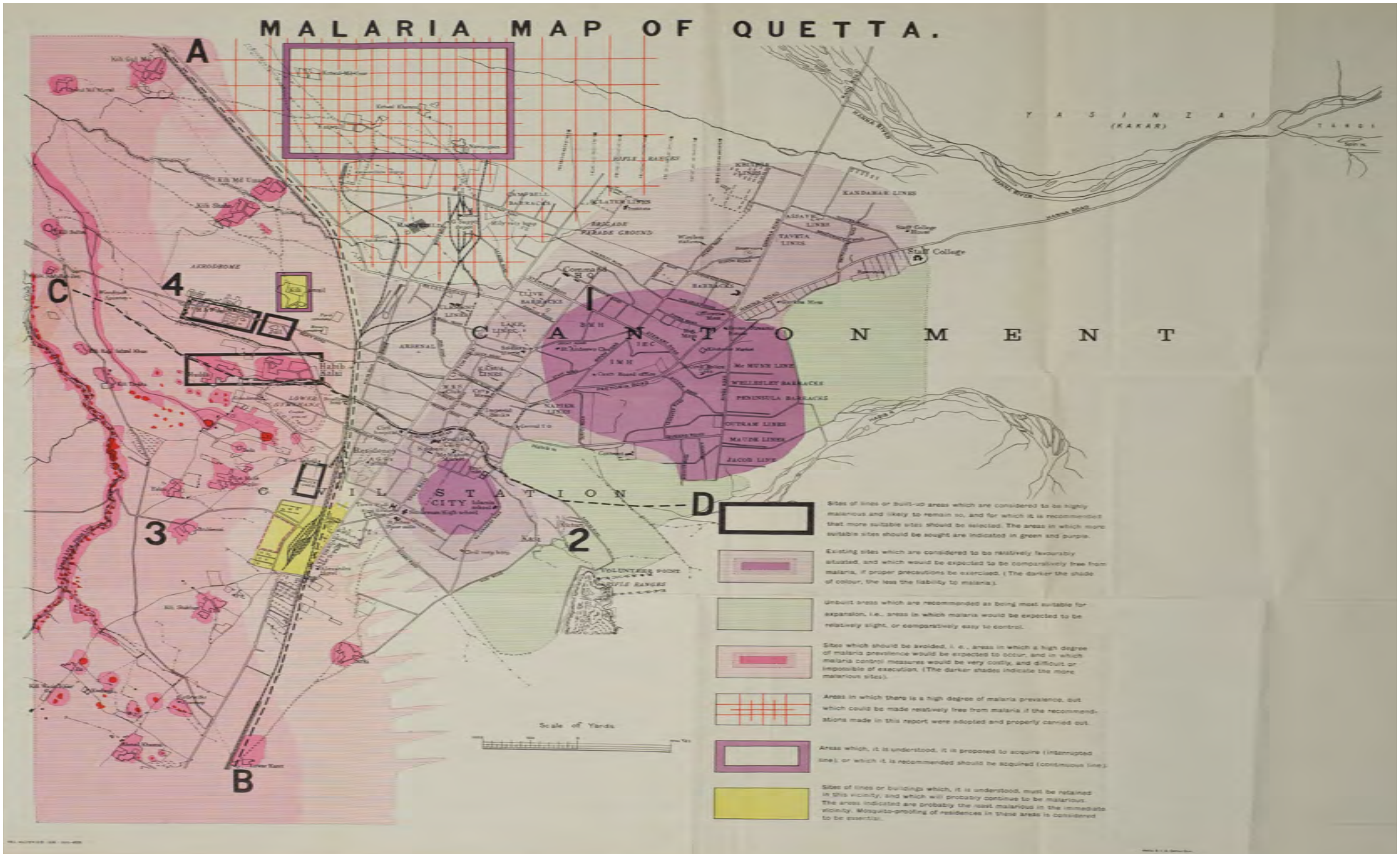

Image 1.8: "Map of Malaria in Quetta." Mulligan, H.W. and Baily, J.D. *Records of the Malaria Survey of India*, VI (2), 1936. Image courtesy of the National Library of Medicine

The “Malaria in Quetta” study was commissioned after a 1935 earthquake that devastated the city in what is now Pakistan and prior to British Army rebuilding efforts to make the “new” city more salubrious. This map identified areas that were healthy, places that could be developed into healthiness by the British, as well as areas that would not be able to be made safe and should be avoided. Malaria is less fixed in the landscape — it is more variable and malleable to the efforts of humans to control it.

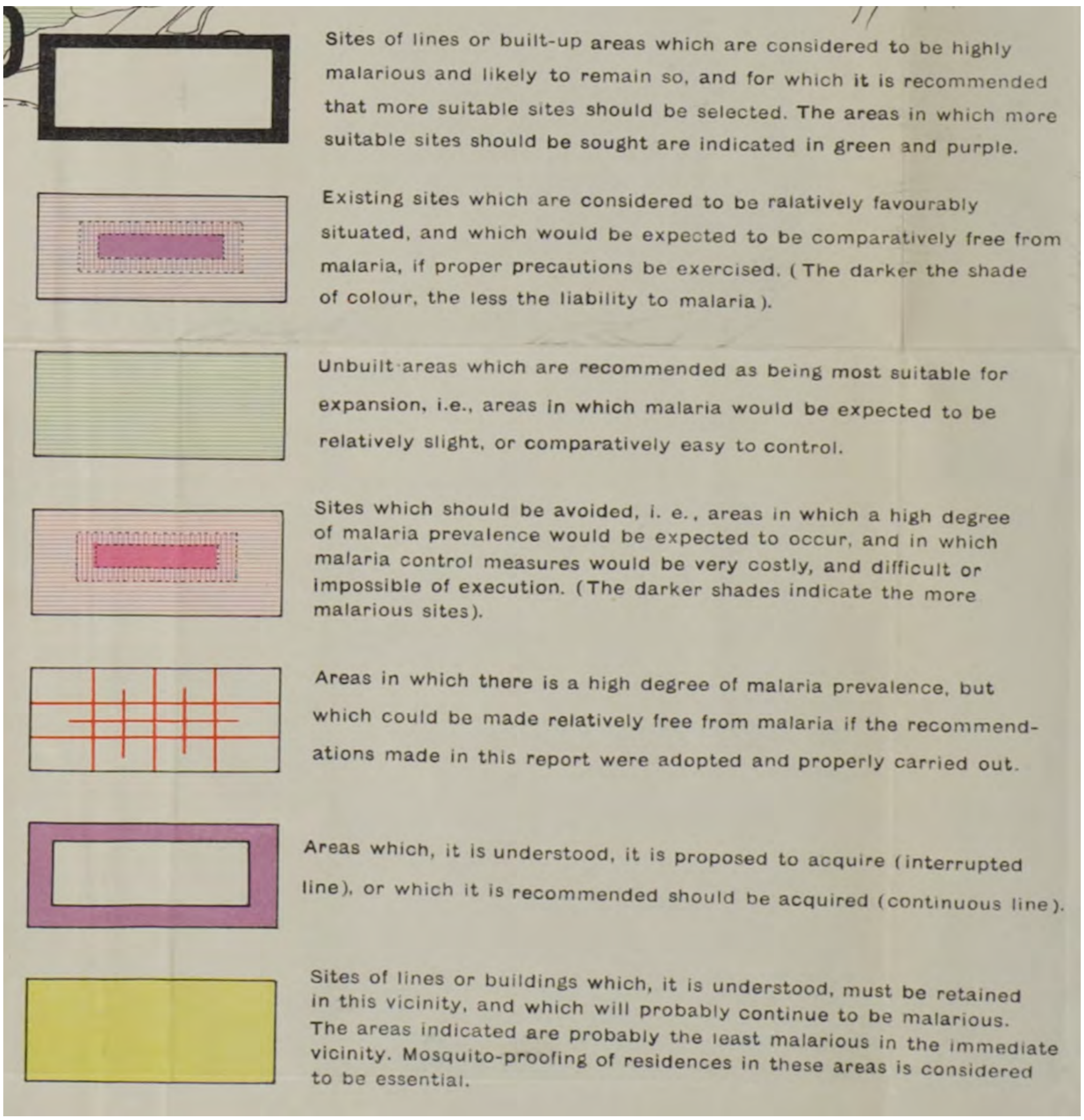

Image 1.9: Legend for “Map of Malaria in Quetta.”

The environment is still powerful, but in many places it is more susceptible to changes by humans. Buildings outlined in black, such as the jail and police station should be relocated because those places will remain malarious. Areas with purple shading and lines — such as the Islamia school need “proper precautions” but are “comparatively free of malaria.” The green shaded areas on the bottom right are identified as “most suitable for expansion” because malaria infections would be minimal or “comparatively easy to control.”

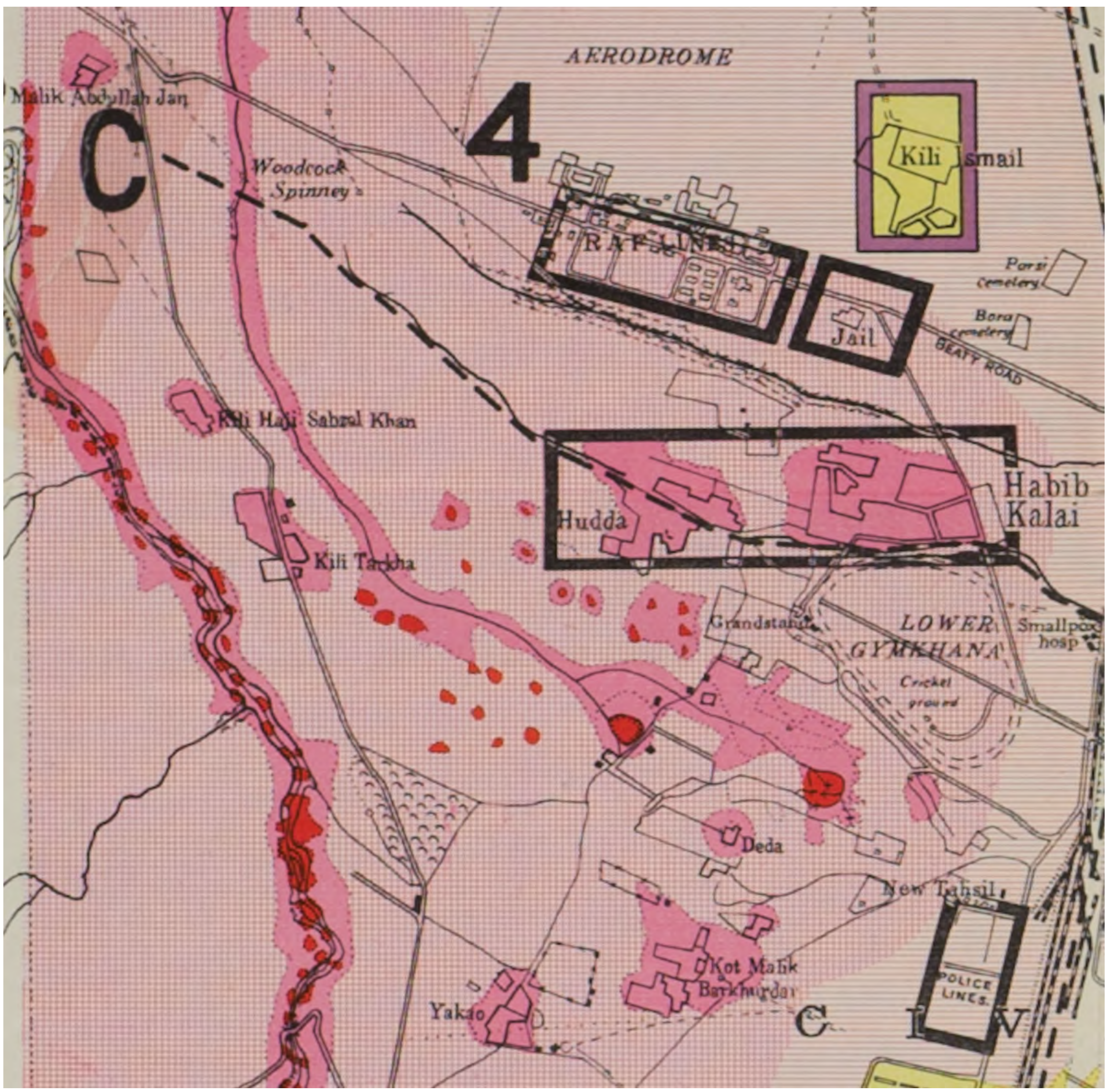

Image 1.10: Closeup of “Map of Malaria in Quetta.”

Areas marked by dark pink are immutable — they will remain dangerous. The danger is constant and static. Disease, specifically here malaria, comes from or is continuously present in these places. Humans shouldn't try to live or rebuild in these areas. Malaria infections cannot be controlled here. These places are explicitly where the danger is. The areas and buildings with the large black outlines are "considered to be highly malarious and like to remain so, and for which it is recommended that more suitable sites should be selected." So the police and royal airforce (RAF) lines and the jail should be relocated to areas that are designated in green and purple:

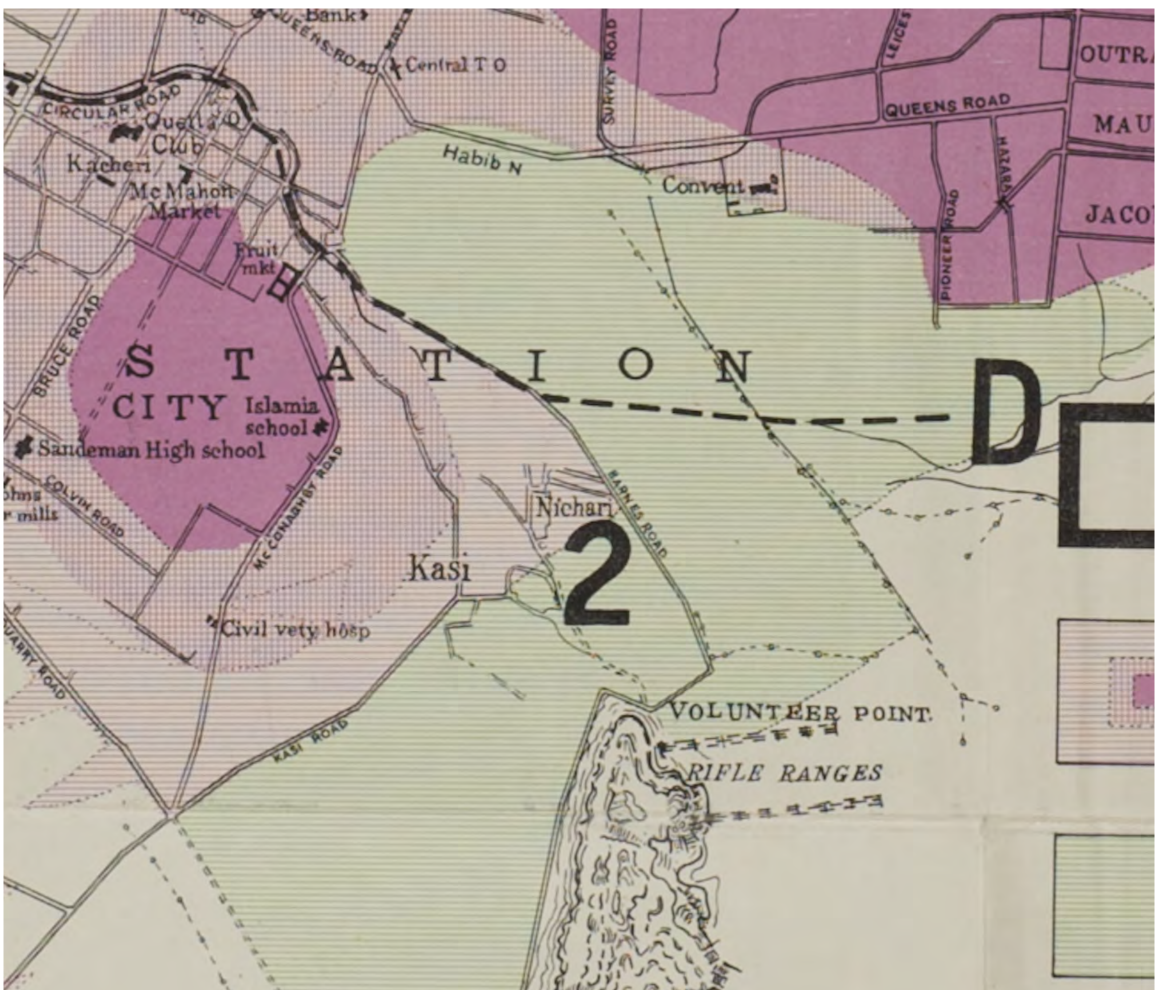

Image 1.11: "Map of Malaria in Quetta."

Other areas are more mutable. But it is the areas with the red grid at the top center of the map, that mark most significant shift in understanding malaria: The red grid designated areas that could be affected by human actions:

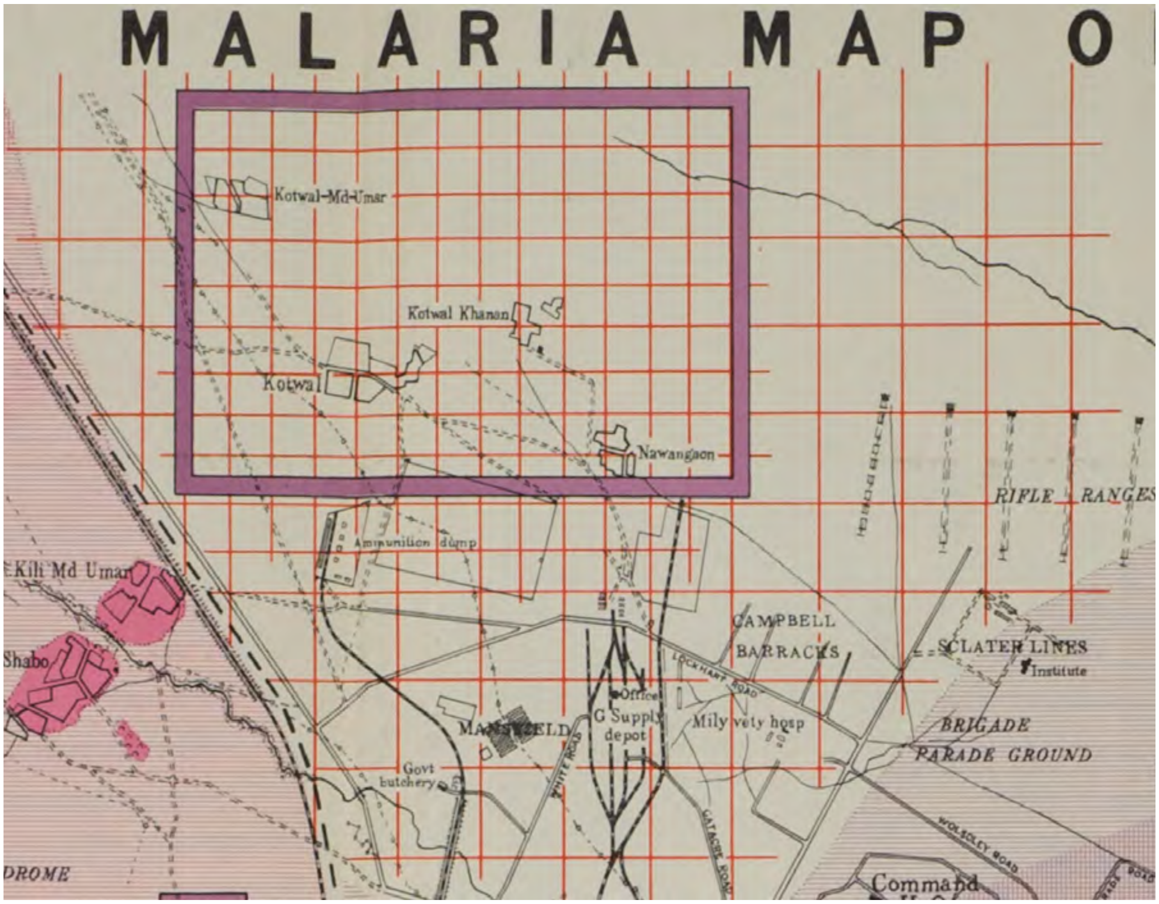

Image 1.12: Closeup of "Map of Malaria in Quetta."

In these areas, there is "a high degree of malaria prevalence" here but "if the recommendation made in this report [are] adopted and properly carried out," could be made significantly safer."[92] These areas would require persistent and dedicated efforts to be made and kept safe.

This shift in human agency in malaria control is further represented in the yellow areas which acknowledged that malaria incidence would be high, but because the

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[92] *Ibid.*

facilities needed to remain in these areas, measures needed to be taken to lessen danger: “Mosquito-proofing of residences in these areas is considered to be essential.”

Image 1.13: Closeup of “Map of Malaria in Quetta.”

This inclusion of mosquitoes made environment capable of being altered and interventions made into malaria rates. Humans are given agency through the presence of mosquitoes. But it is significant that although the Map of Malaria in Quetta articulated a different understanding of malaria, it was created using Christophers’ practices of surveying and mapping. The day-to-day, sociomaterial practices that Christophers established, persisted in changing disease models and articulations.

Conclusion

Charles Alphonse Laveran first identified the malaria parasite in a blood smear in 1880 and Sir Ronald Ross identified the mosquito as malaria's vector in 1897. Both men won Nobel prizes for their work, but the causative connection between mosquitoes and fevers did not supplant environmental models of disease or become naturalized immediately. The prolific publications of Christophers, Stephens, and Bentley, as well as the political power of the Royal Society, the Colonial Office, and the Nobel Prize all helped to stabilize the causative connections between mosquitoes and malaria.

> In studying malaria, [Christophers] encompassed many disciplines, such as parasitology, entomology and sociology and also took into consideration the history and geography of the area. He was responsible for the survey approach to malaria problems and made important discoveries related to the mechanism of immunity in hyperendemic malaria.[93]

Christophers helped to establish the practices of knowing and mapping malaria. Christophers wrote the original version of *How to Do a Malaria Survey* in 1928, which went through six re-printings and was considered the standard in epidemiological surveys and maps.[94] Christophers created the standards for mapping malaria and in so doing, shaped how malaria could be known, and what strategies could control it.

Christophers help to establish an onto-epistemology of malaria that advocated for an entomological epidemiology of malaria, one focused on mosquitoes — identifying them, their breeding locations, behavior, and their malaria infection rates — and tracking the infection in adults and children. He saw little utility in widespread and continual use

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[93] Akhtar, "Geoecology of Malaria," p. 338

[94] Christophers, "Malaria Survey."

of quinine, nor of mosquito brigades. From some of his earliest publications with the Royal Society's Malaria Commission, most of his interventions were aimed at preventing Europeans from getting infected. His analysis of tea plantations engaged structural problems that created perpetual malaria infections among the workers. He advocated for better conditions for those who worked in endemic areas and the isolation or cessation of importing non-immune populations and for those Europeans who needed to be in those areas to take as many precautions as possible in limiting transmission such as segregation, bednets, window screens, limited mosquito control and limited quinine use.

The stability of the causative connection did not produce equally stable strategies to lower malaria rates. Malaria maps were not reflections of an objective state in the world. Malaria was not a priori a stable entity, with set, agreed upon definitions, locations, and treatments. *The Practical Study of Malaria*, *How to Do a Malaria Survey,* and the *Malaria Map of India* all helped to articulate and establish practices of knowing and controlling malaria as a disease entity that could be diagnosed and counted, was produced by natural conditions like seasonal flooding, was mildly control-able by quinine, but intrinsic to many landscapes. Absent from this articulation of malaria was acknowledgement that human actions, particularly British engineering and development projects, had exacerbated and intensified malaria in India, or that a lack of colonial commitment to irrigation and drainage were more responsible for malaria rates than flooding. These knowledges and understandings about malaria are absent from and/or obscured by the stabilizing power of maps. The *Malaria Map of India* presents a disease with few institutional remedies.

By 1936, the *Malaria Map of Quetta* does present institutional interventions in transmission. The British Army could relocate buildings and redesign the city as well as alter landscapes to improve drainage and lower mosquito populations. In Mullian's "Malaria in Quetta," malaria is less fixed in the landscape and the landscapes are more mutable to the British trying to control it. Some landscapes were variable — in areas with the right amount of rainfall, humans might be able to modify and intervene in irrigation to make an area healthier. In the Quetta map, malaria and humans are more active and movable — the power of landscapes is less absolute. It is the efforts of people that are variable in making landscapes safe for people. Malaria control continued to consist of avoidance but it now explicitly included engineering works. This map, produced using surveying and mapping techniques developed and established by Christophers, articulated a different way of knowing malaria, and this different knowledge about malaria traveled.

As Foucault and others have documented, public health departments became new technologies or tools for the modern state to account for its populations, territories, and security, especially after the acceptance of germ theory.[95] The onto-epistemology of malaria that Christophers' established helped to articulate the practices of malaria control as issues of State interest and as techniques importance to its governance and power. He

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[95] See for example: Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (University of Chicago Press, 1987).; George Rosen, *A History of Public Health* (Baltimore: The Johns Hopkins University Press, 1993).; Judith Walzer Leavitt, *Typhoid Mary: Captive to the Public's Health* (Beacon Press, 1997).; Nayan Shah, *Contagious Divides: Epidemics and Race in San Francisco's Chinatown (American Crossroads)* (Berkeley: University of California Press, 2001).; Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception,* trans. A. M. Sheridan Smith (New York: Vintage, 2004).; Michel Foucault, *Security, Territory, Population: Lectures At the Collège De France, 1977-78,* trans. Graham Burchell (Basingstoke: Palgrave MacMillan, 2007).; Steven Johnson, *The Ghost Map: The Story of London's Most Terrifying Epidemic--and How it Changed Science, Cities, and the Modern World* (Riverhead Trade, 2007).; Michel Foucault, *The Birth of Biopolitics: Lectures At the Collège De France, 1978-79,* trans. Graham Burchell (Basingstoke: Palgrave Macmillan, 2008).

helped to implement and integrate older tools such as surveys and censuses and maps into a system of state surveillance of health as well as establishing the everyday practices for malaria's monitoring, control, and treatment. But importantly, Christophers also brought malaria parasites and mosquitoes under state surveillance in new ways.

Chapter 2: Creating Malaria Control in the Pacific Campaign, 1942-5

> This will be a long war if for every division I have facing the enemy I must count on a second division in hospital with malaria and a third division convalescing from this debilitating disease!
> - General Douglas MacArthur in a 1943 letter to Paul F. Russell[1]

This chapter shifts the dissertation's focus to World War II. I analyze the creation of the Malaria and Epidemic Control Organization (MECO), the Allies' response to the technical problem of the malaria epidemic in Pacific theater, where malaria was causing five times as many casualties as combat.[2] In order to be able to successfully lower malaria rates among soldiers, MECO had to work within military command and organizational structures to implement their articulation and in doing so, they changed command hierarchies, organizational divisions (such as those between the Army and Navy), procedures for requesting and receiving supplies, personnel, and materials, the behavior of individual soldiers, as well as to the geography of thirteen Pacific Island and the lives of thousands of their residents who were relocated. MECO's practices effectively lowered malaria rates and I argue that the malariologists of MECO articulated an onto-epistemology that framed malaria as a disease of multiple species and local variations. One of the authors of the official history of the Medical Department of the United States Army in World War II lauded, "casualties due to the disease were reduced

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[1] Paul F. Russell, *Man's Mastery of Malaria* (Oxford: Oxford University Press, 1955). , p. 117

[2] Paul A. Harper, *et al.* "New Hebrides, Solomon Islands, Saint Matthias Group, and Ryukyu Islands." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm, p. 401; Cushing, Emory C. *History of Entomology in World War II*. Smithsonian Institution Publication 4294. Baltimore: The Lord Baltimore Press, 1957. p. 42

to a point where they were not a significant influence on military operations. The decisive factor in bringing about this reduction was the activities of the special medical malaria control organization."[3]

As I discussed in the Introduction, Foucault argued "The formation of discourses and the genealogy of knowledge need to be analyzed . . . in terms of tactics and strategies of power . . . deployed through . . . demarcations, control of territories and organizations of domains."[4] In this chapter, I map the military's response to malaria as an organization — how did the military respond as an institution, what spaces and terrains were created or reorganized, both in terms of geographic territory but also within their command infrastructures and day-to-day working practices — to analyze why malaria was successfully controlled in the three years MECO operated. For this analysis, I engage civilian and military (often formerly classified) sources that include correspondence, memorandum, maps, surveys, photographs, reports, scholarly and personal journals, industry advertisements and reports, books, educational pamphlets, posters, films, and calendars. With these materials, I argue MECO was effectively able to create an organizational infrastructure that reflected their onto-epistemology of malaria, one that had the institutional flexibility to be able to attend to local variation and needs as well as the power to implement appropriate control measures that matched their articulation of malaria. Malariologists involved believed that MECO's success **"**speaks for itself not

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[3] Oliver R. McCoy. "War Department Provisions for Malaria Control." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm, pp.27-28

[4] Michel Foucault, *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977* (Vintage, 1980). , pp.70-1, 79

only in the annals of the South Pacific campaign but in the annals of tropical and preventative medicine."[5]

Malaria's Impacts on the War Effort

Major General Biggan, of the Royal Army Medical Corps, told U.S. officials in 1942 that "Malaria is a disease which may win or loose a war, whether we can control the disease or not."[6] The US Armed Forces' concerns about malaria in WWII originated in late 1940 when soldiers training in the Southern US began contracting malaria.[7] A joint civilian and military effort began mosquito control in 1941, with the Army allocating $1,500,000 for the work.[8] In 1942, these domestic responsibilities were shifted to the newly-formed Malaria Control in War Areas organization.[9]

Malaria was a problem of some concern for the Americans in the Mediterranean and North African campaigns that began in 1942. Infections were especially high in Sardinia and Italy in 1943, reaching almost 33,000 cases and an incidence rate of 71

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[5] "History of the Activities of Base Malaria and Epidemic Control on 'Espiritu Santo,' June 1942 - July 1945." 1945. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, New Hebrides, Folder 1 of 11 [July 1945 - Oct 1945]. A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides. Container 4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD. (Hereafter this Entry No., Record Group, and location shortened to: Entry P90-F: RG 313: NARA College Park MD.)

[6] "Major General Biggan, Royal Army Medical Corps, Addressing U.S. National Research Council Division of Medical Sciences, Subcommittee on Tropical Diseases." 1942. Box 5 [Folder 1: National Resource Council, 1942-3/Div of Medical Sciences/ Subcommittee on Tropical Diseases]. Entry No. 49B. Record Group 52 NM-48: Records of the Bureau of Medicine and Surgery. NARA College Park MD

[7] McCoy, "War Department Provisions," p. 12

[8] *Ibid.*, p. 13

[9] "History of Malaria Control in War Areas." 1946. Folder: Information 3-6: CDC History - General. Box Accession Number: 442.03/ D0-01/ Box 6 of 7. Record Group 442: Records of the Centers for Disease Control and Prevention, 1921 - 2006: National Archives Identifier: 6282663. National Archives at Morrow, GA, p. 2; Justin M. Andrews. "Experience in the United States." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterV.htm, p. 74

cases per 1000 soldiers.[10] This high rate was attributed to a lack of a coordinated military response such as an inadequate supply of the anti-malarial drug Atabrine and soldiers not taking proper individual precautions against mosquito bites.[11] These problems were resolved through integrating malariologists and malaria control efforts within the Army's Medical Services division.

Malaria was a far more serious and impactful problem in the Pacific campaign. It was identified as "the single most serious health hazard to Allied troops in the South Pacific Area during World War II."[12] From 1942-5, malaria was responsible for causing "more than five times as many casualties as did combat." [13] Estimates of the number of Allied military personnel who contracted malaria vary between 100,000 and 246,000, with most soldiers having multiple attacks.[14] Infection incidence rates reached 2,700 cases per 1,000 men on Efate in April 1942; 4,000 per 1,000 on New Guinea, in November 1942; 1,781 per 1,000 on Guadalcanal, in November 1943; 4,000 per 1,000 at Mime Bay.[15] The Army alone lost over 10,000,000 man-days to malaria.[16] The severity of

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[10] Justin M. Andrews. "North Africa, Italy, and the Islands of the Mediterranean." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterV.htm, p. 249

[11] *Ibid.*

[12] Harper, *et al.*, "New Hebrides," p. 401

[13] Harper, Paul A., *et al.* "Malaria and Epidemic Control in the South Pacific 1942-1944." 1945. Reproduced by Engineers HQ SOPACBACOM 2379. Container 15, Folder [P2-3] [Malaria and Epidemic Control in South Pacific Area, 1942-1944] Folders 1-6. Entry #P93: Historical Files, 1942-1946, P2-3, Red 183. Entry P90-F: RG 313: NARA College Park MD, p. 13; Harper, *et al.*, "New Hebrides," p. 401

[14] Cushing, Emory C. *History of Entomology in World War II*. Smithsonian Institution Publication 4294. Baltimore: The Lord Baltimore Press, 1957. p. 42; Harper, *et al.*, "Malaria and Epidemic Control," p. 13; Harper, *et al.*, "New Hebrides," p. 401;

[15] Cushing, *History of Entomology*, p. 43; Paul F. Russell. "Introduction." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm, p. 2

[16] Cushing, *History of Entomology*, p. 42

expanse of the malaria problem in the Pacific prompted a different institutional response than in the Mediterranean and North Africa. Rather than incorporating personnel tasked with anti-malarial duties within the medical division, a separate entity was created, the Malaria and Epidemic Control Organization (MECO).

MECO and the Pacific campaign are my focus, rather than other Allied efforts, for a few different reasons. The first two of which are practical: (1) The National Archives and Records Administration locations I visited in Georgia and College Park, Maryland contained far more materials on the Pacific malaria control efforts; (2) The malaria control efforts themselves were better documented in the Pacific, with thousands of memos, correspondence, and supply and personnel requests, as well as multiple official after-action reports and histories preserved in the archives; and (3) MECO's infrastructure and malaria control practices were more successful in more daunting conditions and provide an important opportunity to analyze their efficacy.

MECO's infrastructure and practices faced several challenges including "the peculiar needs" of combat forces comprised of Americans in in the Army, Marines, and the Navy as well as Australian and New Zealand personnel who were fighting on 13 islands with malaria disbursed across thousands of miles in the Pacific.[17] To address these challenges, MECO developed "several unusual features."[18] These include changing command structures so that the senior malariologist was positioned on the Commander, South Pacific (ComSoPac)'s staff, and the senior base malariologists reports and recommendations went straight to island commanders; tasking a malariologist at each

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[17] Harper, *et al.*, "New Hebrides," p. 401

[18] Harper, *et al.*, "Malaria and Epidemic Control," p. 1

base with organizing the personnel and supplies available to best address their location's needs, an "unusual feature" that gave a great "amount of autonomy and initiative . . . to the local malaria control groups on each island base"; and drawing on personnel and supplies from multiple nations and military divisions which alleviated scarcities of materials and qualified technical specialists.[19]

As I mentioned, the malaria crisis that precipitated this organizational intervention was severe. Efate Island in the New Hebrides was the location of the first malaria epidemic when troops landed to build an airfield in March 1942. Their camp was located in an area with a large mosquito population and near a population of civilians who had endemic (or chronic) malaria. In addition, troops worked at night and did not have adequate bed nets.[20] By April, all of the fighting force had contracted malaria.[21] Because of the "the desperate military situation" on Guadalcanal in September and October, malaria control wasn't initiated until mid-November 1942.[22]

Initially, the seriousness of the malaria threat was not understood and this lead to valuing combat over health or malaria concerns. This misevaluation meant that malaria infection rates increased "ominously" amongst the troops in early Fall and the arrival of mosquito breeding season produced a severe malaria epidemic.[23] It's estimated that "more than three-fifths [of the 100,000 malaria cases in the Pacific] were probably contracted on Guadalcanal, and most of these during the period October 1942 to August

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[19] Harper, *et al.*, "Malaria and Epidemic Control," p. 1; Harper, *et al.*, "New Hebrides," p. 401
[20] Harper, *et al.*, "New Hebrides," p. 421
[21] *Ibid.*, p. 422
[22] Harper, *et al.*, "Malaria and Epidemic Control," pp.19-20
[23] *Ibid.*, pp.13, 20

1943."[24] Not only did roughly 100,000 soldiers, across the Allied forces, contract malaria, they did so twice, on average. Infected troops were then sent from Guadalcanal to non-combat or rear bases where they infected their fellow troops and re-infected each other.[25] Malaria negatively impacted combat and training abilities of these troops, but the lack of consistent treatment protocols also meant that recovering from of malaria attacks took longer.[26]

For those tasked with controlling malaria infections amongst the Allied forces, a primary point of concern were the Melanesian and Tonkinese people who had been living on the Pacific Islands prior to the Islands becoming a combat zone.[27] As James Sapero, the Malaria and Epidemic Control Officer for the South pacific noted in an October 1943 memo to Island Command, "Wherever natives are permitted to live in close relationship to troops and where mosquito control is not absolute, the price will be a large loss of sick days in troops. It is considered that the recommendations to remove the native sources of malaria are urgent and should be carried out."[28] The term "natives" was ubiquitously and unproblematically used to designate the people living on these Islands, and they were commonly and explicitly referred to as a "seed-bed" of malaria to infect Allied troops.[29]

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[24] Harper, *et al.*, "New Hebrides," p. 426

[25] Harper, *et al.*, "Malaria and Epidemic Control." p. 36

[26] *Ibid.*, p. 13

[27] For example, "The population of the New Hebrides in 1939 was given as 218 British, 687 French, 2,282 Asiatics (Tonkinese, Chinese, and Japanese), and about 40,000 native Melanesians. Of the Melanesians, about 4,000 lived on Espíritu Santo and 1,700 on Efate, mostly in small, independent villages scattered through the islands." Harper, *et al.*, "New Hebrides," p. 414

[28] "Secret Memorandum: "Tonkinese and natives, malaria hazard of." from Malaria Control Officer, Espiritu Santo; To The Commanding General, IV Island Command; VIA Malaria Control Officer, South Pacific Area, 4 October 1943." 1943. 1-2. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA College Park MD..

[29] See for example: Harper, *et al.*, "Malaria and Epidemic Control," pp.11-12

Thousands of people across the Pacific Islands were relocated with some being "imported" by the military to work in labor camps on nearly all bases.[30] On Guadalcanal, for example, the labor camps "offered major problems. Five such camps, inhabited by 2,200 laborers, were within mosquito flight range of approximately 40,000 troops from late 1942 to May 1944."[31]

The effects of malaria on the Japanese military were "far worse" than the Allies.[32] Documents "captured" from the Japanese showed that malaria rates reached 2,053 cases per 1,000 men in April 1943.[33] The malaria control supplies the Japanese had on their bases on Munda and Kolambangara were not consistently reaching their troops, causing malnutrition and widespread illness.[34] But the high rates of malaria infection of Japanese soldiers were also a problem for Allied soldiers: the,

> Highly malarious Japanese troops undoubtedly infected a large percent of the anopheles mosquitoes in their vicinity. During ground combat and after occupation of Japanese positions by Allied troops, infected mosquitoes undoubtedly transmitted much malaria from the Japanese to the American troops. Infected Japanese troops were in some instances the principal source of infection for sudden outbreaks of malaria in front-line American troops.[35]

Japanese and Allied troops as well as the other humans were significant components in the rising malaria infection rates — they were all providing the malaria parasite with hosts to reproduce in. However, malaria would not have reached epidemic proportions

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[30] *Ibid.*, pp.15, 68-70, 160-73

[31] *Ibid.*, p. 164

[32] Harper*, et al.*, "New Hebrides," p. 401

[33] Harper*, et al.*, "Malaria and Epidemic Control," p. 16

[34] *Ibid.*, p. 15; Mark Harrison, "Medicine and the Culture of Command: The Case of Malaria Control in the British Army During the Two World Wars," *Medical History* 40(1996). , p. 448

[35] Harper*, et al.*, "Malaria and Epidemic Control," p. 16

were it not for Anopheles mosquitoes and the geography, which was increasingly hospitable to their reproduction and existence.

The material effects of war on the landscape were a signification contribution to rising mosquito populations (and thus malaria infection rates):

> Enormous changes were brought about by the Japanese and American occupations of these islands. Small perimeters were crowded with thousands of men engaged in diverse activities. Thirty airfields were constructed by American throughout the area and approximately eight by the Japanese. Hundreds of miles of all-weather, heavy traffic roads were constructed by the American forces, and thousands of large storehouses, metal huts, hangers, and wood buildings were erected. In many places bitter battles were fought over jungle areas, grass lands and swamps, leaving in their wake a wasteland of shell holes, bomb craters, fallen trees, broken equipment, and other debris of battle. Following the battles previously uninhabited bays and coves became important harbors, with hospitals, supply bases, staging areas and recreational grounds.[36]

Thousands of men 'crowded' together and the construction of airfields and roads created the opportunity for ruts where water could collect and in which mosquitoes could lay their eggs. The construction of new buildings also created areas (particularly walls) for mosquitoes to breed and live, and because "the Army in the field literally tore up the Earth," the creation of craters from bombing and mortars meant that there were many new spaces for mosquitoes to prosper.[37] The conversion of areas next to bays into places where large numbers of humans congregated also introduced a plethora of new feeding sources for mosquitoes.

The effects of these changes to the landscape, as well as the population of imported (not yet exposed) soldiers meant that an ideal setting had been created for

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[36] *Ibid.*, p. 11

[37] Thomas A. Hart, "The Army's War Against Malaria," *The Scientific Monthly* 62, no. No. 5 (1946). , p. 422

multiple devastating malaria epidemics. On Efate, the airfield and bivouac sites were situated next to Anopheles mosquito breeding areas. On many Islands, night shifts were required especially in areas that were subject to air raids, which commonly occurred even after the land battles were completed. These conditions caused problems of hygiene and sanitation and meant troops were forced to go with little sleep and were in greater contact with malaria-carrying mosquitoes.[38]

Military Response to the Malaria Problem: Establishment of the Malaria and Epidemic Control Organization

It is important to situate the responsibilities and activities of malaria control within the context of combat:

> The program for Malaria Control of a military base on foreign soul is not at all comparable to that which would be effective in the Southern United States. It is also apparent that the program must vary from one such base to another. Some bases are on allied possessions, far removed from a battlefront or combat zone; some are on enemy soil, newly established and fighting for survival. And there are all gradations between the two. The point I wish to emphasize is that there is no general routine for Malaria Control in time of war or outside the continental limits of the United States. Each problem is an entity for <u>diagnosis</u>, determination of <u>treatment</u> and <u>application.</u>[39]

MECO worked in service of military operations. The "primary function" of the Malaria and Epidemic Control Organization was to create and execute a blueprint for malaria control to ensure that it was not "a major threat to military operations in the South

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[38] Harper*, et al.*, "Malaria and Epidemic Control," p. 13

[39] Mount, Robert. "Malaria Control in the Field." 1943. Base Malaria Control Unit Espiritu Santo. Container # 1 Arc# 5722964 Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943], [Folder 4 of 5]. 90-F: Records relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Entry P90-F: RG 313: NARA College Park MD, p. 24 Emphasis in original.

Pacific."[40] Their goals were not those of a "peacetime program" to eradicate or completely cure malaria, as such an effort would divert "manpower and equipment vital to other phases of the war effort."[41] The focus of Allied anti-malaria efforts in the Pacific theater was to control it enough so that it wouldn't interfere with the primary purpose of fighting (and winning) a war.

In September 1942, the Army's Surgeon General sent recommendations to commanders that a separate organization be created for malaria control in the Pacific and Mediterranean theaters.[42] He argued that a malaria control organization couldn't just exist in an advisory capacity but needed to be responsible for operations to lower malaria rates. And a separate designation was needed because malaria control work was too intensive and important to be assigned to medical personnel who had other duties.[43] His recommendations were extended to all combat forces in October in a letter to Commanding Generals in all combat theaters.[44] This letter more explicitly detailed what the responsibilities of these specialist personnel would be as well as how to requisition and integrate them into existing medical organizations.

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[40] Harper*, et al.*, "Malaria and Epidemic Control," pp.24, Exhibit III

[41] Allied Forces. South Pacific Area. Malaria and Epidemic Disease Control. "Prevention of Malaria in Military and Naval Forces in the South Pacific. Malaria Training Manual no. 1, 1944 NAVMED 141." 1944. United States. Government Printing Office. History of Medicine Division of National Library of Medicine. NLM Unique ID: 23460100R. , p. 14

[42] Oliver R McCoy. "War Department Provisions for Malaria Control," In *Preventive Medicine in World War II, Volume 6*, edited by Colonel John Boyd Coates Jr., Washington, DC: Office of the Surgeon General, 1963. , p. 14

[43] *Ibid.*

[44] Thomas A. Hart and William H. Hardenbergh. "The Southwest Pacific Area." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterX.htm, p. 537; McCoy, "War Department Provisions," pp.14-15

The initial recommendations by the Surgeon General called for malaria control units to include:

> 1. A malariologist, and one or more assistant malariologists as needed; medical officers trained in large-scale malaria control methods.
> 2. Malaria survey unit.--An entomologist, a parasitologist, 11 technically trained enlisted personnel, and necessary laboratory and transportation equipment.
> 3. Malaria control unit.--A sanitary engineer, 11 enlisted men trained in field methods for malaria control, and equipment necessary for drainage, mosquito larvicidal work, and transportation.
> 4. Antimalaria labor gangs.--Laborers recruited locally as required to work under the supervision of a malaria control unit.
> 5. Antimalaria squads.--Military personnel assigned to conduct minor measures for mosquito control within their unit areas.[45]

From the earliest directives for malaria control, malaria and malaria control were articulated as a problem comprised of multiple species, landscapes, and local variations. Entomologists, parasitologists, and engineers were foundational to any and all Army malaria control strategies. They were specialists who required their own equipment, laboratory spaces, and transportation, and who were responsible for the work of other trained and untrained workers.

Concomitant with the Surgeon General's recommendations for the Army, between September 1942 and May 1943, South Pacific Force Command (ComSoPac) issued his own malaria control directives for the South Pacific Forces, which were under Navy command but were comprised of US Navy, Army, Marine, as well as New Zealand personnel.[46] These directives created and refined the roles, duties, and powers of the Malaria and Epidemic Control Organization (MECO). In September 1942, the initial

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[45] McCoy, "War Department Provisions," p. 15

[46] Harper, *et al.*, "Malaria and Epidemic Control," p. 18

directive of ComSoPac Serial #301e was a general announcement to raise awareness of the "malaria control organization" that were to assist on the three bases that were then occupied (Efate, Espiritu Santo, and Guadalcanal).[47] ComSoPac 301e established the position of "Officer in Charge, Malaria Control, South Pacific Area," a staff officer who reported to Commander South Pacific. This directive also established that each base would have an officer in the medical corps whose sole responsibilities were malaria control. Although this small unit initially consisted only of Navy personnel, "it was assumed . . . *that this organization would provide malaria control for all services and forces.*"[48]

In February 1943, the first malariologists arrived in the Southwest Pacific theater, along with three malaria survey units.[49] One of the main challenges of setting up and implementing malaria control units was the specialization needed for such work. In the summer of 1942, the National Research Council's Subcommittee on Tropical Diseases had begun increasing funding to medical schools to provide classes in tropical medicine.[50] The focus of these schools became the "training of future medical officers for the Army and Navy."[51] An eight-week course in tropical medicine at the Army Medical School was a prerequisite for already enlisted personnel who might be directed into malaria units as malariologists or supervising officers.[52] The curriculum of this course

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[47] *Ibid.*, p. 19
[48] *Ibid.* Emphasis in original.
[49] Hart and Hardenbergh, "Southwest Pacific Area," pp.536,7
[50] McCoy, "War Department Provisions," p. 48
[51] *Ibid.*
[52] *Ibid.*, pp.22-23

focused on how to control and prevent infections from tropical diseases, as well as how to diagnose and treat them.[53] The Navy had their own training programs.

The parasitologists and entomologists assigned to malaria survey units were initially drawn from universities as well as the US Department of Agriculture and the Public Health Service. "Later, commissions were granted to graduate students in these specialties who had been inducted into the Army as enlisted men."[54] Similarly, engineers with experience sanitation and mosquito control were drawn from state and city health departments and later students who had studied engineering at the Army Specialized Training Program were given specialized training and commissions into MECO.[55]

Problems on the Ground

Despite the urgency of the military and malaria situations, as well as the directives from commanders authorizing a new malaria control organization, there were significant problems initially in establishing an efficient and effective infrastructure and effective control policies and practices. While the Army had established its training course, it was two months long and soldiers usually also needed additional training about engineering, entomological, and parasitological aspects of malaria control specific to the South Pacific, which caused delays. Despite the "urgency of the military situation" on Efate, Espiritu Santo and Guadalcanal, combat went on for many months before teams trained in malaria control were deployed to those islands.[56]

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[53] *Ibid.*, p. 48
[54] *Ibid.*, pp.22-23
[55] *Ibid.*
[56] Harper*, et al.*, "Malaria and Epidemic Control," p. 13

The administrative coordination of a joint organization made up of Army, Navy, Marine, and New Zealand forces was complicated: The Army and Navy had different control organizations, with enlisted men having been trained differently. The Army's malariologists came out of the Army Medical School where they had taken a course in Tropical Medicine, while the Navy procured their personnel from the Malariology School of the Naval Medical School in Bethesda, Maryland.[57] Movement of Navy personnel into MECO as well as from one unit to another had to come from ComSoPac on the recommendation of the Area Malaria and Epidemic Control Officer.[58] Army control personnel were initially directed by the Army's Surgeon General but subsequent movement could be directed by the Area Malaria and Epidemic Control Officer.

Military malaria control officers also had to deal with some military commanders who didn't see malaria as their concern. One report noted, "There was too little knowledge of the danger of malaria ans [sic] how to cope with it. The … prevailing attitude was well expressed by one officer who said, 'We are out here to fight Japs and to hell with mosquitoes.'"[59] These problems were described as "typical of the prevailing opinion that malaria and malaria control were of minor importance during combat operations."[60] This attitude meant that some malaria control units were not permitted to work and unit commanders did not pass along malaria control information and policies to

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[57] *Ibid.*, pp.34, 32
[58] *Ibid.*, p. 34
[59] *Ibid.*, pp.13-14
[60] *Ibid.*, p. 20

their troops and "often flagrantly disregarded" malaria control measures that would lower their exposure to mosquitoes.[61]

In addition to disregarding malaria control policies, initial directives allotting malaria control units heavy equipment to alter mosquito-friendly landscapes were often only minimally complied with.[62] Construction projects such as roads, aircraft landing strips, harbors, and storage were deemed by many Base Public Works Officers and by the Base Commander to be more imperative than malaria control, so that even "requests for diversion to malaria control of 10 percent of the Construction Battalion…were frequently disregarded until the base construction was largely complete."[63] Even when base commanders wanted to comply with new malaria control allotments and requisitions, there were frequent shortages and supplies for malaria control work were not initially given priority in supply chain hierarchies, with dearly needed materials "mostly piled up on the piers of the west coast of the United States. The few supplies that went to Australia stayed there and were not moved on to New Guinea because malaria supplies were about tenth down the list of priority of movement."[64] These delayed supplies included heavy and light equipment such as bulldozers, trucks, handheld insecticide sprayers, lab, survey and entomological equipment such as jars, dye, microscopes, portable typewriters, and reams of paper. For example on Efate, Espiritu Santo and Guadalcanal, insecticide and dispensers did not arrive for a year, quinine supplies were limited and Atabrine was not

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[61] Hart and Hardenbergh, "Southwest Pacific Area," p. 514

[62] Harper, *et al.*, "Malaria and Epidemic Control," p. 36

[63] *Ibid.*, pp.36-37

[64] Russell, "Introduction," pp.5-6

widely used.[65] In fact the first malaria control officer sent to Efate in July 1942 "arrived without a staff or equipment."[66]

Many early malaria control reports were handwritten and the requests for typewriters were included in a multitude of memos and supply requests. These requisitions requests continued even to 1945. In a 1942 Memo, the author noted "with the current scarcity of typewriters I am afraid to consign it to the regular mail service" and would one sent with the next "reliable person" going to Espiritu Santo.[67] The strong need for and importance of typewriters was evidenced by a Secret memo of February 1944 by Malaria Control Officer Commander Fred Butler: Butler knew that a requisition of portable typewriters had been approved by ComSoPac, but also that their delivery was not assured: "Be sure that the typewriters will arrive, so make haste slowly in shipping arrangements, a personal escort for each is best."[68] Similar requests were made for microscopes: In a December 1942 Memo to Captain Dearing, Sapero noted that six members of an epidemiological unit "arrived *without microscopes*. Microscopes are so short in the area that the men are practically valueless to us until they are received. . . . If you think it advisable I suggest you also wire and try to obtain atleast (sic) six of these

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[65] Harper*, et al.*, "Malaria and Epidemic Control," pp.13-14

[66] *Ibid.*, p. 18

[67] "Letter to Robert Mount, 21 December 1942." 1942. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Aug 16, 1942- Jan 16, 1942]/ [Folder 5 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA College Park MD..

[68] "Memorandum from Dr. Fred Butler to Mr. Crum. 24 February 1944." 1944. Folder A6-5 General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Entry P90-F: RG 313: NARA College Park MD.. 'Make haste slowly' is an idiom that directs to work to be completed as quickly as possible, but deliberately so as to not make careless mistakes.

microscopes to be sent by plane."[69] Typewriters and microscopes required personal escorts and airplanes to assure their delivery.

Vehicles encompassed all aspects of malaria control, but "transportation was often a serious problem" because of the almost ubiquitous need and problems with supply.[70] Malaria control groups were often tasked with the transportation of workers from their camps to work and back again each day. And malaria control duties themselves involved monitoring about 20 square miles each week. Large scale spraying of insecticide also necessitated vehicles as did the transporting of small equipment and supplies.[71] Requests for vehicles and their upkeep were the source of much paperwork and memos circulating the Pacific.[72]

Organizational Response to Problems

Officers involved in organizing malaria control efforts in the Pacific theater were keenly aware of the problems units were encountering. In particular, the problems of establishing malaria control units on Guadalcanal were evidence that ComSoPac Serial #301e "was entirely inadequate" and that "a strong area directive was necessary."[73]

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[69] "Memorandum from Sapero to Dearing, December, 1942." 1942. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1943]. Container # 8. Entry P90-F: RG 313: NARA College Park MD.. Emphasis in original.

[70] Harper*, et al.*, "Malaria and Epidemic Control," p. 42

[71] *Ibid.*, pp.42, 108

[72] The repair of vehicles proved to be a particular problem for supply officers as spare parts were difficult to find and prompted a particularly long correspondence about trying to procure a replacement windshield wiper blade: at one point the administrative assistant on Espiritu Santo asks "In regard to the Weapons Carrier windshield wiper, how would you like a [new] Weapon Carrier, instead? I think it would be much easier that way" "Memorandum from William Bennett to Malaria and Epidemic Control Headquarters, South Pacific Area, Navy 131 RE HC-4 Report 14 August 1944." 1944. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/[Folder 3 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA College Park MD..

[73] Harper*, et al.*, "Malaria and Epidemic Control," p. 20

ComSoPac intervened with directives ComSoPac Serial 0094b and US Armed Forces in the South Pacific Area (USAFISPA) AG 720, which were issued mid-November 1942 and May 1943 respectively.[74] These orders firmed up the authority of MECO as an organization, gave them supply chain priority (as Paul Russell noted, "in May 1943, the priorities for malaria supplies and personnel were raised to first place, and thereafter no serious shortages occurred") and allocated them authority to influence troop movement and camp placement decisions.[75] ComSoPac also intervened directly when these directives were not being followed sufficiently: the malaria situation on Guadalcanal became so dire in May of 1943 that ComSoPac ordered all of the 63rd Naval Construction Battalion to work on malaria control.[76]

USAFISPA AG 720 proved "to be an effective farsighted document which established a working basis for all subsequent malaria control in the area."[77] Malaria and Epidemic Control became an organization within ComSoPac and was"jointly constituted, being composed of specially trained Army and Navy personnel" and were to "serve all forces without service distinction," meaning that this unit did not prioritize one military branch's malaria control needs over another's.[78] By May of 1944, the organization was made up of 643 enlisted soldiers and 128 officers, with a service breakdown of 282 Navy and Marine, 452 Army, and 37 New Zealand personnel.[79] This coordination was often noted as a reason for the success of MECO and malaria control in general in the Pacific.

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[74] *Ibid.*

[75] Russell, "Introduction," p. 6

[76] Harper*, et al.*, "Malaria and Epidemic Control," p. 37

[77] *Ibid.*, p. 20

[78] *Ibid.*, pp.25, Exhibit III

[79] *Ibid.*, pp.31-32

For example, the Army's history of malaria in WWII noted "much of the success of the organization was due to its joint service nature" which was initiated by the first South Pacific officer in charge of malaria control, James J. Sapero, MC, USN."[80] The multi-force constitution of malaria control necessitated a new command structure: "The direction of these units and all matters pertaining to malaria control in all forces is under the cognizance of an officer-in-charge, Malaria Control, South Pacific area. This officer, in turn, is directly responsible to the Commander South Pacific area and South Pacific Force."[81] [See Images I and II].

The Senior Malaria Control Officer (the Island Malariologist) on each island answered to the Island Commander, who was usually a General from New Zealand or the U.S. Army or Marines.[82] These Island Commanders, who reported to Commander, South Pacific, and Commanding General, USAFISPA, were made "responsible for malaria control in all forces at [their] base."[83] Because each Island Commander bore greater accountability for decreasing the Island's malaria rates than any subordinate officer, and given the complicated multi-force composition of the Control Units, the Senior Malaria Officer had "direct access" to him.[84] This direct reporting of the Senior Malaria Control Officer to the Island Commander is worth noting because it circumvents normal channels of command, power, and hierarchy.[85] It gave the Senior Malaria Control Officer elevated power in the command hierarchy but also more direct communication between these

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[80] Harper*, et al.*, "New Hebrides," p. 399

[81] Allied Forces. South Pacific Area. Malaria and Epidemic Disease Control, "NAVMED 141," p. 14

[82] Harper*, et al.*, "Malaria and Epidemic Control," p. 18

[83] *Ibid.*, pp.18, 47

[84] *Ibid.*, p. 48

[85] *Ibid.*

officers as Island Malariologists were now required to be consulted as soon as information about troop movements "of *any forces* coming to or leaving a malarious base" was given to Island Commanders and they were the highest authority when deciding camp site locations.[86]

The Organization was also directed to:

> (1) make epidemiological studies pertaining to malaria, (2) operate laboratories for diagnosis, (3) train personnel from other organizations in laboratory procedures pertaining to malaria control, (4) advise in regard to mosquito control measures, (5) advise in regard to disinsectization of aircraft, (6) make such recommendations to the proper authorities in regard to malaria control as the circumstances require, (7) procure, store and distribute antimalarial drugs for chemoprophylaxis as may be required by the forces at each base.[87]

These directives emphasize malaria control through epidemiology and insect control. Their first responsibility was to make "epidemiological studies" that determined infection rates (of humans and mosquitoes) and located the disease in a space. Infection rates were determined in laboratories to be run by the Malaria Control Organization.

Staff appointment positions with "duties and responsibilities" were added by directive USAFISPA AG 720: Area Malaria and Epidemic Control Officer, Area Entomologist, Army Liaison Officer, Area Training and Education Officer, Area Administrative Assistant, Assistant Malaria and Epidemic Control Officer, Area Engineer, and Filaria Survey Officers.[88] MECO consisted of a lot of moving parts in terms of personnel (specialists, engineers, enlisted men which included a division of 'colored' soldiers, and local workers) and supplies (laboratory and survey equipment, bull dozers,

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[86] *Ibid.*, pp.20-1, 23 Exhibit II, 68 Emphasis in original.
[87] *Ibid.*, pp.22, Exhibit I
[88] *Ibid.*, p. 26

insecticide, insecticide sprayers, and pharmaceuticals).[89] By June of 1944, Malaria and Epidemic Control personnel included “over 750 technically trained personnel and almost 4000 laborers.”[90] The cost of these personnel, equipment, and other aspects of the control operations was almost $700,000 a month and nearly $9,000,000 yearly.[91]

Flexibility

A core of the Allies’ onto-epistemology of malaria was articulated and demonstrated through the adaptability and flexibility integrated into MECO’s infrastructure. Because malaria was a local and multi-species problem, MECO’s infrastructure needed to be able to adjust its foci and practices to best address local needs. Malaria control units “var[ied] in size from one officer and four enlisted men to seventeen officers and nearly one hundred men depending on island malaria control problems and areas involved.”[92] In highlighting the distinctive aspects of MECO, Paul Harper noted that an important and “unusual feature was the amount of autonomy and initiative allowed to the local malaria control groups on each island base.”[93] Even the Standard Operating Procedures (SOP) for conducting malaria control on every base noted, “This Standard Operating Procedure is merely a sample plan adapted to and used

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[89] *Ibid.*, pp.22, Exhibit I

[90] *Ibid.*, p. 26

[91] *Ibid.*, p. 170 Adjusted for inflation these costs would be nearly $9,300,000 per month and $117,650,000 per year.

[92] “Memorandum: Malaria Control Information for CINCPAC, from Fred Butler, Malaria Control Officer. 9 March 1944.” 1944. 1-8. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1945]. Container # 8. Entry P90-F: RG 313: NARA College Park MD.. p. 1.

[93] Harper*, et al.*, “New Hebrides,” p. 401

during one operation. All such plans should be flexible."[94] There were no universal rules and requirements.

Nor were there codified organizational or equipment tables and allocations: "The theater malariologist and his staff were responsible for recommending assignment of scarce personnel and for establishing uniform policies regarding control measures and supplies."[95] The officers in the control organization also had the authority and ability to travel to the different malarious islands to monitor and adjust base control efforts: "Some member of the headquarters staff made a complete circuit of the malarious bases every 4 to 8 weeks to keep in touch with local work and needs. The area entomologist and engineer offered technical assistance and advice to the corresponding officers in each base unit."[96] The infrastructure and responsibilities of MECO and its personnel reflected their valuing of flexibility and adaptability for controlling malaria.

For the early architects of malaria control programs, the unique challenges of malaria control in a combat setting as well as the variety of landscapes necessitated infrastructural, procedural, and practical flexibility. The Navy control units did not have pre-existing formal structures so personnel could be easily placed into mixed Army-Navy units as well as the Navy-only units as needs arose to replace personnel or expand those units.[97] The easier mobility of Navy units enabled them to be sent "more frequently into

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[94] "Standard Operating Procedure for Control of Malaria and Other Insect-Borne Diseases During a Combat Operation." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. Appendix A, Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

[95] Harper, *et al.*, "New Hebrides," p. 401

[96] Harper, *et al.*, "New Hebrides," p. 438

[97] Harper, *et al.*, "Malaria and Epidemic Control," p. 33

very advanced bases to spearhead control programs."[98] Army units were "small commands" complete with their own designations for the number of people and equipment, so they were placed or transferred together as groups.[99] The Navy provided locations and materials for housing and laboratories for all malaria control personnel, including anti-malarial drugs, while the Army was responsible for transportation and supplies to control mosquitoes.[100] For example, the Army Malaria Survey Units were comprised of 11 enlisted men, a parasitologist, and an entomologist as well as "4 vehicles and adequate laboratory equipment for all ordinary entomological and parasitological survey work."[101] Trial and error on the ground and the ability to transfer staff was considered central to creating an effective division with efficient personnel for each Island's Control Headquarters.[102]

"Malaria Control in the Field," a 1943 training manual noted "On a malarious base of any size, the order of precedence of control measures will vary from one area of the base to another, because the determining factors will vary from place to place."[103] These determining factors were especially salient in regards to forward bases and areas close to combat zones. On the front lines, operations of malaria control were limited to the use of prophylactic drugs and small scale spraying insecticides on soldiers and in "fox holes."[104] The other areas of the island were divided into zones which required different

[98] Malaria Control Info for CINCPAC, p. 7
[99] Harper, *et al.*, "Malaria and Epidemic Control," p. 35
[100] Malaria Control Info for CINCPAC, p. 7
[101] Harper, *et al.*, "Malaria and Epidemic Control," p. 35.
[102] *Ibid.*, p. 19
[103] Mount, "Malaria Control," p. 3
[104] *Ibid.*

malaria control strategies: Zone II was the area directly adjacent to combat where in addition to spraying of insecticide, bed nets and screens could be implemented; Zone III was “a newly established base,” which, if the location could influenced by malaria control concerns, would minimize exposures to “carriers” and where some initial landscape modifications with light equipment were possible.[105]

The options for minimizing exposure could “consist of segregation and treatments or actual separation from troops or anopheline foci”; Beyond Zone III the options for malaria control and longer-term initiatives could be considered and enacted based on resources at hand.[106] These delineations were important for “(1) emphasizing the necessary versatility of malaria control operations with varying conditions, and (2) to show the importance of long range planning of control programs.”[107] Malaria control required diverse strategies to address many different landscapes and circumstances as well as requiring prospective commitment to surveilling and enacting those strategies.

The military’s approach to malaria control in the Pacific was one that emphasized or focused on local variations in climate, topography, mosquito behavior, as well as having different combat conditions. MECO’s organizational infrastructure incorporated flexibility to best account for these varying conditions. By doing so, the Island Malariologist, Entomologist, Engineer, and Parasitologist were able to experiment with methods, techniques, and technologies, to tailor their control programs and methods to

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[105] *Ibid.*
[106] *Ibid.*
[107] *Ibid.*

their situations. The officers had their orders and the manner of accomplishing those orders and addressing problems would be adjusted to fit local conditions.

Adaptations to Labor Shortages

In addition to initial shortages of trained specialists in malaria control, throughout the war there was a dearth of personnel to help carry out the engineering projects. In order to meet their labor needs, MECO made use of non-traditional sources. The labor duties of MECO were designated as 'skilled' or 'unskilled.' These were the designations of those who were not field, survey or lab techs (entomologists, engineers, surveyors, and parasitologists were not considered 'labor,' but specialists) and who worked on changing the physical landscape to control malaria. "Whole swamps were eliminated" in this way and in order "to combat the tiny mosquito the malaria control units used giant bulldozers and draglines."[108] Labor designated as skilled involved working those dragline cranes and bulldozers, as well as expertise with explosives such as dynamite, and wood and metal work to create different paths for water through new channels and drains.[109] Malaria Control procured the requisite personnel and equipment for this work from the Naval Construction Battalion, and to a lessor degree the Army Corps of Engineers.[110]

For the work of spraying oil and insecticide on standing water and buildings and the more labor-intensive work needed when the use of heavy equipment was unfeasible

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108 Hart, "The Army's War Against Malaria," p. 422
109 Harper, *et al.*, "Malaria and Epidemic Control," p. 35
110 *Ibid.*

such as eliminating underbrush from ditches, Malaria and Epidemic Control deployed "unskilled labor."[111]

> Actual control work in the field was a "back-breaking" job. Knapsack containers strapped on one's back were used to spray oil containing DDT on every body of water down to the circumference of a watch crystal. Slow-moving streams choked with vegetation were cleaned out, sometimes by very primitive means.[112]

This labor pool was drawn from local laborers, Troop Unit Antimalaria Details, and from the Army Medical Sanitary Companies, which were comprised of black soldiers.[113]

Each of the Army's Medical Sanitary Companies "consisted of 3 white officers and 119 colored enlisted personnel. (1 Sanitary Company has colored officers)…and were authorized 9 vehicles and other suitable equipment."[114] The status of black soldiers was complicated and contradictory: Malaria control work didn't supersede the U.S. Armed Forces' segregation polices as "These companies provided their own messing facilities."[115] On Guadalcanal, the 702nd Sanitary Company was "set up adjacent to, but in a separate camp area, from [the] Lunga unit."[116]

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[111] *Ibid.*, p. 38

[112] Hart, "The Army's War Against Malaria," p. 422

[113] The naming of the company was a source of disagreement: "These [colored] malaria control battalions would be really labor battalions for mosquito control and be the troops to work under the direction of the local Malaria Control Units. I suggested that these battalions be called Mosquito Control Battalions but VanBergen made the point that such a designation does not carry the 'dignity or imply the contribution to the war effort that the word Malaria Control does.' However, whatever they are called, they would be used under the direction of local Malaria Control Units and would have their own tentage, galleys, cooks, etc." "Letter from Dearing to Commander Sapero, 10, September 1943." 1943. 1-3. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1943]. Container # 8. Entry P90-F: RG 313: NARA College Park MD.. p. 2

[114] Harper*, et al.*, "Malaria and Epidemic Control," p. 38; "Malaria Control Info for CINCPAC," p.6.

[115] Harper*, et al.*, "Malaria and Epidemic Control," p. 38

[116] "Memorandum to Dr. Butler from Paul Harper." 1 February 1944. Headquarters Malaria & Epidemic Control. Folder A6-5 General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [folder 4 of 7]. Container 2. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945; Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC). NARA College Park MD

These troops were given credit for being of "great value as a constant source of experienced labor."[117] Men who demonstrated ability or potential were offered training in explosives, as mechanics or as operators of the equipment used in malaria control, and in making surveys.[118] Although primarily seen as basic laborers, potential for advancement and more complicated (and better paying) work that increased in skills and capabilities were seen as possibilities for these soldiers by the military higher-ups.[119] In a 1944 memo, Island Malariologist Paul Harper makes special note of the arrival of a Black malariologist to Guadalcanal:

> Major Poindexter (colored), malariologist from the 93rd Division, has arrived. He has a pleasing personality, and appears to be well-trained in tropical medicine. He has worked in the Caribbean area, both for the government and for the Rockefellow [sic] Foundation, and was head of the Dept. of Bacteriology at Howard University. A transcript of his record is inclosed.[120]

The movement and arrival of staff is often noted in these kinds of memos but rarely with so much description. Certainly, no other personnel discussions remarked on how 'pleasing' their personality was or wasn't.

While employing "colored" soldiers required complicated spatial and administrative arrangements to ensure segregation, the use of "Native" laborers required complicated legal and bureaucratic agreements between the U.S. military and British

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[117] Harper*, et al.*, "Malaria and Epidemic Control," p. 39

[118] *Ibid.*, pp.39, 185. "There were 8 Medical Sanitary Companies used solely for malaria control within the South Pacific Area as of 1 June 1944, located as follows: 4 companies on Guadalcanal; 1 each on Russell Island, Munda, and Bougainville; 1 divided company with a platoon at Green Island and a platoon at Emiru Island. They rapidly developed an understanding of the problems of malaria control and facility in the necessary procedures" *Ibid.*, p. 35.

[119] *Ibid.*, p. 185

[120] "Memorandum to Dr. Butler from Paul Harper." 22 February 1944. Headquarters Malaria & Epidemic Control. Folder A6-5 General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Container 2. Entry P90-F: RG 313. NARA College Park MD.

colonial governments. Contracts were arranged between the governments of the British Solomon Islands and U.S. Forces such that the Colonial or Protectorate governments paid Islanders for the labor and the U.S. military provided housing, meals "and certain other benefits."[121] Through these agreements, by 1944, over 6000 "imported Melanesian laborers" were working at military bases and 600 were employed for malaria control.[122] "Native contract laborers [were] deemed excellent for this type of work and are preferred to troop labor, in that they withstand the rigors of hard toil in hot jungles and swamp water better than troops."[123] The possibilities of advancement or further training is not mentioned for these workers, though this might partially be due to their labor and the conditions of it being negotiated and determined by Colonial officers.

Malariologists were especially insistent that "native camps" where possible, be relocated away from military bases. Under their direction, some Islanders were given "generous" compensation for leases of lands but most were relocated.[124] Not all living on the islands were given a choice of where to 'settle.' Although little is written about their preferences, what is written hints at the complete upheaval the war and subsequent occupations caused to island inhabitants. The war significantly disrupted "the normal civilian life and economy" through changes to the landscape ("Coconut and coffee groves were not adequately worked and have been largely unproductive for two seasons") and the implementation of rationing and military law.[125] People living on Treasury Island

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[121] Harper, *et al.*, "Malaria and Epidemic Control," p. 40
[122] *Ibid.*
[123] Malaria Control Info for CINCPAC, p. 7
[124] Harper, *et al.*, "Malaria and Epidemic Control," p. 14
[125] *Ibid.*

were completely evacuated and moved to Mono Island.[126] Most people on Green Island were moved to a remote site on Guadalcanal. Emiru Island was first occupied by the Japanese who removed all healthy men and boys.[127] The 220 people remaining when the U.S. occupied the island were relocated to a nearby island.[128] On Bougainville, "Native families comprising all ages and sexes were smuggled through the combat lines into the perimeter until in June 1944 about 1600 were present."[129] Those who remained "in proximity to troops" were give anti-malarial drugs (usually Atabrine) and "comprehensive sanitary measures" were instituted.[130]

About 70% of "Natives" used by the Allies in the South Pacific Campaign were "imported labor" from nearby islands under the auspices of the Colonial Labor Corps.[131] These workers were housed "in labor camps," initially amongst troop bivouacs and "were urgently needed in the conduct of military operations and the command decision was to use them in spite of their hazard as a 'seed bed.'"[132] On Espiritu Santo, in November, 1943 "all the natives" were segregated into "three villages [and placed] under the direct supervision by the armed forces, the sites for which were chosen with a view toward accessibility by organizations utilizing the natives for labor. The natives were to return to the village at night, and to carry mess gear" while working during the day.[133] On

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[126] *Ibid.*, p. 166

[127] *Ibid.*, p. 167

[128] *Ibid.*, pp.167-68

[129] *Ibid.*, p. 167

[130] *Ibid.*, p. 14

[131] *Ibid.*, p. 66

[132] *Ibid.*

[133] Mount, Robert. "Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942." 1942. 1-33. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA College Park MD.. p. 5

Guadalcanal, labor camps were identified as particularly significant dangers.[134] Roughly 2200 laborers lived in five labor camps and all “were located within mosquito flight range of approximately 40,000 troops from late 1942 to May 1944.”[135]

The moving of locals away from troop areas on all islands created the problem of where to locate their new labor camps. This proposition caused prolonged debate among competing interests: Malariologists wanted distance of at least one mile between the labor and military camps; those U.S. officials in charge of deploying natives as labor wanted them closer to where they would be working so the expenses of transporting them to and fro could be kept low; and Colonial administrators enjoyed the centrality and advantageous locations of their offices within the base and didn’t want to be relegated to more isolated areas.[136]

MECO’s risk assessment knew that these laborers were a hazard but needed their labor enough that they were forced to find ways to mitigate against their danger. In an October 1943 letter RE “Native Labor for Malaria Control” to the Commanding General, Paul Harper, Island Malariologist wrote, “It must be recognized that natives are an undesirable source of labor, being dangerous and carriers of malaria and frequently of filariasis. However, the need for labor for malaria control projects is so acute that their use is justified, porvided (sic) proper safeguards are taken.”[137] These “safeguards”

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[134] *Ibid.*, p. 164

[135] *Ibid.*

[136] *Ibid.*, p. 66

[137] 12 October 1943 letter to the Commanding General, Forward Area, APO 709 from Major Paul Harper, Island Malariologist APO 709 RE “Native Labor for Malaria Control” [NARA Feb 25 IMG_2675] (probably from Container 2 Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Oct 3, 1943 - Dec 1 -1943]/[Folder 5 of 7])

include surveillance of as well as medical and geographic interventions on the bodies of these islanders. To determine the how hazardous the native carriers were, malariologists conducted spleen and parasitic surveys, which initially showed that more than 75 percent of natives had malaria.[138]

These determinations were achieved by performing physical examinations of the workers' bodies (spleen manipulation to diagnose malaria) as well as the taking of blood samples for the parasite diagnosis and surveys. In addition, U.S. medical officers were "authorized to undertake the treatment of indigenous natives to reduce the health hazard to our forces. The expenditure of medical supplies for this purpose [was also] authorized."[139] Special funding and material approvals were created for the continued (medical) protection of the Allied Forces, mediated through the bodies of islanders.

While the malariologist was reminded that "the natives are under the protection of foreign governments," the monitoring of their bodies was continuous and on-going: the physical and laboratory examinations were repeated to monitor infection rates and to track treatment efficacy.[140] In addition, Island commanders were directed to "maintain a close watch on potential native sources of malaria [and] make appropriate recommendations to Commander, South Pacific, in each case where natives are considered a potential menace."[141] The recommendations that could be authorized against the 'public health hazard' and 'menace' of Island laborers were spatial (the "removal of natives from troop areas [and] 'Out of Bounds' regulations for native villages"), and

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[138] *Ibid.*, pp.64, 65
[139] *Ibid.*, p. 64
[140] *Ibid.*
[141] *Ibid.*

corporeal and material ("Temporary measures to reduce the hazard of natives: drug therapy, spraying of native huts, and issuance of bed nets to natives”).[142] Malaria was only a problem in the population of Island laborers in so much as it affected Allied soldiers. The perpetually potentially infected bodies of those laborers, while given some protection of their ‘own’ governments, were movable and manipulated in service of the Allied’s war efforts. There are no references in the boxes of correspondence that I read that indicated that they were asked about their knowledge of the area or their methods for malaria control.[143]

The desires for malaria control and power of the malariologists prevailed over the Service Commanders and Colonial labor officers as by mid 1944 the majority of laborers had been resettled.[144] On New Georgia, the malariologist’s success meant that the labor camp was relocated to “a small island about a mile off shore where they were taken late each afternoon and whence they were returned to work early the following morning. This was the most sucessful [sic] manner of segregating native laborers.”[145] There is almost no discussion of resistance, except for a note about “the indigenous natives [on Guadalcanal] offered only monor [sic] problems except for the constant influx of small groups for trading,” and no discussion of their reactions or opinions to relocations.[146]

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[142] *Ibid.*

[143] The one source I found that described local people beyond population and labor statistics was in a 1946 article “The Army’s War Against Malaria” by Major Hart of the Army’s Sanitary Corps. He comments, “The cooperation of the New Guinea fuzzy-wuzzy and other native laborers in this dangerous [malaria control] work was one of the pleasant experiences the men remember. These people were eager to learn and were willing workers; thousands of them aided in the important work of malaria control. Their usually jolly and carefree manner, their singing on the way to work, and their love of any mechanical equipment, particularly trucks and jeeps, endeared them to the GI and helped him to banish monotony.” Hart, “The Army’s War Against Malaria,” pp.421-22

[144] Harper*, et al.*, “Malaria and Epidemic Control,” p. 66

[145] *Ibid.*, p. 166

[146] *Ibid.*, p. 164

Despite having been given drugs to suppress and treat malaria, a low but persistent infection rate of two percent remained in the local Island population.[147] The efforts to control malaria among the labor corps through material and corporeal means was rarely successful and often resisted, though for the U.S. authors of the report that resistance came not from the laborers but from the Colonial administrators. The authors believed that "the value of the [control] program is often destroyed by laxity of administration" and that "frequent change in labor camp personnel, due to the recruiting of new natives, and the discharge of those indenture expires, interferes with the program."[148] For MECO, the success of a malaria control program required continued vigilance on the part of administrators and personnel as well as an ability to closely monitor and carefully treat populations of those infected. Colonial officials not having the same standards or being unwilling to adhere to those standards undermined these requirements. The entire discussion of natives and bed nets received the terse sentence "Issue of bed nets to natives is not a satisfactory procedure."[149] The lack of control over the movement and administration of the lives of Islanders (beyond determining their the location of their living spaces and the work of other non-military personnel) was an obvious frustration.

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[147] *Ibid.*, p. 67

[148] *Ibid.* This locating of control problems with the migration of laborers resonates with the problems identified by James and Christophers in the Mian Mir report that I discussed in chapter 1.

[149] *Ibid.*, p. 68

Success and Conclusions

In his introduction to the Army's history of malaria control in WWII, Paul Russell (who also worked on malaria control for the Rockefeller Foundation) noted that WWII demonstrated that the three foundational aspects needed for the successful control of malaria were: 1. An organization devoted to and specializing in malaria control; 2. The materials and personnel for that organization needed to have a high priority in supply chains; and 3. Malaria discipline (the details of which I will analyze in chapter four). He argued that malaria control was not achieved easily nor by rote, but through the combination and "compound[ing] of law and persuasion, organization and training, supplies and technical application."[150] Once properly authorized and respected, the organization had the institutional flexibility to adapt to the particular needs of each Island and base and successfully contain the malaria epidemic.

Throughout the Pacific theater, malaria rates dropped dramatically after their peak 1943. MECO was able to accomplish this decrease in infections despite "the fact that operations continued in highly malarious territory and involved increasing numbers of troops."[151] MECO was successful because of ComSoPac's interventions to give them more authority and power within command and supply structures, but also because of the infrastructural and bureaucratic flexibility that Sapero had insisted on and their adaptations to supply and labor problems. In late 1944, Brig. Gen. (later Ma]. Gen.) Guy B. Denit, Chief Surgeon, Southwest Pacific Area praised the accomplishments of the malaria control units:

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[150] Russell, "Introduction," pp.6-7

[151] McCoy, "War Department Provisions," pp.27-28

> The reduction of the malaria attack rate in this theater to a point at which it no longer constitutes a dangerous handicap to our military effort is an achievement of historical importance in preventive medicine. . . .The Medical Department is proud of your initiative and perseverance, of your professional contributions, and of the striking success of your efforts.[152]

This undertaking was accomplished through the organization, coordination, training, and labors of approximately 2,500 enlisted men and 350 officers. By April 1, 1945, there were 39 malariologists, 85 control units, and 52 survey units in the Southwest and Pacific Ocean Areas.[153] In addition, these units directed the work of thousands of enlisted men and local labor.[154]

Conclusion

Historian Mark Harrison has noted, "paradoxically, the greater ability of armies to control malaria during the Second World War made the disease a more important factor in military operations."[155] It was a greater deciding factor because, "whereas, previously, opposing forces had usually been affected by the disease in equal proportion, it was now possible for an army which took malaria control seriously to gain a comparative advantage."[156] For the Allies, taking malaria control seriously involved approaching malaria as a technical military problem.

MECO and their malaria control efforts were successful because the organization's articulation of its onto-epistemology of malaria as a local and multi-

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[152] Quoted in Russell, "Introduction," p. 10. Denit, G. B. "Message from the Chief Surgeon in the Far East." *Bulletin of the U.S. Army Medical Department* 86, (March 1945). p. 53

[153] *Ibid.*, pp. Table 4, 27-8

[154] *Ibid.*, pp.27-28

[155] Harrison, "Medicine and the Culture of Command," p. 452

[156] *Ibid.*

species problem aligned with the military's own onto-epistemological conventions of combat strategies and tactical operations. In his forward to the Army history of WWII, Surgeon General Leonard Heaton wrote that in creating and executing strategies to control malaria, it was not enough to understand malaria epidemiology nor clinical manifestations and procedures. Instead, "knowledge of the strategic concepts and plans and the place and timing of future tactical operations [against malaria] had to be gained. It was necessary to develop and evaluate medical intelligence on diverse and little-known areas of the world."[157] To effectively plan a battle, campaign, or war it is important to understand the conditions on the ground: the topography, climate, health and population of local communities, etc. This attention to and focus on local conditions and variability pervades the after-action reports on malaria control activities in the Pacific.[158] These reports don't begin with how malaria was a problem for the war or what the control efforts accomplished, but with chapters on an area's climate, physical geography, and history of the area including its discovery, government and period of occupation, the available medical facilities, population and health census data, as well as modes of economy.

This chapter has been concerned with the military's articulation of malaria as a problem, the technical and infrastructural solutions created, and the difficulties in implementing those solutions. This was an articulation of a local, multi-species malaria

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[157] Leonard Heaton. "Forward." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, DC: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/forewordrev.htm, p. 1

[158] See: "Epidemic Control on Espiritu Santo"; Harper*, et al.*, "Malaria and Epidemic Control"; Harper*, et al.*, "New Hebrides"; Hart and Hardenbergh, "Southwest Pacific Area."

and was instantiated in MECO's organizational infrastructure and interventions into larger military command and supply structures. The actual practices and work of malaria control are the concern of my next chapter. This work was described by Leonard Heaton as:

> work which required a highly technical knowledge of the subject; work which required time training of hundreds and thousands of other officers and men; work which required staff coordination at the highest as well as the lowest unit command levels; work which was hot, dirty, wet and which many times involved the dangers inherent in combat itself. It was in the latter areas that prevention and control were not only most difficult to carry out, but for which the dire necessities of control were so obvious.[159]

I analyze how this work was an articulation of MECO's onto-epistemology of malaria, how these practices were executed and evaluated as well as how reports and maps played a productive role of in those processes. What counted as malaria was enacted through the practices of collecting mosquitoes and blood samples, diagnosing infections, locating and surveying mosquito breeding sites, standardizing reporting practices, spraying mosquito larvicide and insecticide, engineering projects to reduce standing water, and visually representing and circulating knowledge in files and reports as well as through the coordinating work of the malariologist in assembling the reports of different specialist units into a single report legible to both medical officers and non-specialists up command levels.

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[159] Heaton, "Forward," p. 1

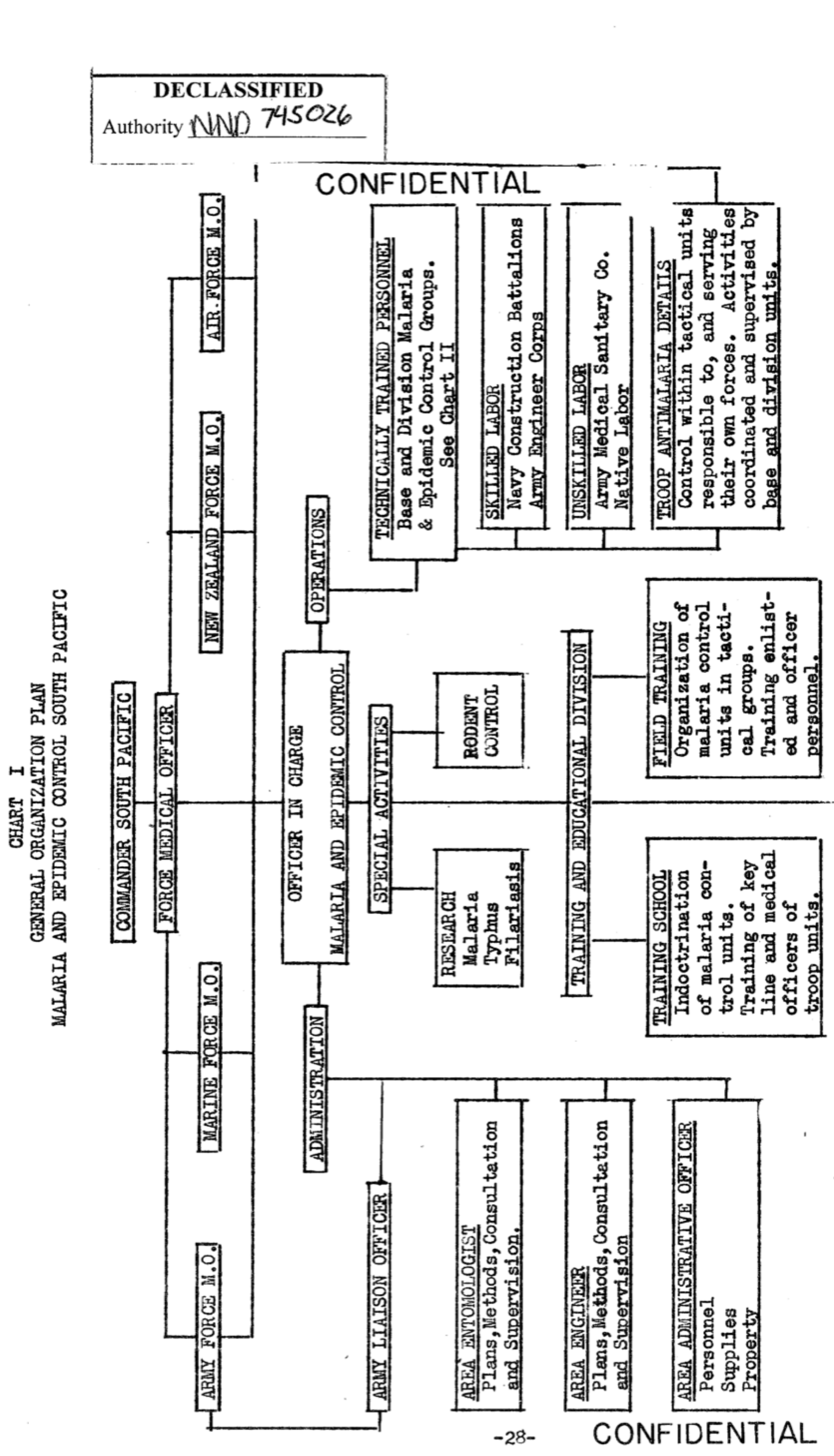

Image 2.1. Chart I: General Organization Plan, Malaria and Epidemic Control South Pacific. From Harper, *et al.*, "Malaria and Epidemic Control," p. 28.

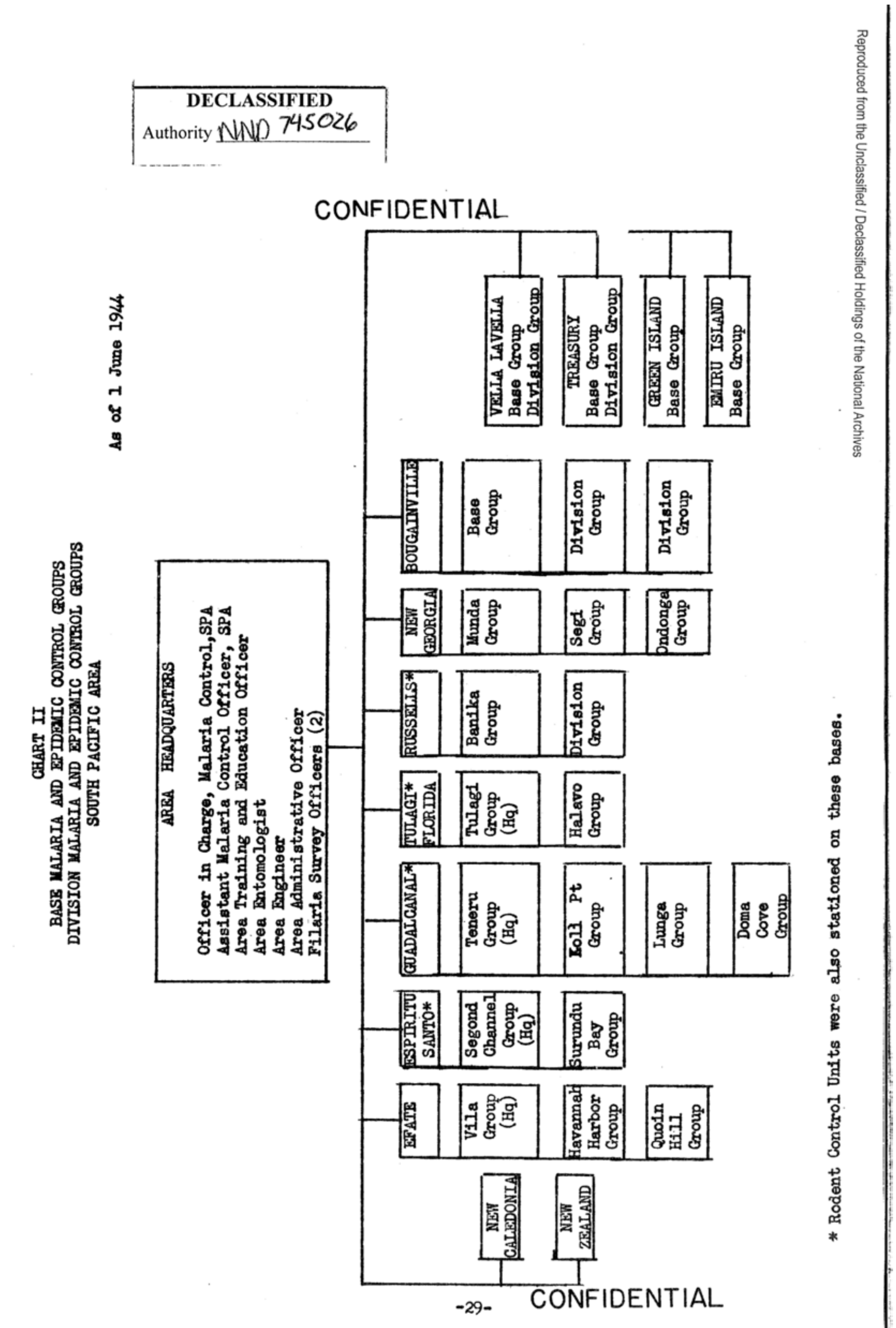

Image 2.2: Chart II: Base Malaria and Epidemic Control Groups, Division Malaria and Epidemic Control Groups, South Pacific Area. From Harper, *et al.*, "Malaria and Epidemic Control," p. 29

Chapter 3: Coordinated Practices of Malaria Control

> "It is perhaps natural and almost necessary for a successful activity in their respective fields, that the biologist should look at malaria as an entomological problem, while the health officer should see it only from the point of view of treatment or mosquito eradication, because only in their fields can they act; but the specialist neither can nor will explain the whole phenomena."[1]

This chapter shifts the focus from the military's infrastructural responses to the problem of malaria in the Pacific theater to the "common, day-to-day," sociomaterial practices and techniques the Malaria and Epidemic Control Organization (MECO) used to control malaria.[2] MECO's infrastructure created new "geographies of responsibility."[3] Using Mol's discussions of coordination and practice, as well as Joyce's analysis of the bureaucratic file, in this chapter I analyze how memos, records, surveys, and reports were the technical objects that directed particular "geographies of responsibility" as well as what those responsibilities entailed for malaria control. These technologies and practices articulated MECO's onto-epistemology of malaria as a local, multi-species problem.

MECO established a Senior Malaria Control Officer (a malariologist) on each island who coordinated the efforts of that island's Malaria Control Units. "Within the unit are entomologists who supervise mosquito breeding surveys, parasitologists who supervise and instruct in laboratory diagnosis of malaria and native surveys, and sanitary

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[1] Erwin H Ackerknecht, *Malaria in the Upper Mississippi Valley 1760-1900* (Baltimore: Johns Hopkins Press, 1945). , p. 130

[2] Annemarie Mol, *The Body Multiple: Ontology in Medical Practice (Science and Cultural Theory)* (Durham: Duke University Press, 2003). , pp.6-7

[3] Madeleine Akrich. "The De-Scription of Technical Objects," In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, Cambridge: The MIT Press, 1992. , p. 207

engineers who supervise oiling, draining, filling, and other control activities."[4] The malariologist's efforts involved organizing and integrating each component of the units' practices which included surveying, mapping, taking water samples from swamps and marshes to count mosquito populations, reading blood tests, spraying DDT, filling in road ruts, creating drainage ditches, and draining marshes. The Malaria Control Officer also organized the creation, standardization, and circulation of weekly and monthly reports, surveys, and maps documenting the practices and activities of each malaria control group, as well as assembling this information into a separate report for the base and theater commanders. These reports were used to evaluate the efficacy of control efforts, plan base locations, and troop movement.

My analysis focuses on two aspects within the technologies and practices of malaria control: 1. the "common, day-to-day" work of counting and controlling mosquitoes and parasites; and 2. the work of translating and representing that work into useful information in the form of reports that could circulate up and down command hierarchies. Both of these aspects were coordinated by a senior malariologist. In this chapter, I argue that malaria was enacted and articulated through *both* the practices and the reporting of those practices, and that malaria was successfully controlled because the malariologist coordinated and translated both.

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[4] "Memorandum: Malaria Control Information for CINCPAC, from Fred Butler, Malaria Control Officer. 9 March 1944 (Secret)." 1944. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1945]. Container # 8. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD, p. 1 (Hereafter Entry, Record Group, and National Archives abbreviated to Entry P90-F, RG 313, and NARA MD)

Practices and Files

In *The Body Multiple*, Annemarie Mol analyzes the multiple ontologies of arteriosclerosis.[5] Mol argues that arteriosclerosis is a different disease in different situational contexts and geographic spaces: A patient who has trouble walking up the stairs of their home because of leg pain experiences and knows a different arteriosclerosis than a surgeon in an operating theater or a laboratory technician looking through a microscope at tissue samples. But for Mol, this multiplicity of arteriosclerosis does not make it fragmentary; rather "even if it is multiple, it also hangs together."[6] For multiplicity not to equal fragmentary chaos, for the term arteriosclerosis to have any meaning that can be commonly understood across contexts and spaces, requires "various *forms of coordination.*"[7] These forms of coordination involve "establishing common measures" through practices of translation, quantification, and calibration.[8] In order to analyze the multiple object and the hanging together, Mol advocates for attending to technologies, objects, and practices. Her methodology "locates knowledge primarily in activities, events, building instruments, procedures, and so on," and attends to "the techniques that make things visible, audible, tangible, knowable."[9] Mol argues that objects and knowledge must be understood through practice, as mediated through objects: "In practices, objects are enacted."[10]

The practices of the parasitology, entomology, and engineering units enacted and

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[5] Mol, *The Body Multiple*.
[6] Ibid., p. 55
[7] Ibid.
[8] Ibid., pp.84-85
[9] Ibid., pp.32,33
[10] Ibid., pp.33, 41

articulated multiple, different, local, and multi-species malarias in the Pacific theater. The malariologist had to coordinate these practices (malarias) for each group as well as coordinating these malarias into something that could "hang together" and be legible in different contexts and to different audiences, and could circulate up and down chains of command, to people with different specialities and knowledges about malaria (the entomologist, the general planning military strategy). The head malariologist was aided in coordinating these multiple malarias through the "common measures" established through monthly and weekly reports, surveys, and maps. These reports, surveys, and maps included standardized quantifications of malaria control efforts such as the number of anopheles larvae found in an area, the number of parasites in a blood smear, or the number and location of troops and local islanders with parasites in their blood smears.

These files were important to the translation and coordination work of the malariologist and directed the geographies of malaria control responsibility. For Patrick Joyce, files are of foundational importance to institutions and bureaucracies: "The file is the central unit by which information is assembled and knowledge produced, knowledge that enabled the institution to know and control itself as well as that which it governed."[11] MECO was created through files, memorandum, and directives. These files also helped MECO and the larger Allied military command to evaluate its malaria control practices.

I closely analyze the files used in malaria control, which include the forms each unit filled out, the engineers and entomologists' surveys and maps, and the monthly

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[11] Patrick Joyce. "Filing the Raj: Political Technologies of the Imperial British State," In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett, Patrick Joyce, London: Routledge, 2010. , p. 111

report on a base's malaria control efforts. Following Joyce, I believe that files are "concerned with excluding as much as including things, the 'engineering out' as well as the 'engineering in' of knowledge production and capacities for action."[12] The forms and reports of the malaria control units codified ways of articulating malaria, as well as the geographies of responsibility for its control. Certain groups were authorized for certain actions (e.g. mosquito control or the monitoring of malaria rates among troops and island laborers) and these files excluded the possibility of incorporating any ways of knowing or articulating malaria that island residents might have had.

I analyze the components of the Malaria Control Units' files in such depth because,

> Thus while the file is a means of controlling matters and hence stabilising the institution and its works, it is also always a contingent and to some degree arbitrary framing of the world. Also, often an unstable one. There was, and is, nothing necessary or inevitable about the ways in which files were composed and how information got into files and became knowledge, so that it becomes necessary to look in some detail this business of how a file is made.[13]

The forms, surveys, maps, and reports of the Malaria Control Units were developed and revised throughout the war. These files were a mode for stabilizing knowledge about malaria and malaria control and were curated and shaped by the practitioners of malaria control as well as those overseeing their practices.

The documents contained within the Malaria Control Units' files produced and codified relationships and responsibilities through the power of what Lisa Gitelman

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[12] Ibid., p. 112

[13] Ibid.

identifies as the "knowing/showing" function of documents.[14] This function shapes "the ways people think as well as to the social order that they inhabit."[15] As I will show, the files, reports, surveys, and maps created by individual malaria control units as well as by Island Malariologists shaped the articulations of malaria and malaria control practices.

I will discuss the work of the Island Malariologist and malaria control units generally, the training required for both malaria control specialists and general officers and enlisted personnel, and then analyze in greater depth the specific work and reporting practices of the entomology, parasitology, and engineering units. I will conclude by re-engaging the malariologist and the work of coordinating multiple malarias into a disease that was legible to the Allies as a local, multi-species malaria.

Work of the Malariologist and Malaria Control Units

As I discussed in the previous chapter, MECO was created by a series of command directives and memorandum beginning in 1942.[16] Once established, MECO's

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[14] Lisa Gitelman, *Paper Knowledge: Toward a Media History of Documents (Sign, Storage, Transmission)* (Durham: Duke University Press Books, 2014). , p. 5

[15] Ibid.

[16] "Malaria Control Info for CINCPAC."; "History of the Activities of Base Malaria and Epidemic Control on 'Espiritu Santo,' June 1942 - July 1945 (Secret)." 1945. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, New Hebrides, Folder 1 of 11 [July 1945 - Oct 1945]. A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides. Container 4 ARC# 5722964. Entry P90-F, RG 313, and NARA MD.; Paul A. Harper*, et al.* "New Hebrides, Solomon Islands, Saint Matthias Group, and Ryukyu Islands." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.; Harper, Paul A.*, et al.* "Malaria and Epidemic Control in the South Pacific 1942-1944 (Confidential)." 1945. Reproduced by Engineers HQ SOPACBACOM 2379. Container 15, Folder [P2-3] [Malaria and Epidemic Control in South Pacific Area, 1942-1944] Folders 1-6. Entry #P93: Historical Files, 1942-1946, P2-3, Red 183. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD.; Thomas A. Hart, "The Army's War Against Malaria," *The Scientific Monthly* 62, no. No. 5 (1946). ; Mount, Robert. "Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942 (Secret)." 1943. 1-33. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P90-F, RG 313, and NARA MD.

malaria control units were regularly dispatched to each malarious base within two weeks of its occupation.[17] Initially, control units which had been assigned to combat divisions would set up temporary measures. Then, within 30 days, the "permanent" organization responsible for malaria control on that base would arrive and begin to set up the base's malaria control program. This program was organized into eight components, in descending order of priority:

> (1) Surveys and mapping of entire occupied area for anopheles breeding.
> (2) Initiation of temporary control measures for entire bases by malaria control personnel and troop mosquito control squads, principally oiling as indicated by surveys.
> (3) Survey of entire base by sanitary engineer for needed and practical permanent projects such as drainage, filling, stream clearance, etc., and submission of requests to base commander for priority on base construction list.
> (4) Survey of indigenous natives for malaria status; blood films, spleen rates; initiation of suppressive treatment, relocation, etc.
> (5) Educational and propaganda campaign among troops on following points: malaria discipline, taking of suppressive atabrine, creation of man-made malaria, avoidance of natives.
> (6) Immediate provision of adequate laboratory diagnosis for all field medical facilities.
> (7) Formulation and recommendation of necessary base directives regarding malaria control.
> (8) Collection of statistics on malaria incidence.[18]

These components were distributed among the entomology, parasitology, and engineering units, and overseen by the Island Malariologist.

The job of the Island Malariologist (also sometimes known as Senior Malaria Control Officer) was a complicated and multi-tiered one with the role resembling that of a commanding officer. The malariologist coordinated with all the units involved in

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[17] "Malaria Control Info for CINCPAC," p. 3

[18] Ibid., pp.3-5

control work which necessitated being "in constant touch" and helping to resolve problems that arose about supplies, people, and materials.[19] Each Island Malariologist's responsibilities included: assigning, coordinating, and keeping track of control work and its efficacy; the malaria rates among troops and island labors; tracking, assigning, and requisitioning supplies, materials, and personnel; helping to choose camp sites, exercise and drill areas; designating areas out of bounds; coordinating information campaigns about malaria control and discipline.[20]

The Island Malariologists also produced monthly reports summarizing all of this information that were sent directly to the Island Commander and "forwarded directly to the senior subordinate commands of the various services at each base, to the Force Medical Officer, Commander South Pacific, the Surgeon, USAFISPA [United States Army Forces in South Pacific Area], and Headquarters, Malaria and Epidemic Control."[21] It was also the job of the malariologist and his inspectors to check planes and ships for "compliance with directives designed to prevent dissemination of mosquitoes from one base to another."[22] These spot inspections were done weekly at all base airfields and seaplane landings and violations were passed up the chain of command to the Island Commander.[23]

Training

In his *History of Entomology in World War II*, Emory Cushing noted the lack of

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[19] Harper, *et al.*, "Malaria and Epidemic Control." p. 54
[20] Harper, *et al.*, "New Hebrides." pp.441-45
[21] Ibid., p. 437; Harper, *et al.*, "Malaria and Epidemic Control." pp.76-77
[22] Ibid., p. 61
[23] Ibid.

personnel with knowledge about malaria in the early years of the Pacific theater:

> Our entry into global war in 1941 found us ill prepared to cope with the malaria problem in the areas to which we were to send some 3 million troops during the next two or three years. Of the many doctors in the armed forces, few ever had seen a case of the disease. Probably not one in ten laboratory technicians in the medical departments could identify with certainty the various types and forms of the malaria plasmodia as seen in stained blood films under the microscope.[24]

This dearth of trained personnel was initially addressed through drafting university researchers in entomology as well as Department of Agriculture, Public Health Service, and state health department workers, funding tropical medicine programs in medical schools, and state-side training courses and field work for malaria control specialists, with the Army and Navy each having their own programs.[25] In order to address the local conditions, all personnel working in the control organization were taught the basics of what was considered the "essentials of good antimosquito work" when they arrived at a base and again through "refresher" courses.[26]

The practices of the military's malaria control work were articulated, codified and reproduced in training programs and schools for enlisted men, officers, and specialists.[27] For enlisted men, these were three day classes that "constitute[d] indoctrination into the entomology of the mosquito malaria control problems, methods and technique of control,

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[24] Emory C. Cushing, *History of Entomology in World War II* (Baltimore: The Lord Baltimore Press, 1957). , p. 41

[25] Harper, *et al.*, "New Hebrides." p. 439; Oliver R. McCoy. "War Department Provisions for Malaria Control." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm., pp.22-3, 48

[26] Harper, *et al.*, "Malaria and Epidemic Control." p. 178; "Epidemic Control on Espiritu Santo." p. 9

[27] Harper, *et al.*, "Malaria and Epidemic Control." pp.173-94

and practical field application."[28] These essentials consisted of identifying larvae and adult anopheline mosquitoes as well as their breeding places, knowing how to take samples of larvae and adult mosquitoes (including different methods of killing them), "map making and map reading, adequate to locate breeding places," use of different larvicides, and basic engineering involved in small drainage projects.[29] The specific malaria control conditions of their current island were also covered.[30] This basic skill set was diverse and encompassed entomology, surveying, and engineering and created an organization in which all personnel were familiar with the practices and activities of each others' work.

These skills were also emphasized at Schools for Troop Antimalaria Personnel and Labor, which offered specialized classes for enlisted men, officers, and specialists.[31] For commissioned officers, their class was also three days and "constitute[d] an indoctrination course in malariology, with emphasis upon the responsibilities of commanding officers, both line and staff, as regards Malaria Control."[32] By the end of the war, nearly 5,000 officers had attended the course which was developed and taught by an area malaria control entomologist, parasitologist, engineer, and malariologist.[33] Although Malaria Control Units were designated to do wide-scale measures, all officers in the Pacific were "responsible for all malaria control activities within his lines, including

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[28] "Malaria Control Regulations, AG 710 (Secret)." 1944. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/ [Folder 3 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA MD, p. 4

[29] Harper, *et al.*, "Malaria and Epidemic Control." p. 178

[30] "Epidemic Control on Espiritu Santo," p. 9

[31] "Malaria Control Regs AG 710." p. 4; Harper, *et al.*, "Malaria and Epidemic Control." p. 181

[32] "Malaria Control Regs AG 710," p. 4

[33] Harper, *et al.*, "Malaria and Epidemic Control." p. 182

larvicidal work in and adjacent to his bivouac site."[34]

Similar to the curriculum of the enlisted men, officers were also instructed in the "identification of anopheline larvae and adult mosquitoes; use of maps to mark breeding places; control of mosquito breeding by draining, filling, spraying with oil, and use of drip oilers; assembly and repair of knapsack oil sprayers."[35] A functional knowledge of making and reading maps was considered to be the next priority. Maps were the materials through which locations of anopheline larvae and adults were documented; these maps both set the stage for further control work and was a way of measuring the efficacy of past control efforts. In these courses, "an effort [was] made not only to show how to control malaria, but also to explain the rationale of this work, thus creating a nucleus of informed officers and men in each battalion and company."[36] Properly instilled, the logics and practices of military malaria control knowledge would be reproduced in these officers and then disseminated to the men under their command.

Within the malaria control units, specialists were encouraged to stay up to date on the advances in their field. Parasitologists could take a two week course "designed for both primary and refresher training for hospital corpsmen, laboratory technicians, and for men in positions who may desire such training. Emphasis is stressed upon the thick smear diagnosis of malaria, staining techniques, etc."[37] All specialists were also encouraged to discuss new developments and problems with each other at monthly meetings with other

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[34] Ibid., pp.47-48

[35] Ibid., p. 181

[36] Ibid.

[37] "Malaria Control Regs AG 710," p. 4

specialists.[38] These gatherings were also used as a time "to make field trips" as well as to present papers to each other.[39]

Specialists also communicated with each other through memorandum and sent materials between bases. For example, in a November 1943 Memorandum to Lt. Lever, Government Entomologist on Fiji, Lieutenant Kenneth Knight on Espiritu Santo, thanks Lever for passing along an entomology journal and some specimens.[40] In particular Knight notes "The pair of adults [mosquitoes] which you sent to me are of a new genus for my collection and I am surely indebted to you. . . . I am enclosing several mimeographed items from this office."[41] In addition to these organized meetings and collaborations, control officers from headquarters would visit malarious bases on a monthly or bimonthly basis in order

> to keep in touch with local work and needs. The area entomologist and engineer offered technical assistance and advice to the corresponding officers in each base unit. Distribution of technical information was also accomplished through a newsletter and through special publications such as synoptic keys to mosquitoes. Uniform methods of reporting information were adopted for all base reports as well as for area reports.[42]

MECO's senior officers worked to circulate between malarious bases to coordinate, monitor, and assist with control efforts. These efforts as well as the monthly meetings fostered scientific collaboration and camaraderie, and offered spaces for the

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[38] Harper*, et al.*, "Malaria and Epidemic Control." p. 60

[39] Ibid.

[40] "Memorandum to Lt. Lever, Government Entomologist, Fiji from Lieutenant Kenneth Knight Headquarters Navy 140, 10 November 1943 (Secret)." 1943. Folder A6-5(16-1) General Correspondence - Fiji Islands - American Division [Apr 3, 1944-Oct 1, 1945]/ [Folder 1 of 2]. Container 3. Entry P90-F, RG 313, and NARA MD.

[41] Ibid.

[42] Harper*, et al.*, "New Hebrides." p. 438

dissemination and codification of ways of knowing and articulating malaria.

The material covered at these schools reveals an onto-epistemology of malaria as a local, multi-species problem for the military. In rendering malaria a technical problem, the courses provided the foundations and logics for its solution. The courses for specialists, officers, and troops each provided the parameters of what malaria was and how it might be controlled, as well as the geographies of responsibility within those parameters. In the courses for both enlisted men and officers, identifying the different stages of anopheline mosquitoes was given first priority. The knowledge and practices that were most valuable and universally needed in control work were the ability to identify what the enemy (i.e., larval and adult mosquitoes, the agents of infection) looked like, locate them in the landscapes, mark those spaces on maps so that they could be re-located by oneself or someone else, and then to kill that enemy most effectively, with the main emphasis on changing landscapes through altering drainage or through insecticide.

Work of the Malaria Control Unit — Entomology

Briefly, the entomology unit "furnished information about the breeding of mosquitoes and other insects, their biology, and relations to disease. This information was always accompanied by recommendations as to specific control measures."[43] This work was perpetual and "was recorded on maps and other forms so as to give a clear and continuous check on the effectiveness of control."[44] These were the everyday, sociomaterial practices of malaria control; these were the articulations and enactments of

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[43] Ibid., p. 445

[44] Ibid.

malaria through maps, surveys, records and their circulation.

The work of monitoring and controlling mosquitoes was difficult and performed under combat conditions as well in the high heat and humidity of tropical swamps and jungles, with the potential threats of wild boars and crocodiles.[45] Rainy seasons brought severe storms and thick mud through which vehicles and personnel had trouble negotiating. "Wading hip-deep across streams and walking knee-deep in muck was the common lot of [control workers]."[46] Traversing through mud and jungles was necessary to locate, survey, monitor, and try to reduce mosquito breeding areas which would typically encompass areas not near established camps.

An important component to the work of the entomology unit was the creation of surveys. The term survey was frequently an umbrella term that could refer to an accounting of malaria infections in humans (usually with further delineations, such as a survey of the natives, surveys of all island personnel who passed through a hospital, a survey of aviators, etc.), or mosquitoes and landscapes.[47] The entomology group, overseen by the entomologist, created "surveys of mosquito larvae and adults to determine incidence, geographical and seasonal distributions, biology and relation to malaria."[48] This information on location, population density, type, and threat was then utilized by the entomologist to identify areas that needed control measures, decide what those measures would be, and pass those recommendations along to the Island's

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[45] Hart, "The Army's War Against Malaria," p. 421
[46] Ibid.
[47] See e.g.: Mount, "MCU Base Button," p. 4
[48] Harper*, et al.*, "Malaria and Epidemic Control." p. 79

malariologist.[49]

In addition to the senior entomologist "with special training in collecting mosquitoes and identifying them," Malaria Survey Units were comprised of one Senior non-commissioned officer who oversaw the work in the field and lab; 2-3 Laboratory and Insectary men who made maps, kept records of mosquito population, rainfall, as well as of supplies and the larvae brought to the insectary, and those anopheline raised there; and 5-8 Field men who were usually subdivided into pairs, with each unit being responsible for an area of 9 to 15 square miles that was to be checked weekly to report on mosquito populations and the status of control measures.[50] Field work was considered essential for this Malaria Survey Unit, with even the lab and insect personnel being expected to participate on surveys and make recommendations where necessary. It was thought that these excursions fostered better working relationships between the men working in the field and those in the lab.[51]

In 1943, the memo "Summary of Survey Duties in Various Areas" was included in the first directive about monthly and weekly reports.[52] It began with the instruction to "Prepare a map of all mosquito breeding areas in your section every two weeks," with these areas encompassing locations with human populations and (especially) isolated locations.[53] Importantly, surveyors were directed to "remember you are responsible for

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[49] Ibid.

[50] Quoted in Hart, "The Army's War Against Malaria," p. 421 See also Harper*, et al.*, "Malaria and Epidemic Control." pp.79-80

[51] Ibid., p. 80

[52] "Directive "Weekly Malaria Reports" from Harry Bennett to Medical Officers of All Naval Activities, July 19 1943 (Secret)." 1943. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P90-F, RG 313, and NARA MD, p. 4

[53] Ibid.

knowing the location of all mosquito breeding in your area!"[54] The survey crew were instructed to collect and return with local fauna for further study and accounting: "Bring in collections of mosquito larvae - especially from tree holes, coconut shells, cacao pods, artificial containers, as well as ground pools. These collections will be identified in the laboratory and the information added to our general mosquito survey."[55] These particular duties emphasized the importance of knowledge about and attention to local conditions, with the understanding that these conditions would change. Smaller aspects or features of the local, such as tree holes or ruts caused by construction or vehicles, were important and required monitoring for mosquitoes.

Entomologists were directed to "devote a large part of his time to field work" because his job required detailed knowledge of the landscape so to be able to determine areas that needed control measures as well as areas that would be recalcitrant to particular control methods.[56] In service of those responsibilities, he also needed to have close relationships with the survey units within his group and the larvicide units (which may have been outside his unit) in order to better translate information across these communities of practice and to ensure effective control.[57] Malaria was articulated by the entomology group through the practices of field work, making, surveys, keeping records, and relationships with mosquitoes, landscapes, other specialists.

Once the surveys of mosquito populations were completed, that information was translated onto maps. Maps were the initial step in malaria control practice for the

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[54] Ibid.

[55] Ibid.

[56] Harper, *et al.*, "Malaria and Epidemic Control." p. 80

[57] Ibid.

entomologist to situate current problems and future sites of surveillance. For each new territory, the entomology Malaria Survey Unit did a preliminary survey that identified the "location, extent and description of actual and potential breeding places"; a record of the populations of anopheline larvae and adults; and the "location of native villages, or other reservoirs of infection."[58] These territories were then sub-divided into areas with boundaries determined by "artificial or natural" landscape features: Natural boundaries were considered those already existing in the landscape such as jungles, cliffs, and bodies of water like rivers, swamps, and beaches, while artificial boundaries were features of the built environment "provided by military establishments such as ration or ammunition dumps, by air strips and roads or trails."[59] Below is a "Malaria Survey Map" of the West Renee Sector of Espiritu Santo that represents the landscape and build environment of the island from August 1944.[60] Roads, swamps, ponds, and villages are among the features designated in the Legend, while areas of jungle, lagoons, and rivers are also marked on the map.

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[58] Ibid., p. 82

[59] Ibid., p. 83

[60] "Malaria Survey Map of the West Renee Sector of Espiritu Santo (Secret)." 1944. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides, Folder 2 of 5 [Aug 30, 1944-Dec 31, 1944]. Container # 1 Arc# 5722964 Folder A6-5 (1-1). Entry P90-F, RG 313, and NARA MD.

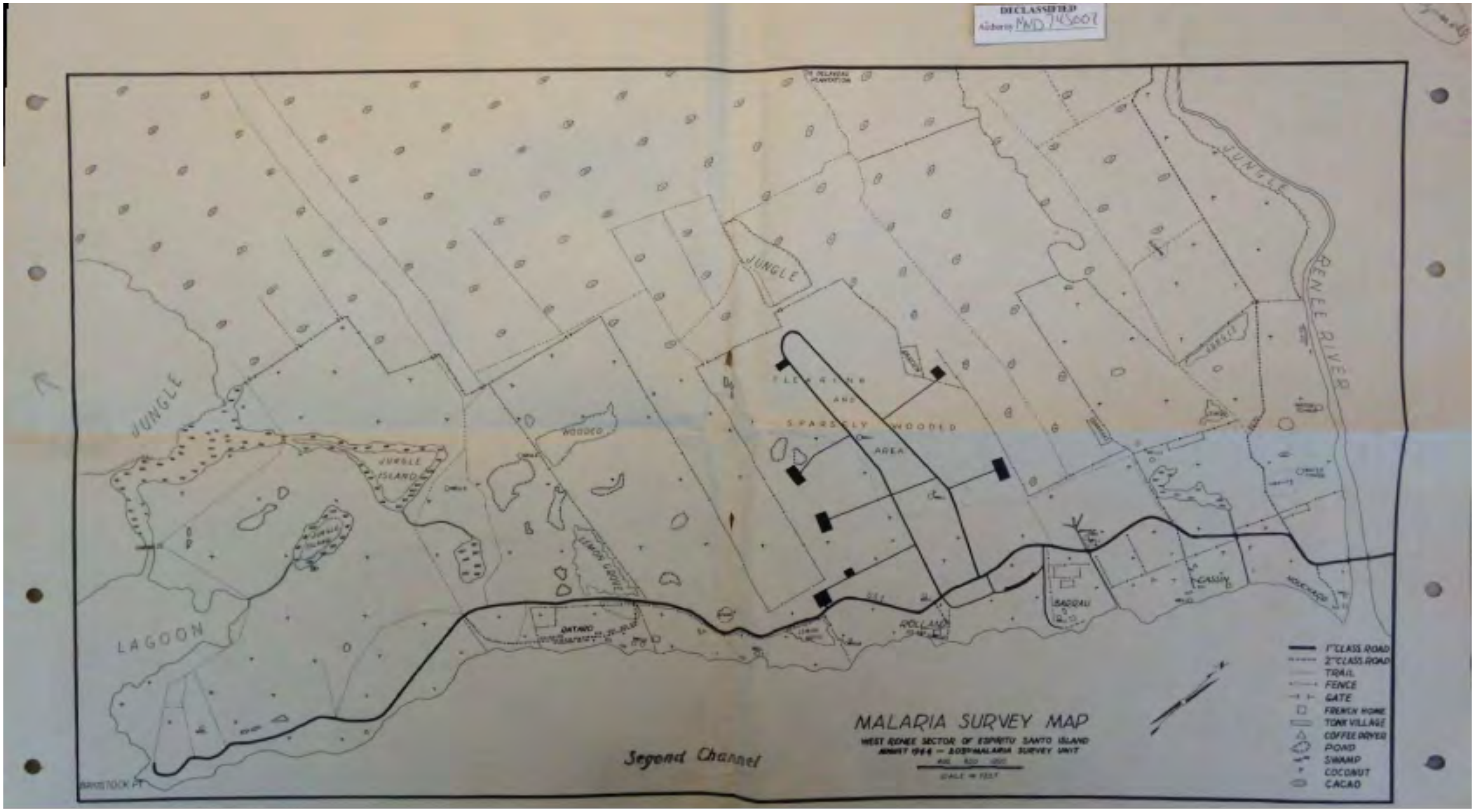

Image 3.1: Malaria Survey Map of the West Renee Sector of Espiritu Santo. 1944. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides, Folder 2 of 5 [Aug 30, 1944-Dec 31, 1944]. Container # 1 Arc# 5722964 Folder A6-5 (1-1). Entry P 90-F: RG: 313: NARA College Park.

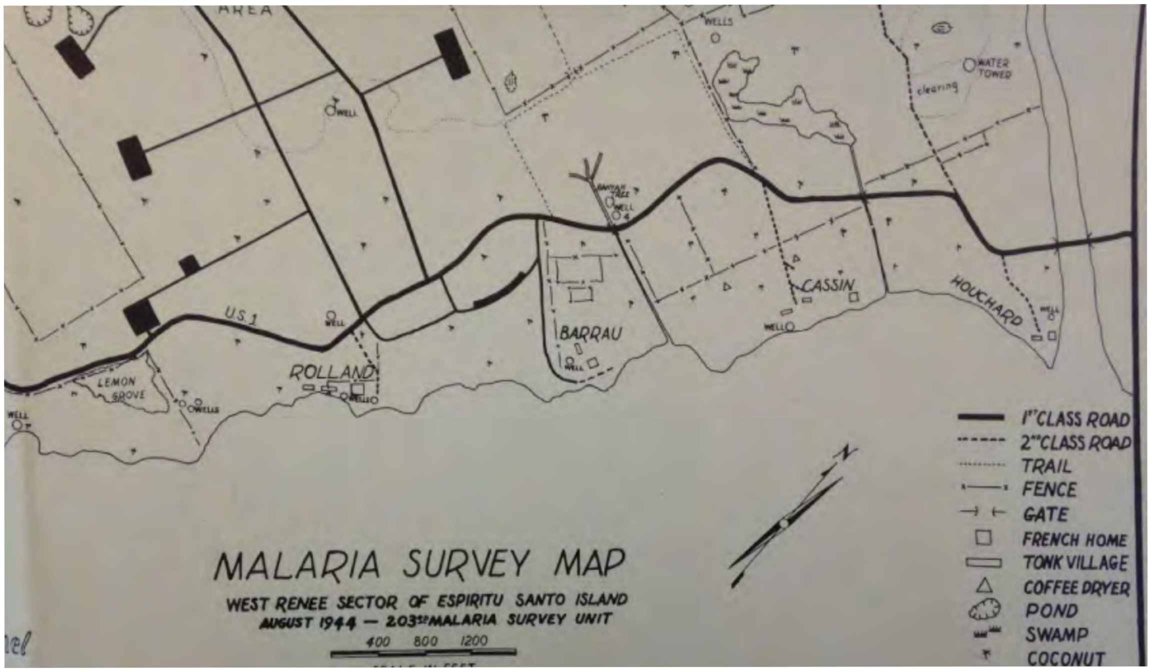

Image 3.2: Close-up of "Malaria Survey Map," 1944.

The work of making the initial survey and instituting control measures were usually begun together, with a quick transition to monitoring and surveillance of those measures.[61] The activities and practices of the "routine checking system" involved identifying "the exact location" of anopheline mosquitoes breeding sites as well as their "habits and characteristics" and checking those areas weekly.[62] The weekly check of "all water sites" was to monitor the populations of larvae as well as to update and refine the preliminary survey.[63] This knowledge about mosquitoes was translated into "a quantitative record" of anopheline populations that demonstrated "the progress of control

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[61] Harper*, et al.*, "Malaria and Epidemic Control." p. 82

[62] Ibid., pp.82-83. The use of "exact" here is interesting — in a January 1944 letter between malaria control officers, William Perry inquires if the use of the grid system in maps is more useful for referencing a "specific location" for reports and asks "But how frequently is it used by your men in the field? When they plot breeding on their sectional maps, if they are like most survey crews, the locations are only approximate anyway." "Letter to Belkin from Perry, 26 January 1944 (Secret)." Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Container 2. Entry P90-F, RG 313, and NARA MD.

[63] Harper*, et al.*, "Malaria and Epidemic Control." p. 83

work."[64] The accuracy of this report was produced through refining the techniques of collection and monitoring as well as the collection of additional data.[65] The metric of success for this unit was measured through the number of mosquitoes and mosquito larvae.

The progress report was the result of three standardized reports about mosquito breeding that the entomology group regularly completed. The data collected in each of these reports was transferred to and represented on a wall map (to be discussed below). The report titled "Anopheline Larvae Survey," informally known as (Entom. 1), was filled out and submitted to the entomologist after each area check.

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[64] Ibid., pp.82-83

[65] Ibid., p. 84

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initial survey. This work is repeated and improved with each checking period, and an accurate progress record of mosquito breeding gradually evolves.

Form: Entom. I, Anopheline Larvae Survey, records information submitted at the end of each day's work.

FORM: Entom. I.

ANOPHELINE LARVAE SURVEY
MALARIA AND EPIDEMIC CONTROL
APO or FPO ___

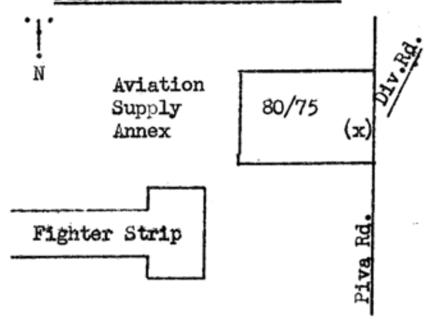
AREA Yoke DATE 28 June 1944 NOTES BY W.C.K.

LOCALITY Aviation Supply Annex

SAMPLING DIPS 75 ANOPHELINE LARVAE 80 (-63; + 17) NO. PER DIP 1.06

IDENTIFICATIONS ______

DIAGRAM OF BREEDING SITES



NOTES Anophelines found only in one large pool in equipment storage area. Can be corrected through use of bulldozer. Sufficient fill available.

The number of indicated dips is a rough index of breeding surface. Thus, if 100 dips are recorded in the Air Torpedo Dump of 2nd Bomber Strip Area, whereas the record of a month ago shows 300 dips, the implication is that the water surface has decreased roughly to one-third.

The number of larvae/number of dips indicates both the anopheline population and water area. Thus, 80/75 indicates 80 anopheline larvae in 75 dips. If

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-84-

Image 3.3: Form: Anopheline Larvae Survey, from Harper, *et al.*, "Malaria and Epidemic Control." p. 84.

The metric of 'dips' was "a rough index of breeding surface area" of a water source and allowed for tracking the size of the water surface area and the density of the larvae population in that water over time.[66] This form had three purposes: a copy of it was filed for future reference; it was used by the control crews to keep track of breeding locations; and the information from it was transcribed to the wall map.[67]

The "Mosquito Survey - Accession Record" (Entom. II) was a short form for keeping track of the collection locations for the mosquito specimens used for identification and raising.[68]

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[66] Ibid., pp.84-85
[67] Ibid., p. 85
[68] Ibid., p. 88

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larvae are found the area is marked with a white flag for guidance of the oiling crew, and the location of the flag is indicated on the wall map by a red "F". The oiling crew notifies the laboratory when a flagged area has been oiled. The symbol is then removed from the map. This same plan is used to notify the oiling crews of troop antimalaria details when late instar breeding is found in their areas.

FORM: Entom.II.

MOSQUITO SURVEY - ACCESSION RECORD
MALARIA AND EPIDEMIC CONTROL
APO or FPO ______

ACCESSION NO. 198 DATE 16 May 1944

LOCATION Hill 260, Torokina River Bottom COLLECTOR John Smith

SPECIES ______ DET. BY John Doe

STAGE 3rd and 4th Instars: pupae

HABITAT DESCRIPTION Shell holes at base of hill in an area under heavy fire, one month previously. Water clear, with no marginal growth.

NOTES Breeding adjacent to artillery position. Immediate control recommended.

Image 3.4: Form: Mosquito Survey - Accession Record, from Harper*, et al.*, “Malaria and Epidemic Control.” p. 88.

While the Entom. II form tracked the “habitat,” and location of mosquitoes, as well as information about the personnel involved in their collection and identification, the “Adult Mosquito Survey” (Entom. III) categorized the type of mosquito collected, the amount of time (“per man hour”) was dedicated to the task of collection, and the conditions of the location.[69]

DECLASSIFIED
Authority NND 745026

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FORM: Entom. III.

ADULT MOSQUITO SURVEY
MALARIA AND EPIDEMIC CONTROL
APO OR FPO ______

STATION Yoke I TIME 1930-2000 DATE 28 June 1944

METHOD Aspirator -Screened quarters COLLECTORS Smith and Brown

TEMPERATURE 26°C WEATHER Clear WIND None LIGHT Lamp

SPECIES	BLOODED	NON-BLOODED	TOTAL	NO/MAN HOUR
Anopheles punctulatus	2	1	3	3
Culex annulirostris	22	43	65	65
Culex sitiens				
Culex pacificus				
Culex quinquefasciatus				
Culex feminous	0	1	1	1
Culex hilli	0	1	1	1
Culex basiciuctus				
Aedes aegypti				
Aedes vexans	0	5	5	5
Aedes funereus				
Aedes fimbripes				
Aedes scutellaris	2	10	12	12
Triperoides caledonica				
Mansonia crassipes				
Aedes spp (undetermined) **	0	15	15	15
Culex spp (undetermined) **	2	15	17	17
TOTALS	28	91	119	119

** Males and damaged specimens.

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-89-

Image 3.5: Form: Adult Mosquito Survey, from Harper, *et al.*, "Malaria and Epidemic Control." p. 89

The locations of these stations were chosen by the entomologist, and at least twice a week each member of the survey team was required to go and catch adult mosquitoes for an

[69] Ibid., pp.88-89

hour at night.[70] These mosquitoes would then be brought to the lab and their species would be identified.[71] The information from both Entomology II and III, that is, the locations and conditions of collection, would also be added to the wall map.[72]

The desire for a precise visual record and representation of "the mosquito situation" made "accurate maps … essential to survey and control work."[73] The strong emphasis on precision initially created problems for malaria control units because the majority of military maps were not made in the most useful scale for control work and didn't provide exact enough information about drainage topography and locations of swamps.[74] As a result of this problem of scale, the entomologists and survey units developed their own practices to create an accurate control map. The first step was to request "an aerial mosaic" through the Photo Wing of the South Pacific Command.[75] For example, in October of 1942, the malariologist on Espiritu Santo noted that he was having "a map with elevations, depressions, native villages, roads, spring, swamps, and streams accurately portrayed" made.[76] To do so, he "sent it in as an official request to the 7th Engineers and it has been approved and areal photographers are about the task. I hope to have it in 2-3 weeks (I hope)."[77]

Once this "mosaic" map was created, the malariologist and entomologist would a

[70] Ibid., p. 90

[71] Ibid.

[72] Ibid., pp.88, 90

[73] Ibid., p. 81

[74] Ibid.

[75] Ibid.

[76] "Report from Malaria Control Unit, Buttons (Lt. R. Mount)." 1942. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Aug 16, 1942- Jan 16, 1942]/ [Folder 5 of 5]. Container # 1 Arc# 5722964. Entry P90-F, RG 313, and NARA MD, p. 2

[77] Ibid.

use it to make working beta map in the proper scale. This properly scaled map would be revised and updated after local conditions could be observed first hand.[78] The maps themselves were made on "blue print paper or printed by engineer topographical or photo groups on sensitized paper," and then reproduced on white paper.[79] Here is an example of a blue map for the Island of Efate in January 1944:

[78] Harper*, et al.*, "Malaria and Epidemic Control." p. 81

[79] Ibid., p. 82 According to Harper et al's report, the practices of malaria control required two differently sized maps: one with scale of 1:30,000 to be used for records and reports; and one with a scale of 1:5000 (1" to 416.6') to be used as a map on the wall of the laboratory. A template map with a scale of 1:30,000 is provided in the report (See Image 3.8). Ibid., pp.85, 91. However, in the boxes of monthly reports in the National Archives, the scales vary by Island and unit. Sometimes the scale is provided on the maps, sometimes not.

Image 3.6: Map of Efate Island, "Map of Efate Island. Drawn by S/SGT. R.T. Young, Dec 9, 1943. Scale 1:125000 (Secret)." *Monthly Report of Activities (Jan. 1944) Efate*, 1944. 1-8 (plus 3 maps). G-3 Office. Folder A9-4(2) Monthly Malaria Reports - Espiritu Santo, New Hebrides; Folder 2 of 4 [Jan 44 - Oct 44]. Container # 5 ARC# 5722964 A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides - A9-4(3) Monthly Malaria Reports - Guadalcanal, British Solomon Islands. Entry P90-F, RG 313, NARA MD.

Image 3.7: Closeup of map of Efate Island, Jan. 1944 Efate map

Wall maps like this gave "a day to day graphic picture of [anopheline] breeding."[80] In order to not have to remake the wall map every month, a celluloid overlay was used.[81] If it was not possible to use this overlay, then colored pins or pins with flags could also be used.[82] As with the map of Efate above, a red grease crayon was used to convey the information from the Anopheline Larvae Survey onto the map.[83] The population of other mosquito species collected were marked with orange.[84] Particular

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[80] Harper, *et al.*, "Malaria and Epidemic Control." p. 85
[81] Ibid.
[82] Ibid.
[83] Ibid.
[84] Ibid.

areas of anopheline breeding could be“lightly outlined in crayon.”[85] Large enough larvae populations and/or areas with persistent mosquito presence were marked on the map with a flag and prompted the deployment of an oiling crew within 24 hours to that area, sometimes accompanied by a survey man.[86] That mark or flag was then removed from the map when the oiling was completed.[87]

For Malaria and Epidemic Control program organizers, “this wall map then present[ed] a graphic picture of actual and potential mosquito breeding conditions.”[88] The wall map was a fluid, active representation and documentation of multiple kinds or modes of knowledge through scale, space, and color. The recent past could be made visible, the present could be attended to, and futures could be imagined and prepared for. The wall map was an example of the ways the bureaucratic and strategic planning structures of the military were incorporated or built into malaria control work. Areas were mapped, designated, and assigned to units; missions were planned and executed based on the intelligence brought back; metrics of success were established and marked on the map. The map was used to direct and designate entomological control efforts and spraying.

The entomologist had to collate and codify different kinds of knowledge from different subgroups within his Malaria Survey Unit. Making, updating, and storing maps was tasked to the survey unit, but the quality and condition of the records and maps were

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[85] Ibid.
[86] Ibid.
[87] Ibid., p. 88
[88] Ibid., p. 85

ultimately the entomologist's responsibility.[89] The accuracy and preservation of the records and maps were necessary to "[provide] a clear and continuous picture of the mosquito situation" for the malariologist.[90] The wall map was central in the translation process from knowledge collected in the field to representing the data of the three entomologist records. The information from those records and the map were translated again at the end of a surveillance interval onto a new map and record, which were then sent to the Island Malariologist. This new map was the "Malaria Control Record Map, Scale 1:30,000" and was to be created after every checking period (weekly or biweekly).[91] Entomologists were offered this template:

[89] Ibid., p. 81
[90] Ibid., p. 80
[91] Ibid., p. 90

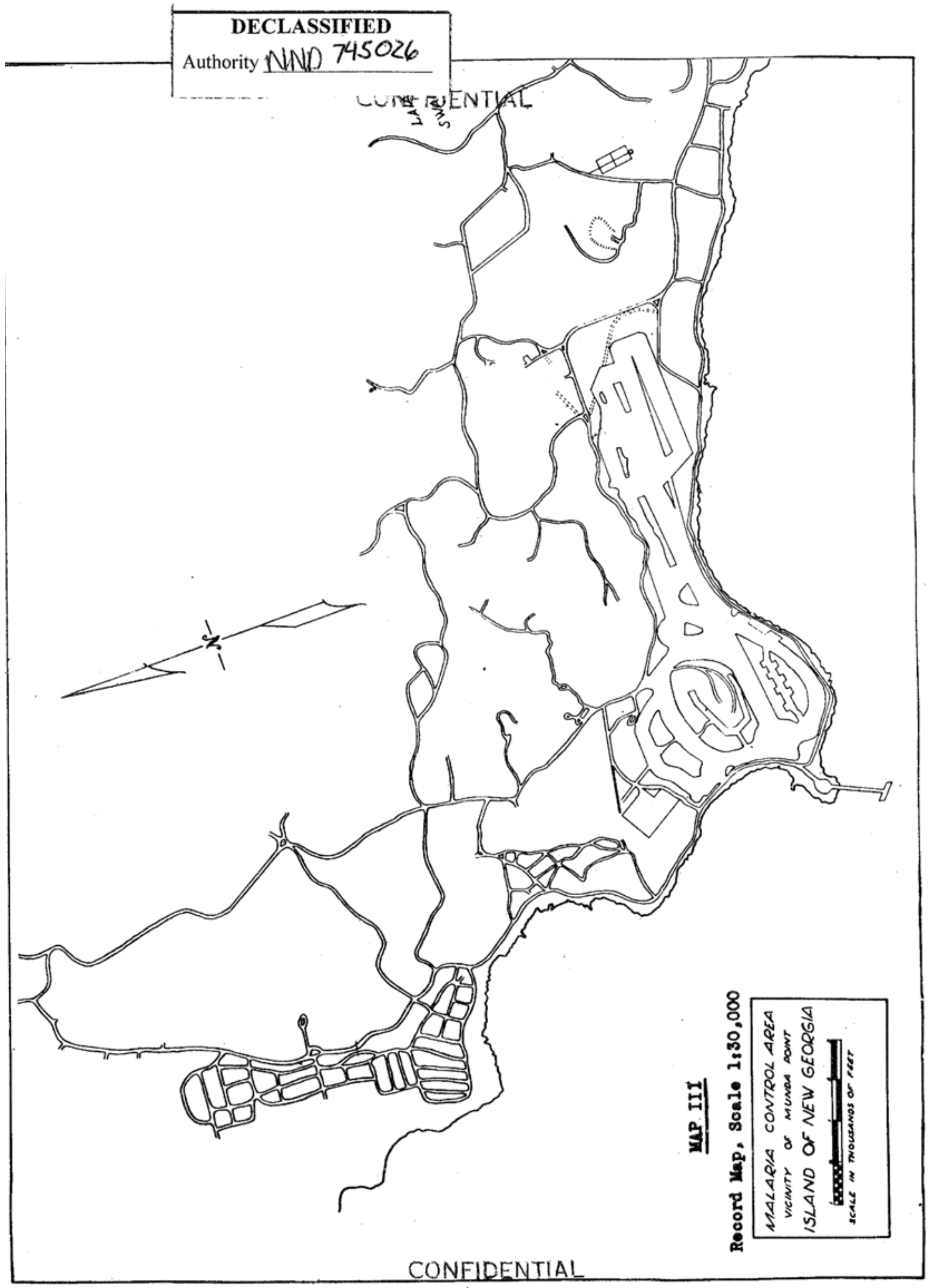

Image 3.8: Map III, Record Map, Scale 1:30,000 from Harper*, et al.*, "Malaria and Epidemic Control." p. 91

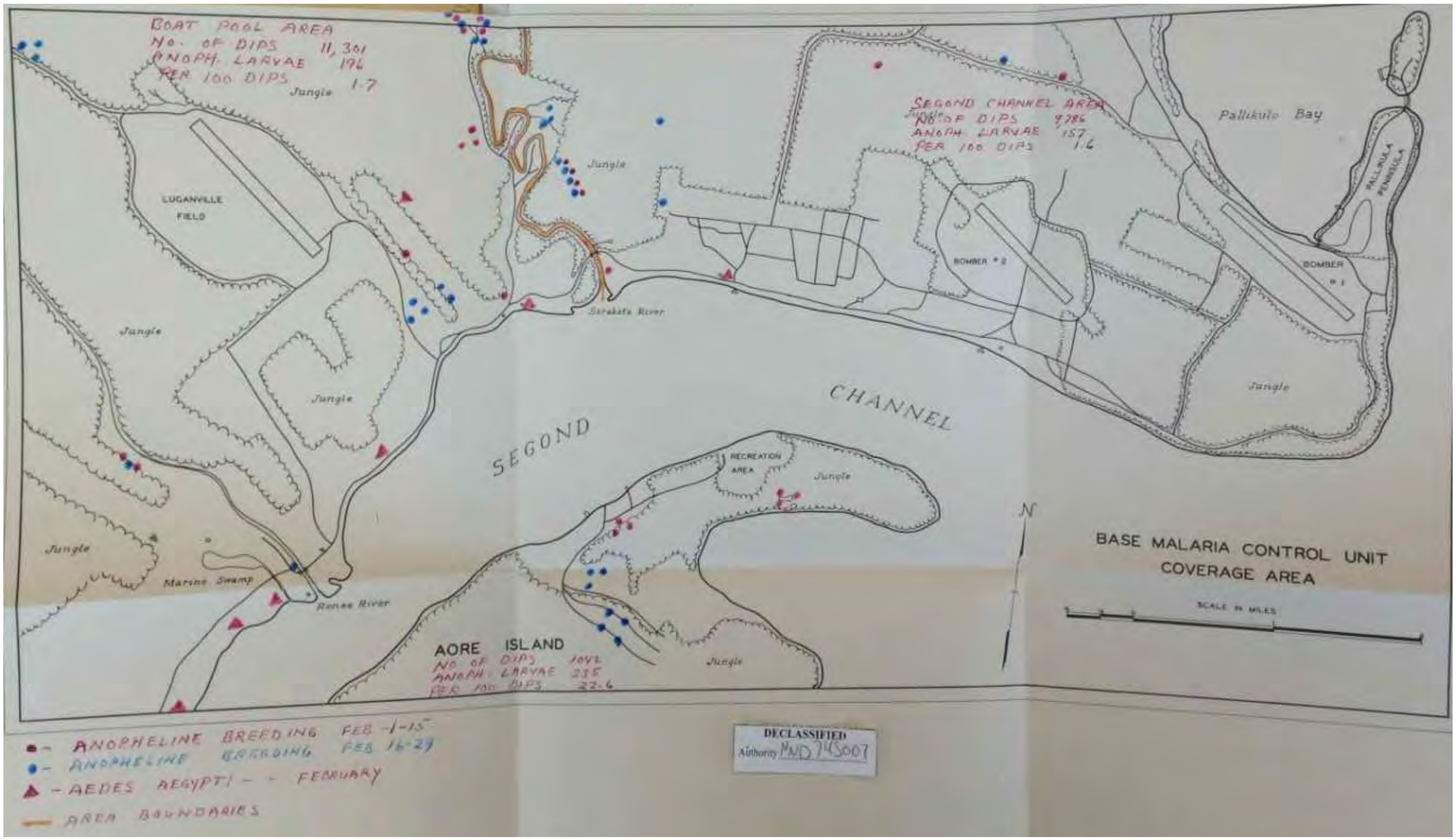

Image 3.9: Map of Coverage Area for Espiritu Santo, included in "Monthly Malaria Report for February 1944, Espiritu Santo." 1944. [Folder A9-4 (1) Monthly Mal Reports - Espiritu Santo, New Hebrides, February 1944 - March 1944, Folder 6 of 11. Container #4 ARC# 5722964. Entry P90-F, RG 313, and NARA MD.

A 1000 yard grid was used in these 1:30,000 scale maps because this dimension "correspond[ed] to local military maps. Such coordinates facilitate[d] location and description of malaria control projects in making recommendations to higher echelons."[92] This scale was judged to be best for the translation and mobility of knowledge. This map from the February 1944 Monthly Report of Base Malaria Control of Espiritu Santo is an example of this scale of map in practice:

[92] Ibid., p. 82

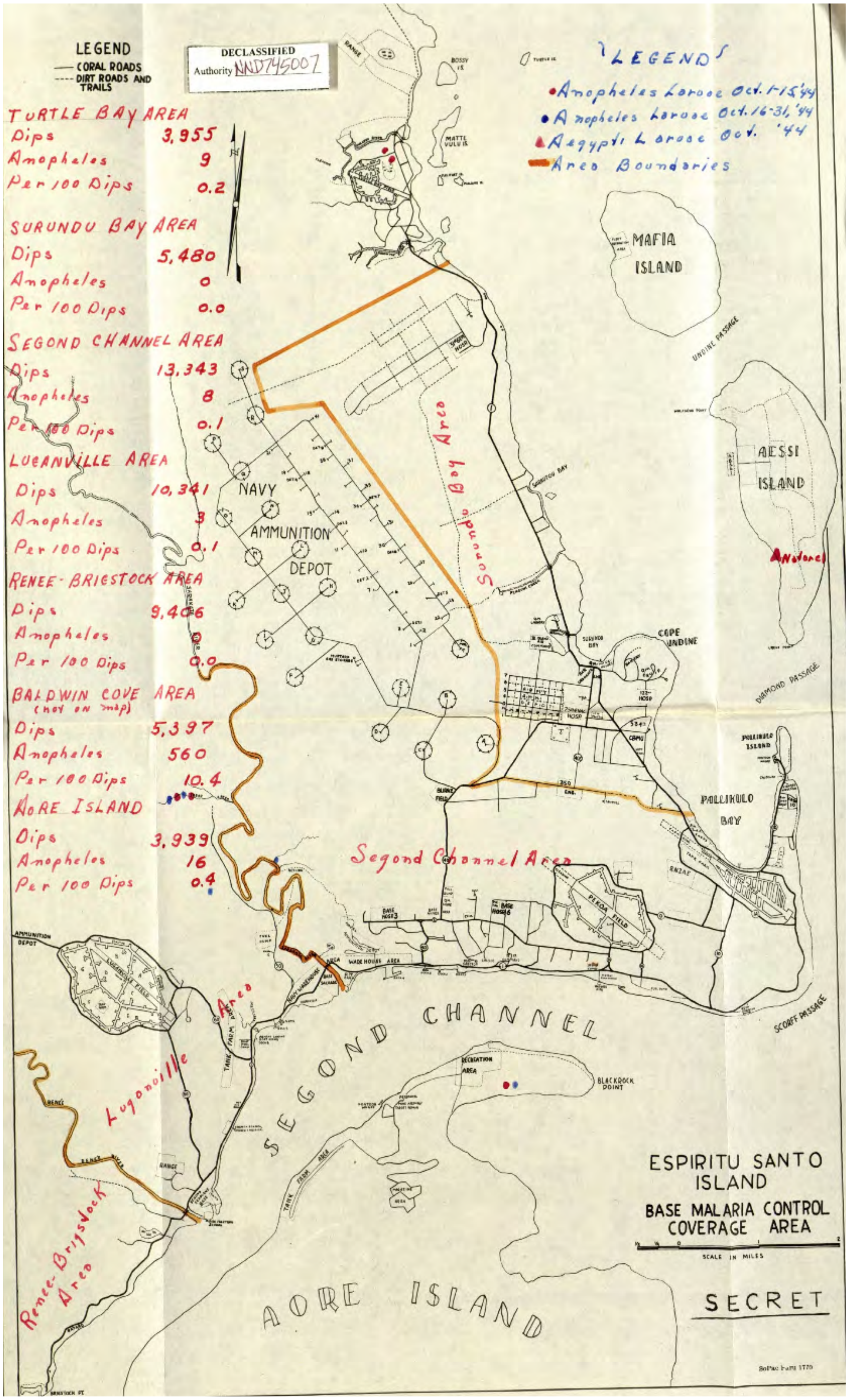

Image 3.10: "Map of Espiritu Santo Island, Base Malaria Control Coverage Area. October, 1944." 1944. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, New Hebrides: Folder 4 of 11 [Oct 1944-Dec 1944]. Container 4 ARC# 5722964. Entry P 90-F: RG 313: NARA MD

The process of making mosquito population control projects understandable or knowable to superior officers through these maps began with transferring "the larvae populations and other pertinent data …. in colored ink from the wall map to the record map,… [making the record map] a summary of the intensity and extent of anopheline breeding," as it is on the map above.[93] The locations of Anopheles breeding sites over the month were broken down into two-week intervals. Some of these spot location-identifiers exceed the boundaries of the map. For the Aedes Aegypti species of mosquito, which spread dengue fever, the tracking period was one month. This maps also delineated the labor of the entomology units through the hand written descriptions of "No. of dips" the process of taking water samples and identifying the presence, type, and number of mosquitoes in that sample.

Some of these map aspects became standard features, such as the hand-written reports of "dips" and two week intervals for Anopheles and monthly ones for Aegypti. Over time, the scales of the maps began to change, but the work of translating malaria control efforts for those in the "higher echelons" remained. In the map below, the control efforts on Espiritu Santo for October 1944 resulted in remarkably fewer dots indicating breeding mosquitoes:

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[93] Ibid., p. 90

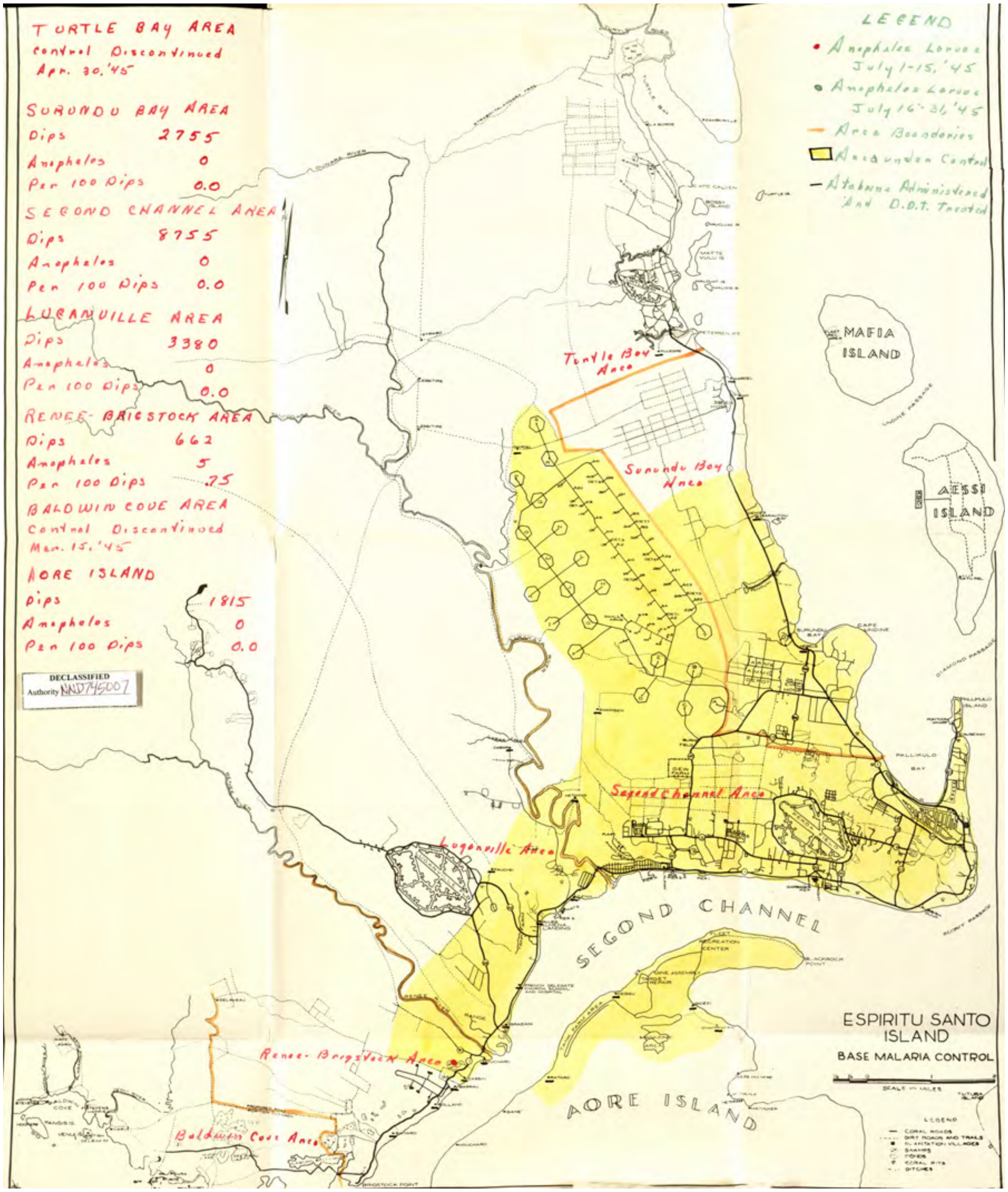

Image 3.11: Map of Espiritu Santo Island Base Malaria Control, July 1945. From: "Monthly Malaria Report Espiritu Santo Island, July 1945." 1945. Folder: A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides [July 1945 - Oct 1945]/[Folder 1 of 11]. Container #4 ARC# 5722964. Entry P 90-F: RG 313: NARA MD.

Areas under control and without anopheline breeding were not indicated on this map; the success of controlling mosquito populations was marked by the absence of dots. By July 1945 areas under control were shaded yellow.

It is interesting to note that in these articulations of malaria from the entomologists, malaria wasn't explicitly present. The malaria parasites were implied to be within mosquitoes and the work of knowing where malaria was became articulating where the vector was; where it bred, laid its eggs, rested (what and where were its habitat). Knowing malaria was knowing mosquitoes and landscapes, and the relationships and interactions between the two. Humans, mosquitoes, and landscapes were the primary actors in this configuration of malaria. The necessity of repeating this work of entomology, surveying and engineering acknowledged the potential for resistance by the landscape and the mosquito.

Work of the Malaria Control Unit - Parasitology

"The parasitologic section of the survey unit furnished information about the incidence of malaria and other parasites in natives, in U.S. troops, and in Japanese prisoners and recorded this knowledge so as to aid both the planning and the evaluation of control work."[94] The Survey Unit's parasitology section was comprised of one Parasitologist who, like the Entomologist and Engineer, was an officer; one Senior Non-Commissioned Officer who ran the laboratory; and one or two parasitology technicians.[95] The "parasitologist [was] trained in laboratory and field procedures for estimating the status of malaria in a population through blood examination, spleen rates, and the interpretation of epidemiological data."[96] While the entomology survey unit focused on

[94] Harper, *et al.*, "New Hebrides." p. 445
[95] Harper, *et al.*, "Malaria and Epidemic Control." p. 95
[96] Hart, "The Army's War Against Malaria," p. 421

mosquitoes through tracking and mapping their populations, the parasitology unit focused on the malaria parasite through incidence in humans measured through analysis of blood samples smeared on slides and physical examinations of patient's spleen.

Similar to the entomologist, the parasitologist had many responsibilities. In addition to those listed above, the parasitologists was in charge of "determin[ing] the incidence, the geographical distribution and the seasonal variation of malaria, and the efficacy of drug and control measures"; setting up and over-sight of "thick film diagnostic service[s]" for hospitals and sickbays; taking part in malaria control training; and keeping ongoing statistics on malaria infections within the military.[97] The tracking of malaria in "indigenous natives and imported native laborers" had to be coordinated directly with Colonial administrative officers.[98]

Thick Blood Smears

The diagnosis of malaria through the lab was and continues to be a challenge. The techniques and equipment have not changed much from those Laveren used in his initial sighting of the malaria parasite in a blood slide in 1880. Diagnostic procedures require a small sample of blood (usually taken from a finger), one slide on which the blood is placed, and another with which that blood is gently smeared and then covered, a staining agent, and a microscope.[99] The delicate stirring and staining processes make identifying the presence of malaria parasites on a blood smear a very difficult skill. Additionally,

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[97] Harper, *et al.*, "Malaria and Epidemic Control." p. 95

[98] Ibid., p. 96

[99] Noppadon Tangpukdee, *et al.*, "Malaria Diagnosis: A Brief Review," *Korean J Parasitol* 47, no. 2 (2009). ; DC Warhurst and JE Williams, "ACP Broadsheet No 148. July 1996. Laboratory Diagnosis of Malaria.," *J Clin Pathol* 49, no. 7 (1996).

because not all blood samples contain the same density of parasites, a low density sample also makes diagnosis more difficult.[100]

Good microscopes and lighting are necessities in addition to the glass slides and staining agent, which created problems during the early months of the Allied's Malaria Control program when most materials were in short supply. From the earliest correspondences about setting up the Malaria and Epidemic Control Program, Sapero noted that "Special attention is directed to the request for <u>binocular</u> microscopes. Malaria diagnosis requires hours of tedious microscope work which cannot be done accurately with monocular equipment."[101] Technicians would become attached to particular microscopes and bring them when transferred to a new base, causing headaches for supply clerks and administration.

By 1945, the technological and personnel infrastructure was established enough that over 90% of reported incidences of malaria were diagnosed through blood tests.[102] This organizational success was not the result of finding a way to ameliorate or negate the difficulty of diagnostic practices; instead to was due to vigilant monitoring of technicians: "there [was] a constant need …. for checking on the quality of diagnostic work of all laboratories engaged in reading thick blood films."[103] This supervision was codified early into Allied malaria control practices by an August, 1943 directive from the Officer-in-Charge of malaria control in the South Pacific instructing all Base Malaria Control Units

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[100] Tangpukdee*, et al.*, "Malaria Diagnosis."

[101] "Memorandum from James Sapero to Force Surgeon, South Pacific Area and South Pacific Forces, 14 October 1942 (Secret)." 1942. Folder A11 (4-1) Force Medical Officer, SPAC [South Pacific] [Jul 22 43-mar 27 45]. Container # 8. Entry P90-F: RG 313: NARA MD, p. 2 Emphasis in original

[102] Harper*, et al.*, "Malaria and Epidemic Control." p. 98

[103] Ibid.

to “systematically check at regular intervals” the techniques for thick film diagnosis in the labs of each base because “experience in the past has repeatedly shown that even the most competent laboratories require checking from time to time.”[104] These checks involved sending slides thought to be positive for malaria by the base lab techs to a central malaria control unit lab for evaluation.[105] A consequence of this oversight was having to “attend a refresher course at a malaria control laboratory for two or more weeks if the quality of diagnostic work is not adequate.”[106] Quality control and standardization were achieved through the circulation of slides and the repeated inculcations of particular practices of reading, especially practices of reading with microscopes.

After diagnosis, the sources of infection were identified and tracked. The incidence rates of the civilian population was tracked using Parasit. I Form for Rapid Malaria and Microfilarial Survey of Natives:[107]

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[104] “Directive from James Sapero to Base Malaria Control Units, South Pacific Area RE Checking of Thick-film Diagnoses. 13 August 1943.” Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943], [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P90-F, RG 313, and NARA MD.

[105] Ibid.

[106] Harper, *et al.*, “Malaria and Epidemic Control.” p. 98

[107] Ibid., p. 96

FORM: Parasit. I.

FORM FOR RAPID MALARIA AND MICROFILARIAL SURVEY OF NATIVES

Name of Village: Name of Labor Corps Officers or Native Chief:

Location of Village: Date and Hour of Survey:

History of Recent Antimalarial Therapy in Village:

NATIVE*				SPLEENS						BLOOD SMEAR										
										Malaria								Filaria		
Slide No.	Name or Number of Native	Age	Island of Origin	Not Felt	PDI	1	2	3	4	Neg.	P. vivax Asex.	P. vivax Sex.	P. falcip. Asex.	P. falcip. Sex.	P.mal. Asex.	P.mal. Sex.	Sp. Undet.	Neg.	Pos.	No/Per Slide.
1.																				
2.																				
3.																				
4.																				
5.																				
6.																				
7.																				
8.																				
9.																				
10.																				
11.																				
12.																				
13.																				
14.																				
15.																				
16.																				
17.																				
18.																				
19.																				
20.																				

* If it is not essential to preserve the identity of individual natives, the second column may be omitted, and interpreters need not be used. The slide is then identified by number only in the first column, which allows laboratory findings to be set down opposite age and island of origin and spleen size.

Image 3.12: Form: Parasit. I. Form for Rapid Malaria and Microfilarial Survey of Natives, from Harper, *et al.*, "Malaria and Epidemic Control."., p. 97

In addition to requiring information about the names and location of villages, this form asked for information about methods of diagnosis and past treatments. An asterisk after the category "Native" linked to text saying "If it is not essential to preserve the identity of individual natives, the second column ['Name or Number of Native'] may be omitted, and interpreters need not be used."[108] The slide would then be "identified by number only in the first column, which allows laboratory findings to be set down opposite age and island of origin and spleen size."[109] This form was a material quantification of people and parasites; names were erased from and/or deemed to be ancillary to the data being gathered, with the other data points (age, geographic location) deemed sufficient to represent the "laboratory findings" for these bodies.[110] The parts of the "Natives" that might reveal the presence of parasites (the size of their spleen and their blood) and characteristics that could be conveyed by Colonial administrators such as "Age" and "Island of Origin," were more important than names or other information that might be gathered from other interactions which might require a translator.[111]

Each blood smear tested at the parasitology lab required the form Parasit. II.

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[108] Ibid.

[109] Ibid.

[110] Ibid.

[111] Ibid.

CONFIDENTIAL

FORM: Parasit.II LABORATORY RECORD
X Malaria Survey Unit Date: ______________

NAME........................Disp.or Hosp............Ward.......
(Last) (First) (Initial)

Regt........................ Bn.....................Co..........
Number of Previous Attacks of Malaria..........................
Laboratory Diagnosis: P. vivax........P. falciparum............
(Check One) Mixed Species
Infection.........Undetermined.............
Additional Data: ....
....
....
....

(Signature)

Image 3.13: Form: Parasit. II Laboratory Record. From Harper, et al., "Malaria and Epidemic Control." p. 98

This form needed to be submitted in duplicate, with the lab keeping one copy on file and other "returned to the patient's medical officer."[112] Despite shortages of personnel and equipment, results were to be expected within twenty-four hours and if high numbers of parasites were present in the slide then a "emergency notification" would be made to the area parasitologist and malariologist.[113]

The parasitologist used the data recorded on Parasit. II. to track the humans infected with at their base.[114] These incidence rates were then incorporated into tables for the island malariologist in form Parasit. III.

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[112] Ibid., p. 96

[113] Ibid.

[114] Ibid., p. 98

CONFIDENTIAL

EXHIBIT VII.

Tables used in presenting statistical data in the monthly report of the island malariologist:

TABLE A
MALARIA - ALL FORCES - ISLAND
Rates per 1000 per Annum

	June 1943	May 1944	June 1944
Primary Admissions			
Relapses			
Total Admissions			

TABLE B
ARMY MALARIA INCIDENCE
Rates per 1000 per Annum

	June 1943	May 1944	June 1944
Primary Admissions			
Relapses			
Total Admissions			

TABLE C
NAVY MALARIA INCIDENCE
Rates per 1000 per Annum

	June 1943	May 1944	June 1944
Primary Admissions			
Relapses			
Total Admissions			

TABLE D
MARINE MALARIA INCIDENCE
Rates per 1000 per Annum

	June 1943	May 1944	June 1944
Primary Admissions			
Relapses			
Total Admissions			

Image 3.14: Exhibit VII: Tables used in presenting statistical data in the monthly report of the island malariologist. From Harper, et al., "Malaria and Epidemic Control." p.102

The parasitology unit didn’t create maps that represented their work, but similar to the entomologists, parasitologists used specialized practices and a multitude of forms and reports to quantify the presence of the malaria parasite and effectiveness of control measures. These forms created uniform methods of reporting malaria incidence and tracking the parasite, its human host, and treatment efficacy. The parasitologist then translated this specialized knowledge into recognizable and usable data for the island malariologist.

For the parasitology unit, malaria was articulated through microscopes and physical examinations of human bodies; through practices of counting the presence and severity of the parasite on slides, the recording, ordering, and use of that data into information about malaria incidence for the parasitology lab, and then translating that information for the Island Malariologist and beyond. Numbers were the primary output of parasitology, in and out of the lab, with malaria rates used as the evaluating metric. Knowing the malaria incidence rates at a base was of primary importance for evaluating whether control efforts (whether chemotherapeutic, chemoprophylactic, or through landscape modifications) were working, and so having accurate data about parasites and humans was imperative. In order to achieve accuracy, the parasitology unit incorporated surveillance into all levels of their work and practices: they monitored the blood and spleens of humans for the presence of parasites, and they address the complexities of reading blood smears through standardized reporting practices and the continual monitoring of lab technicians’s work

Work of the Malaria Control Unit — Engineers

By far the largest unit within the base malaria control organization, the engineers in Malaria Control Units worked with the entomology unit's maps, information, and territory divisions to carry out control measures.[115] Their work was extensive and continuous: "No building, logging, road making, ditching or other project is considered complete until all mosquito breeding hazards incurred by the operation are eliminated. The organization carrying on the project will maintain a complete oiling program in the area until the hazards occasioned by the project have been permanently removed."[116] The engineering units applied larvicide as the first intervention, but were also tasked with controlling malaria through small and large-scale landscape modification using heavy and light equipment.[117]

The use of heavy engineering equipment such as dragline cranes and bulldozers in control work was credited with being "one of the most important factors in reducing malaria rates."[118] But prior to heavy equipment reaching the Pacific theater, "early mosquito fighters . . . slushed through the jungle mud on Guadalcanal and New Guinea to wage the war on malaria . . . This was accomplished through diligent search for mosquito-breeding areas, extensive drainage, and thorough oil larviciding."[119] These interventions were designated as "semi-permanent and permanent control work" and involved the filling in of "man-made breeding places" and a variety of drainage

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[115] The names Malaria Control Unit or Malaria Control Groups are imprecisely used to describe entire Island malaria control units as well as the sub-units of the engineers.

[116] "Malaria Control Regs AG 710."

[117] Harper*, et al.*, "Malaria and Epidemic Control." p. 107

[118] Ibid., p. 44

[119] Cushing, *History of Entomology*., p. 55

projects.[120]

The engineering unit consisted of one head Engineer or Officer in Charge; a Senior Non-Commissioned Officer (NCO) who assisted the Engineer and did broad oversight as a foreman; five other NCOs, each tasked with either general clerk duties, organizing vehicle repairs and use, repairing the spraying equipment, working with the chemical spraying squads, or the heavy equipment units; and an additional two NCOs to "supervise" the crews of "Native workers"; three Privates First Class to drive trucks; and 100 to 250 enlisted men.[121] The engineer was accountable for "Preparation of detailed plans for mosquito control measures based on the work of the survey unit"; carrying out and monitoring those measures; overseeing and keeping track of personnel and equipment as well as anticipating possible changes in mosquito populations that upcoming seasons might cause; and the "maintenance of suitable records so that a continuous and clear picture of control activities is readily available."[122] Similar to the head entomologist, the head engineer was responsible for planning malaria control campaigns to fit local conditions, implementing them and then measuring and tracking their efficacy.

The initial work of oiling required making routes through swampy terrain and creating banks on streams. Creating these banks was complicated work: "It is important to preserve as much shade as possible and trees are not to be removed. A clean bank and a three or four foot cleared margin so that the oiling crew can walk along the stream is

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[120] Harper, *et al.*, "Malaria and Epidemic Control." p. 126
[121] Ibid., pp.105-06
[122] Ibid., p. 106

sufficient."[123] Removing trees would create larger areas of sunlight which was viewed as a catalyst for increasing mosquito populations, so it was important to clear the area but leave the trees. The landscapes were not static, making it necessary to repeat this clearing work every sixty to 120 days.[124] MECO officers noted, "Natives, working with machetes, [were] superior to any other labor for this work."[125]

Engineers tried to keep a weekly schedule for their workers, with one day off "for recreation," although this was not possible to sustain during rainy seasons.[126] Units of five to fifteen men would "larvicide completely" a territory in four to five days.[127]100-150 "oilers" were "put in the field each day," which caused some supply and transportation problems (as discussed in the previous chapter). To minimize transportation and make oiling easier, the engineer and foreman picked locations for oil depots, which were "wooden racks built of native trees and large enough to hold one to three oil drums (55 gal.)."[128] These depots were located along pre-existing oiling routes and reachable by truck.[129]

After clearing paths to access areas with standing water, workers in the engineering unit would spray the area with larvicide. Initially diesel oil was used for this purpose: 1,325 drums with 55 gallons of oil were used in the Pacific Islands during October and November of 1943 (which was the dry season), while 3,275 drums were

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[123] Ibid., p. 109

[124] Ibid.

[125] Ibid. See Footnote 3.

[126] Ibid., p. 108

[127] Ibid.

[128] Ibid., p. 109

[129] Although how much transportation costs and labor time was saved is unclear: "When a sufficient number of racks are built a truck and crew are kept busy replenishing them with full oil drums." Ibid..

used in January and February of 1944 (the wet season).[130] The chemical Paris Green was used briefly in areas that had not been cleared, but was stopped because it was difficult to mix, dispense, and store.[131]

In early 1944, the chemical Dichlorodiphenyltrichloroethane (DDT), later termed "the atomic bomb of insecticides," was first sprayed in the Allies' Pacific Islands war effort.[132] "The discovery and application of the various insecticidal actions of DDT against the vectors of disease," has been credited as "the principal advance in insect control during the war."[133] DDT quickly replaced all other chemical control measures as it "result[ed] in an economy of labor and of diesel oil."[134] Where 1,500 gallons of diesel oil might be used in an area, 150 gallons of DDT would be needed.[135] DDT could be dispensed with knapsack sprayers or "Flit Gun" style hand sprayers whose nozzle created a fine mist.[136] This disparity between the amounts of DDT and diesel oil needed for larvicide work caused unexpected problems initially: larvicide crews would spray too much DDT because it didn't produce a visible film when sprayed over an area. MECO officers cautioned that "Constant precaution against overdosage is necessary [because]

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130 Ibid., p. 110

131 Ibid.

132 Quoted in Thomas Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton University Press, 1983). , p. 17. For more on the military's development of DDT see Thomas A. Hart. "The Army's War Against Malaria."; C.W. Hays. "US Army and Malaria Control in World War II." *Parassitologia* 42, (2000): 47–52; Russell, Edmund. *War and Nature: Fighting Humans and Insects With Chemicals From World War I to Silent Spring* (Studies in Environment and History). Cambridge University Press, 2001.; Edmund P. Russell. ""Speaking of Annihilation": Mobilizing for War Against Human and Insect Enemies, 1914-1945." *The Journal of American History* 82(4), (1996): 1505; Webb, James. *Humanity's Burden: A Global History of Malaria* (Studies in Environment and History). Cambridge University Press, 2008; also: NARA records of the National Resource Council 1942-1945, in College Park, Maryland; NARA records of the CDC and Malaria Control and War Areas, in Atlanta, Georgia

133 McCoy, "War Department Provisions," p. 42

134 Quoted in Harper*, et al.*, "Malaria and Epidemic Control." p. 112 See also p. 109, 111.

135 Ibid.

136 Ibid., pp.112, 115

oiling crews want to see the results of their labor in the form of a visible film of oil."[137] To help calibrate DDT use and to evaluate the proper "coverage" of an area, the entomology survey crew would measure larvae prior to application and then again a day later and coordinate with the oiling units.[138]

In addition to knapsack and hand sprayers, DDT could also be dispersed by airplanes. This method necessitated altering machinery and equipment, modifying spraying practices, and pilots learning new, somewhat dangerous methods of flying. The use of airplanes for dispersing DDT required attaching sprayers to planes and "adequate coverage depends upon precision pilotage, which requires practice and enthusiasm."[139] In a 25 September 1944 letter to Commanding General, of the South Pacific Base Command (SOPACBACOM), Major General Fred Wallace stated

> Precision pilotage is essential to this work. It requires six (6) weeks to thoroughly train a pilot in such technique. The necessity for having the above equipment [two L4B Piper Cub airplanes, two Spray units designed to apply DDT solution from such planes] and pilot present in this area for training, elimination of technical problems, and the earl establishment of control cannot be over-emphasized.[140]

One difficulty was the low altitude needed for effective dispersal (25 to 35 feet above grasslands and 120 to 150 feet above areas with tree cover).[141] This was done in 40 foot intervals, and required additional personnel on the ground to assist in designating the 40

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[137] Ibid., pp.113, 115

[138] Ibid., p. 115

[139] Ibid., p. 116

[140] "Memorandum from Fred Wallace to Commanding General, SOPACBACOM RE: Procurement of plane and pilot for Malaria Control, 25 September 1944. (Confidential)." 1944. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Aug 30, 1944-Dec 31, 1944]/ [Folder 2 of 5]. Container # 1 Arc# 5722964. Entry P90-F: RG 313: NARA MD.

[141] Ibid., pp.116, 117

foot coverage area.[142]

Another challenges for pilots dispersing DDT was often the plane itself: A pilot involved in designing the spray equipment included recommendations that other pilots add “a simple locking mechanism” for a flap lever “to prevent vibrations from moving the lever to the ‘up’ position which would put the pilot in a critical situation during low altitude spray runs.”[143] To avoid this and other potential “critical situations,” this pilot also suggested the following practices for DDT pilots: “thoroughly familiarize [your]selves with [your] plane, require strict inspection of the engine and hydraulic systems, and follow up inspection with [your] crew. With confidence in the plane plus careful practice on simulating runs at the recommended settings the strain from this type of flying will be eased considerably.”[144]

While DDT significantly changed malaria control practices and effectively reduced populations of mosquito larvae after its introduction in 1944, the bulk of early malaria control measures and successes came from the engineering units’ environmental interventions. These interventions were not without their challenges: before the needed equipment arrived in the Pacific theater, engineering crews had to develop “improvised methods” to “accomplish necessary drainage jobs”[145] In some areas, ”Bangalore torpedoes were used to blast ditches through mucky swamps [and] coastal landlocked lagoons were opened to the action of tides and salt water by installing flumes made of oil

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[142] Ibid.
[143] Ibid., p. 119
[144] Ibid.
[145] Cushing, *History of Entomology*., p. 55

drums welded end to end."[146] Even after the arrival of equipment, many engineering efforts had to be adapted to fit local conditions and circumstances: some ditches were made using dynamite or Bangalore torpedoes where the ground was too water-logged for equipment to navigate; ditch-digging machines had "only limited value" and were rarely used because they didn't function well when coral was present and the ditches they created were the wrong dimensions; and some smaller 'feeding' ditches had to be created by hand near bivouac sites by soldiers.[147]

Engineering units also had to fill in "man-made" features including "foxholes, borrow pits [areas where dirt was removed to create roads], bomb craters, and road ruts."[148] Each of these required different techniques and equipment to remedy including bulldozers, tractors with an attached harrow, and "Native laborers."[149] The initial creation of roads without grading to prevent standing water was "one of the chief causes of man-made malaria in the early days."[150] The materials for building roads were taken "from borrow pits dug perpendicularly to highways, [and] roads were built across natural drainage courses without any provision to care for water thus impounded."[151] To remedy this problem of having created "thousands of acres of breeding area," hundreds of miles

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[146] Ibid.

[147] Harper, *et al.*, "Malaria and Epidemic Control." pp.127-29. Some MECO officers lamented the underuse of hand ditching: "Survey and oiling crews are urged to be alert to the possibility of hand drainage since a very small ditch often releases a surprising amount of water and saves much larvicidal work." Hand ditching was also sometimes delegated to "Native labor" who were reluctant to use shovels with their bare feet and so couldn't be used in larger drainage projects. Ibid., pp.127-28

[148] Ibid., p. 134. Road ruts were divots caused by tires and were a particular focus of malaria control efforts because they were a common and hospitable areas for mosquitoes to breed. Information campaigns involving posters, windshield stickers, and public lectures were focused on road ruts (as well as other types of 'man-made' malaria) and will be a focus of my next chapter.

[149] Ibid., pp.126-27

[150] Ibid., p. 130

[151] Ibid.

of ditches were needed.[152]

Drainage ditches were made also with dragline cranes, which created ditches of the desired width (3/8 to 3/4 yard). These cranes were considered "the most valuable piece of ditching equipment for malaria control" because they were versatile and effective at "draining swamps, cutting oxbows into streams, putting in deep roadside ditches and channeling streams."[153] By placing ground coverings underneath them, these machines could be used during the wet seasons, greatly extending their usability.[154]

The versatility of engineering units and their methods was important for the successful alteration to the large areas of the Pacific Islands done in service of malaria control. Using an array of equipment, labor, and techniques many sources of standing water were eliminated or modified. The different topographies and geologies of the Islands forced engineers to adapt their draining methods to local conditions. For example, the many sink holes on Russell Island required complicated vertical drainage where a large hole was dug near the sink hole and a channel was made to connect them. Bomb craters provided effective drainage with little modification on on Munda, Ondonga, and Bougainville. The sixty plus lagoons near bases and their proximity to beaches on Guadalcanal fostered the breeding of mosquitoes. To address these conditions, engineers used multiple flumes to decrease the amount of water, its salinity, as well as to make it easier to oil those areas.[155] These flumes were complicated engineering and required

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[152] Ibid.

[153] Ibid., p. 128

[154] Ibid.

[155] Flumes are channels built to move water. On Guadalcanal, they connected lagoons and the ocean and helped keep the lagoons drained despite tidal changes. A plan for a flume is attached at the end of the chapter. Ibid., pp.129-32

significant and frequent maintenance.[156] On Green Island, a nine foot rod was drilled through the soil to the coral underneath. Then "a single strong blow often [sank] the rod to a depth of 6 feet or more, and as much as 20 gallons of water [would] drain away in a few minutes."[157] This technique would be repeated and the multiple cracks were sufficient to evacuate hundreds of gallons of water.[158] After the water drained, the cracks would be covered over and future traffic would be prohibited.[159] These modifications to the landscape were not minor ones, even for small pools of standing water.

To track and coordinate construction projects, the head engineer used maps. Usually drawn by engineers, these maps showed the engineering projects in an area and delineated ongoing and completed construction. For example, this map 1944 map of the Vila section of Efate Island, various malaria control projects are represented:

[156] Ibid., p. 134
[157] Ibid., p. 130
[158] Ibid.
[159] Ibid.

Image 3.15: Map of Efate Island Malaria Control, Engineering projects. "Map of Malaria Control Efate Island, Villa Section. Drawn by L. F. Korth 1st C.B. (Secret)." Monthly Report of Activities (Jan. 1944) Efate, 1944. 1-8 (plus 3 maps). Folder A9-4(2) Monthly Malaria Reports - Espiritu Santo, New Hebrides; Folder 2 of 4 [Jan 44 - Oct 44]. Container # 5 A9-4(1) ARC# 5722964 Monthly Malaria Reports - Espiritu Santo, New Hebrides THRU/ A9-4(3) Monthly Malaria Reports - Guadalcanal, British Solomon Islands. Entry P90-F, RG 313, and NARA MD.

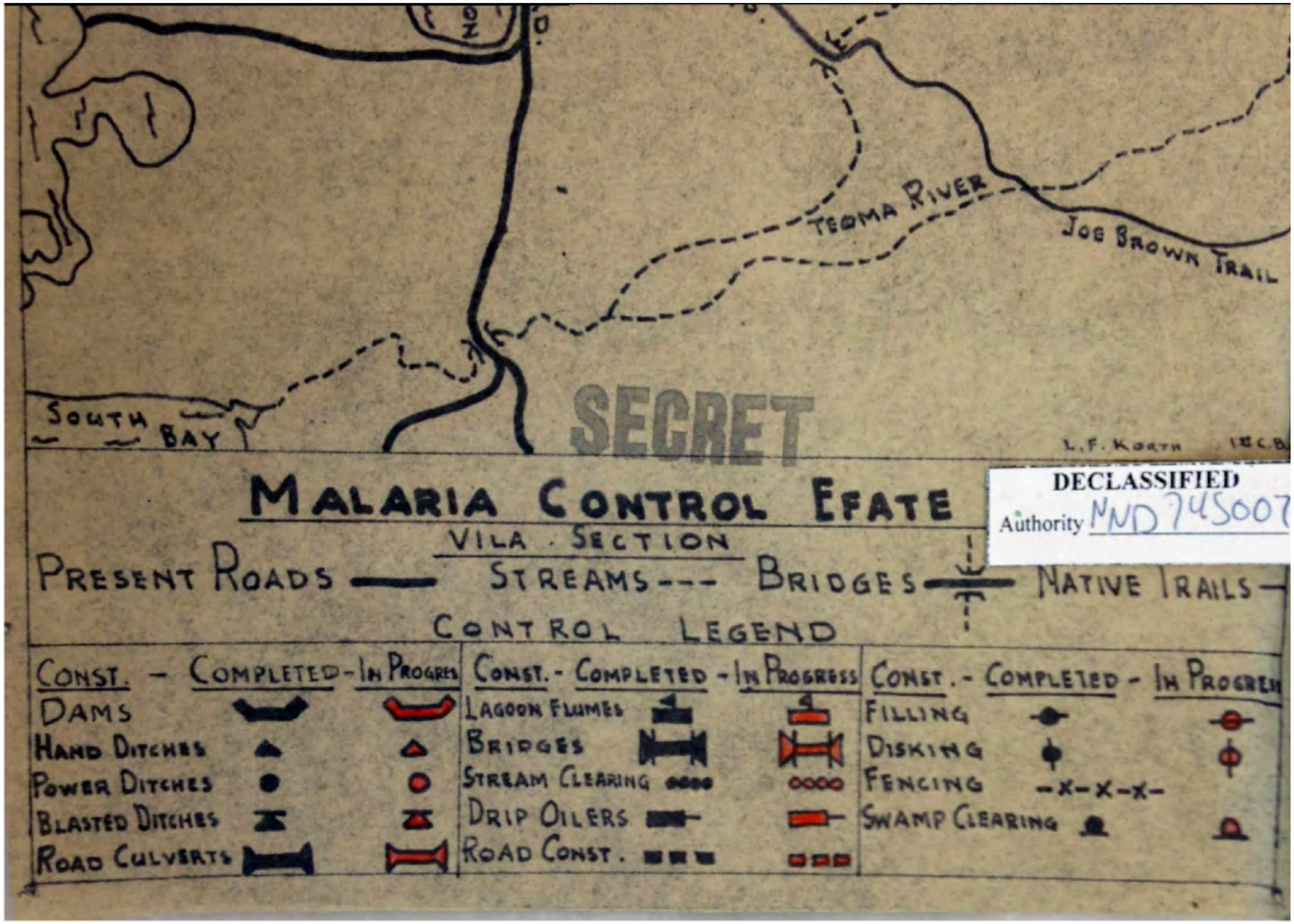

Image 3.16: Legend of Map of Efate Island Malaria Control, Engineering projects. Jan. 1944
Efate map Villa Section.

These maps translated the work of the engineering units into legible information about what work was being done, where, and how it was progressing. Malaria is articulated through the engineering projects to alter local landscapes undertaken to control it. The head engineer included these maps in their reports to the head malariologist who then included it in his monthly report about base malaria control activities.

Monthly Malaria Reports: Surveys, Reports, and Maps

Surveyors, parasitologists, engineers, and entomologists each had different field methods and data collection practices but the Island Malariologist needed a way to collate and evaluate their work.[160] Creating and having standard and uniform paperwork was determined to be a solution: "Uniform records, are essential to allow comparison and correlation of the work of different groups."[161] However, this uniformity was not created immediately and each survey and report had different versions that changed what was included, what was deemed to be unwanted information, and how to best convey knowledge and information to readers with different levels of knowledge or expertise. In building these better forms and records, the style or practice of particular malariologists, entomologists, surveyors, and parasitologists would be disseminated and incorporated as or into the standard. For example, in a January 1944 in a letter the Area Entomologist praised Espiritu Santo's Island Entomologist for his survey design, reports, and for having "one of the best survey programs."[162] The praised survey program would serve as

[160] Harper*, et al.*, "Malaria and Epidemic Control." p. 54
[161] Ibid.
[162] "Letter to Belkin from Perry."

a template which the Area Entomologist planned to “pass on to” other survey teams.[163]

The uniformity of records enabled the translation and transferability of information across the various methods for malaria control, especially as the scope and personnel of malaria control organization increased. In an August 1943 memo, Paul Harper recommended the switch from weekly to monthly reports on malaria control efforts. He also delineated what should be included:

> The growth of this organization makes essential a certain amount of uniformity in reports from all bases and plans to this end are being developed. Meanwhile, it is requested that your monthly report include a brief summary of: a. The Entomological situation. b. Engineering projects: (1) Completed. (2) Contemplated. (3) Which are desirable but not immediately contemplated because of lack of equipment or man-power. c. Suppressive therapy situation. d. Natives - segregation of. Only with this information can this office foresee the needs of your area and of other areas - and make the necessary representations to the proper authorities.[164]

Uniformity of reports made it possible to move personnel, supplies and materials as well as send coherent and actionable information up command channels.[165] Thus, malaria control and knowledge about malaria were created and articulated through the scaffolding and circulation of many reports by each section and sub-section of malaria control.

It was in and through the everyday practices of the malariologist, the engineer, the surveyor, and the entomologist that malaria was enacted and articulated in the Pacific theater: Through filling out and filing reports; through the making of surveys and maps; through the annotating and overlaying information on the wall map and then erasing it;

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[163] Ibid.

[164] “Memorandum from Paul Harper to Lt. Col. L.L. Parks.” 1943. Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Mar 1, 1943 -Oct 2, 1943]/[Folder 6 of 7]. Container 2. Entry P90-F, RG 313, and NARA MD, p. 1

[165] Harper*, et al.*, “Malaria and Epidemic Control.” pp.54, 58

through changing locations of water and dirt. They made knowledge about the space and spaces of malaria first for themselves through their (embodied) practices and then made it knowable to others through paperwork. Reports and maps were the templates and scaffolding for how to understand malaria, for knowing what malaria was.

The reports and files were able to articulate a legible malaria and malaria control strategy to the larger military community because of the coordination and translation work of the island malariologist. His monthly malaria report for his superiors was based on data in the weekly reports he received from the head entomologist, parasitologist, and the engineer. Each of their reports was based on the weekly reports they had received from their units. Each unit articulated a malaria to themselves but in the reports to the island malariologist, unit heads needed to translate their methods in the field and lab into legible reports that could travel to the malariologist. The malariologist then coordinated and translated that knowledge up the chain of command to different audiences with differing expertise. These reports enabled him to bring together and coordinate the expertise of these specialists to address the complex, multi-species phenomenon of malaria.[166] The success of the malaria control units was due to the malariologist's ability to attend to the whole phenomenon of malaria's local, multi-species ontology on multiple scales, through the local practices of each unit, and the stabilizing work of reports.

Conclusion

The arc of this and the previous chapter have been about how Allies in the Pacific theater articulated malaria as a technical, local, and multi-species problem, and the

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[166] Ackerknecht, *Malaria in the Upper Mississippi Valley*., p. 130 See epigraph that begins the chapter.

institutions and organizational infrastructures that were established to address this problem, and the practices implemented to control the problem. Military malaria control emphasized and valued local knowledge. This local knowledge was not the knowledge or experiences of the local people, but instead the knowledge about the local geography and its specifics.[167] Local meant of a place, not local to a people — knowledge about local variation was what was valued.

However, concurrent with valuing the local and particular, military malaria control strategies also involved and valued sharing knowledge. The sharing of knowledge within survey units, entomology groups, parasitology labs, and camps and island control organizations as well as across the Pacific was encouraged and built into structures of military malaria control. This distribution and circulation of praxis, methods, and results was also about creating and standardizing better, more useful practices and strategies for a more effective campaign. The knowledge created about malaria by the entomology and parasitology units in and through surveys, mosquito dips, spleen counts, and blood smears was utilized and acted upon by the engineering unit who leveled roads, drained swamps, redirected rivers, created ditches using tools that ranged from the hands of enlisted men and "Native laborers" to repurposed torpedoes and flumes.

These structures and practices of malaria control were created to lower malaria

[167] In a January 1943 letter accompanying a report about malaria control efforts on Espiritu Santo, Robert Mount mentioned that "field trips" were taken for "ascertaining methods fo [sic] control most applicable, and to find out the histories of organizations in relation to malaria, past and present. . . .Questioning of English and French residents disclosed the fact that many areas free from anopheles breeding at the time, after the onset of the rainy season, held water and became very bad anopheline breeding areas." There is no mention of questioning non-European residents for their history of malaria (and malaria control efforts) in the area. "Letter from Robert Mount RE: Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942. January 17, 1943 (Secret)." 1943. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: RG 313: NARA MD, p. 1

transmission rates among combat troops. James Sapero and other architects of MECO worked to isolate malaria control work from other military responsibilities.[168] They wanted to establish a separate malaria control organization so that the work of malaria control wouldn't be added onto the responsibilities of medical or combat personnel, which they believed would lead to malaria control efforts being de-prioritized. Malaria control thus generally became the primary responsibility of those personnel assigned to it, perhaps with the exception of some of the engineering units who also had general engineering assignments. Mosquitoes and landscapes were the primary focus of much malaria control work, but efforts to decrease mosquito habitat and monitor mosquito populations would be futile unless *all* personnel in the Pacific theater understood the threats that malaria and mosquito transmission posed to them personally and to the war generally and changed some of their behaviors to lower their interactions with mosquitoes. The strategies MECO developed to educate soldiers about malaria, malaria transmission, and the need to practice malaria discipline (lowering contact between mosquitoes and soldiers) are the focus of the next chapter.

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[168] McCoy, "War Department Provisions," p. 14; Russell, Paul F. "Introduction." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm. p. 6; Harper*, et al.*, "New Hebrides," p. 399

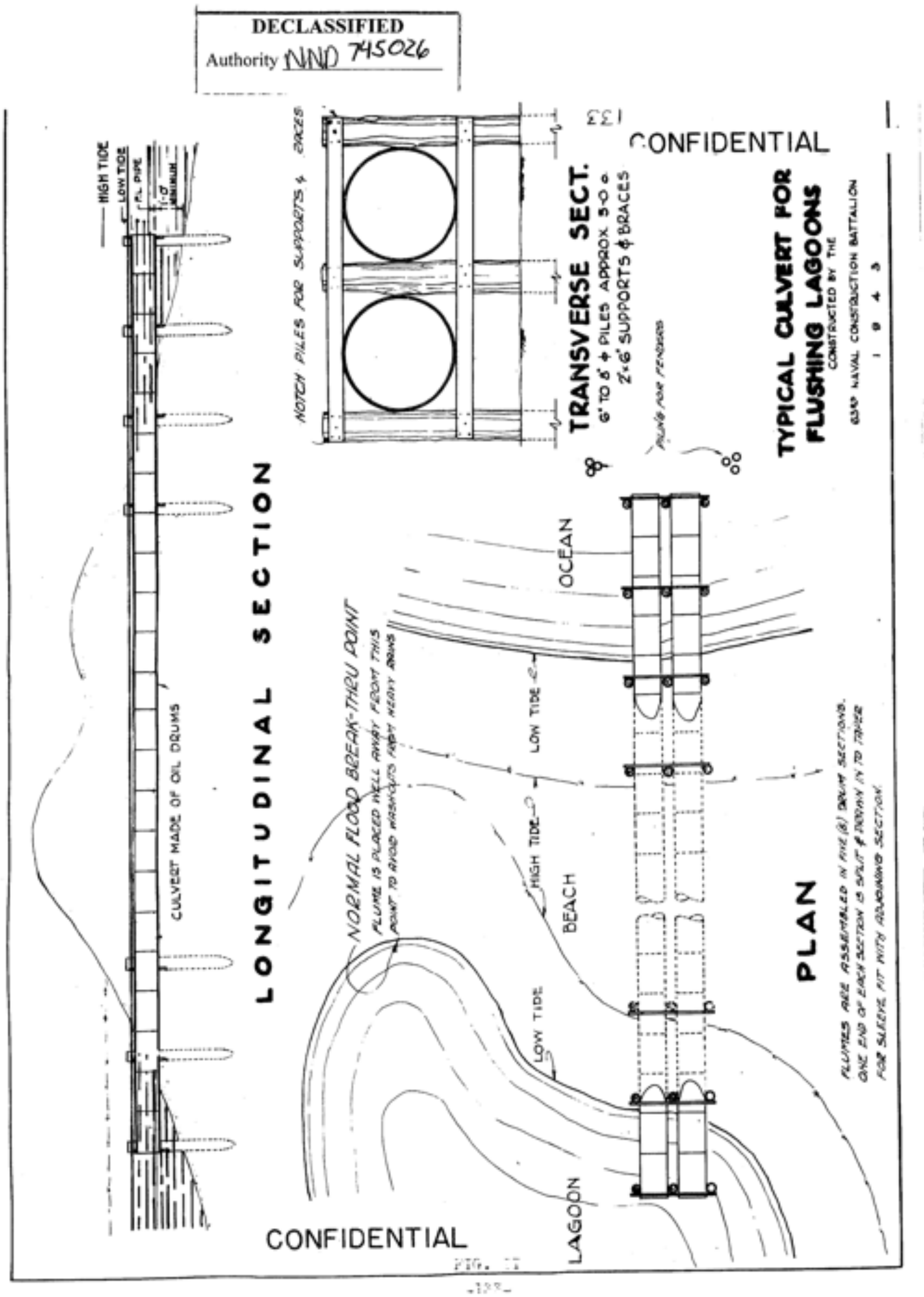

Image 3.17: Plan for Flumes from Harper*, et al.*, "Malaria and Epidemic Control." p 123

Chapter 4: The Visual Culture Campaigns for Malaria Discipline

> "Sanitation is a form of war. It requires not only money and effort, but also thought, organisation and discipline." Ronald Ross, 1910[1]

> "Health is one of several modern concepts that seek to order and make intelligible the relationship between the self and society through the tutoring of conduct and the reformation of space." Nayan Shah, 2001[2]

In his Introduction to the Army's history of malaria in WWII, Paul Russell noted there were three primary reasons for malaria being "thoroughly defeated" by the Allies: the institutionalization of specialized units for malaria control; securing supplies for these units; and "the enforcement of malaria discipline."[3] Malaria discipline encompassed behaviors to limit a soldier's contact with mosquitoes such as: not being in areas while mosquitoes were active such as swimming holes and "Native villages" at or after sundown; wearing long pants and long sleeved shirts regardless of weather; properly using bed nets and mosquito repellent; and taking suppressive atabrine as directed.[4] In this chapter, I analyze how the Malaria and Epidemic Disease Control Organization (MECO) was able to achieve widespread malaria discipline among enlisted men, despite their initial resistance, through propaganda campaigns that changed

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[1] Ronald Ross, *The Prevention of Malaria* (Nabu Press, 2010 (1910)). , p. 314

[2] Nayan Shah, *Contagious Divides: Epidemics and Race in San Francisco's Chinatown (American Crossroads)* (Berkeley: University of California Press, 2001). , p. 16

[3] Paul F. Russell. "Introduction." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm, pp. 5-6

[4] "History of the Activities of Base Malaria and Epidemic Control on 'Espiritu Santo,' June 1942 - July 1945 (Secret)." 1945. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, New Hebrides, Folder 1 of 11 [July 1945 - Oct 1945]. A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides. Container 4 ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD, p. 24 (Hereafter, this Entry Group, Record Group, and National Archives at College Park abbreviated to P90-F: RG 313: NARA College Park.)

common understandings and articulations of malaria.

Similar to the commander who commented that he and his unit were "out here to fight Japs and to hell with mosquitoes," enlisted soldiers needed to have an understanding of malaria that was legible to them.[5] For that officer on Guadalcanal and most of the troops, malaria was perceived as a lesser threat than the humans fighting for the Axis: the "prevailing opinion was that malaria and malaria control were of minor importance during combat operations."[6] For officers, direct orders from the Commander of the South Pacific Forces were ultimately effective imperatives to accept MECO's articulation of malaria, or at least be cooperative with MECO's practices. However, as I will show, orders and regulatory measures were not successful in getting the majority of the military personnel in the Pacific theater to enact malaria discipline. Rather than forcing compliance with punitive measures, MECO's propaganda campaigns were needed to successfully convince soldiers to *choose* to practice malaria discipline — to agree that malaria was an enemy at least as dangerous as the Japanese, and only through the constant vigilance of each individual soldier in enacting common, everyday "day-to-day" mosquito control practices could malaria be defeated.

My analysis traces the colonial legislative origins and uses Foucault's theories about the disciplined and "docile bodies" of soldiers to make sense of why the initial malaria discipline regulations in the Pacific campaign were not able to get enlisted men to

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[5] Harper, Paul A., *et al.* "Malaria and Epidemic Control in the South Pacific 1942-1944 (Confidential)." 1945. Reproduced by Engineers HQ SOPACBACOM 2379. Container 15, Folder [P2-3] [Malaria and Epidemic Control in South Pacific Area, 1942-1944] Folders 1-6. Entry #P93: Historical Files, 1942-1946, P2-3, Red 183. RG 313: NARA College Park, pp.13-14

[6] *Ibid.*, p. 20

change their behaviors. I then analyze the development and formation of MECO's propaganda campaign that used visual representations of anthropomorphized mosquitoes and "pin-up girls" in animated cartoons, comic strips, posters, and calendars to translate malaria from a regulatory and pesky nuisance into an enemy actively and intentionally fighting to defeat the Allies and the American way of life. I argue that these translations and articulations of malaria worked to convince enlisted soldiers that territorial concerns and combat zones extended to their personal spaces (especially their skin) and that their behavior and bodily practices were essential to winning the war.

Anti-Malarial Legislation

In my first chapter, I discussed instances when segregation was recommended as a strategy for lowering malaria transmission, such as Christophers and Stephens' suggestions to segregate native children because they were dangers to Europeans in Africa.[7] Another strategy deployed by colonial administrators was enacting anti–malaria and anti–mosquito legislation that proscribed the movement of people and prescribed the maintenance of landscapes. After briefly reviewing this history, I focus on how these proscriptions and prescriptions were instituted during World War II by US and British Forces for what came to be call malaria discipline.

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[7] See for example, Christophers, S.R. and J.W.W. Stephens. "Segregation of Europeans." *Reports to the Malaria Committee of the Royal Society*, Third Series. 1900. London: 21-24. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division of National Library of Medicine; S.R. Christophers and J.W.W. Stephens, "The Native as the Prime Agent in the Malarial Infection of Europeans (With Map)," *Reports to the Malaria Committee of the Royal Society* Second Series(1900). University of Oxford, Radcliffe Science Library; "Memorandum: "Tonkinese and natives, malaria hazard of." from Malaria Control Officer, Espiritu Santo; To The Commanding General, IV Island Command; VIA Malaria Control Officer, South Pacific Area, 4 October 1943 (Secret)." 1943. 1-2. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. P90-F: RG 313: NARA College Park.

In *Colonial Pathologies*, Warwick Anderson identifies a shift in colonial rule in the first decades of the 1900s that involved increased surveillance and inspection of the bodies of colonial subjects, and he argues that tropical medicine and hygiene were central to this shift.[8] Nayan Shah similarly identifies this time period as key for the development of the modern, liberal subject, and sees the development of public health as a key constituent to this change, occupying a space of "centrality in definitions of modernity."[9] The development of the discipline and governmental practices of public health inculcated "the idea [that] securing the 'health' of the population linked the condition and conduct of individuals with the vitality, strength, and prosperity of society overall."[10] Across British and American colonies, hygienic practices, and the perceived absence of such practices among colonial subjects, was used to justify the surveillance of hygienic behavior as well as the continuation of colonial rule. The values of sanitation and hygiene were often

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[8] Warwick Anderson, *Colonial Pathologies: American Tropical Medicine, Race, and Hygiene in the Philippines* (Durham: Duke University Press, 2006). This is a common focus within secondary literature on tropical medicine. See e.g. David Arnold, *Imperial Medicine and Indigenous Societies (Studies in Imperialism)* (Manchester: Manchester University Press, 1989).; David Arnold, *Science, Technology, and Medicine in Colonial India* (Cambridge: Cambridge University Press, 2000).; Roy MacLeod, ed. *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion* Routledge, 1989-01).; Alison Bashford, *Imperial Hygiene: A Critical History of Colonialism, Nationalism and Public Health* (Houndsmills [England] ; New York: Palgrave Macmillan, 2004); Philip D. Curtin, "Medical Knowledge and Urban Planning in Tropical Africa," *The American Historical Review* 90, no. 3 (1985/06/01).; Stephen Frenkel and John Western, "Pretext or ProphylAxis? Racial Segregation and Malarial Mosquitos in a British Tropical Colony: Sierra Leone," *Annals of the Association of American Geographers* 78, no. 2 (1988).; Mark Harrison, ""Hot Beds of Disease": Malaria and Civilization in Nineteenth-Century British India.," *Parassitologia* 40, no. 1-2 (1998).; Mark Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600-1850* (Oxford University Press, USA, 1999).; Dane Kennedy, *The Magic Mountains: Hill Stations and the British Raj* (University of California Press, 1996).; Maryinez Lyons, *The Colonial Disease: A Social History of Sleeping Sickness in Northern Zaire, 1900-1940 (Cambridge Studies in the History of Medicine)* (Cambridge University Press, 2002).; Michael A. Osborne. "The Geographical Imperative in Nineteenth-Century French Medicine," In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, 31–50. London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000.; Shah, *Contagious Divides*; Michael Worboys. "The Emergence of Tropical Medicine: A Study in the Establishment of a Scientific Specialty," In *Perspectives on the Emergence of Scientific Disciplines*, edited by G. Lemain et al., Mouton: The Hague, 1977.

[9] Shah, *Contagious Divides*, p. 3

[10] *Ibid.*, pp.3-4

codified in legislation, in colonial outposts and the metropole, rural as well as urban spaces. Throughout the early twentieth century, the laws created around ideas of "public health" included regulations about building and housing standards, spitting, sewers, and water treatment as well as newly created positions for officers to inspect and enforce those laws.[11]

Sanitary policies and regulations circulated across the globe as the early twentieth century's "sanitary goals" undergirded new health legislation throughout Western Europe and North America.[12] These territories of governmental or bureaucratic surveillance for the good and welfare of the public were expanded under the aegises of controlling malaria. In his influential monograph *Malaria in India,* Patrick Hehir noted that by 1926 many of the sanitary laws and regulations implemented in India were "modified from an Ordinance of the US Public Health Service and the International Health Board."[13] Charles Bentley's arguments for increased malaria control measures in Bombay in 1911 drew upon American Colonel Gorgas' successful solicitation of local politicians in Cuba and Panama to issue anti-mosquito ordinances.[14]

Bentley distinguished Gorgas as "the first medical officer to carry out a successful

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[11] For more on the history of public health in North America and Europe see: Erwin H. Ackerknecht, *Medicine at the Paris Hospital 1794-1848* (Baltimore: The Johns Hopkins Press, 1967).; Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception,* trans. A. M. Sheridan Smith (New York: Vintage, 2004 (1973)); Judith Walzer Leavitt, *Typhoid Mary: Captive to the Public's Health* (Beacon Press, 1997-07-31).; Dorothy Porter, *The History of Public Health and the Modern State* (Editions Rodopi, 1994).; Dorothy Porter, *Health, Civilization and the State: A History of Public Health From Ancient to Modern Times* (Routledge, 1999).; Roy Porter, *The Greatest Benefit to Mankind: A Medical History of Humanity* (W. W. Norton & Company, 1999).;. George Rosen, *A History of Public Health* (Baltimore: The Johns Hopkins University Press, 1993).; Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (University of Chicago Press, 1987).

[12] Curtin, "Medical Knowledge and Urban Planning," p. 613

[13] Patrick Hehir, *Malaria in India* (Oxford: Oxford University Press, 1927). , pp.245–251, 444–5

[14] Bentley, Charles. "Report of an Investigation Into the Causes of Malaria in Bombay and the Measures Necessary for Its Control." 1911. Bombay: Printed at the Government Central Press. Historical Medical Library of The College of Physicians of Philadelphia. ZDm 9 (#000059824), p. 119

anti–mosquito campaign in a large city."[15] Gorgas' ordinances made having standing water "anywhere within the City limits" an offense punishable by fine.[16] The centrality given to legislative intervention for malaria control was a model that Bentley wanted Bombay to adopt. These arguments made an impact: in the response to Bentley's report, the Chairman of the Malaria Investigation Committee remarked "It seems clear that some legislative power must be taken to ensure the entire prevention of [malaria]," and called for the "drafting" of such a amendment to the Bombay Municipal Act.[17] These laws gave administrators the power to enter private property and the interior of homes, provided they gave enough notice for the privacy of the women in the house to be preserved.[18] The spaces of malaria control and public health increasingly encompassed areas, property, and behavior that had been regarded as private and excluded from governmental control.

Military Malaria Regulations

Concerns about the role of soldiers in malaria transmission began early in WWII.[19] Malaria was an especially serious threat to an Allied victory in the Pacific campaign, and MECO and commanders such as General Douglas MacArthur, wanted all troops to understand that: "Malaria control in the army is a military problem. A malaria policy must not only be formulated: it must be enforced. Malaria discipline is absolutely

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[15] *Ibid.*

[16] *Ibid.*

[17] *Ibid.*, pp.2, 6

[18] This section goes on to state that "due regard shall also be had, so far as may be compatible with the exigencies of the purpose for which the entry is made, to the social and religious usages of the occupants of the premises entered." *Ibid.*, p. 122

[19] Oliver R McCoy. "War Department Provisions for Malaria Control," In *Preventive Medicine in World War II, Volume 6*, edited by Colonel John Boyd Coates Jr., Washington, DC: Office of the Surgeon General, 1963. , pp.11-15

necessary to an army's success in fighting the Plasmodium-mosquito Axis."[20] In addition to mosquito-population control measures and the US military's relocation of local Melanesian and Tonkinese villagers to reduce the potential for mosquitoes transferring malaria from that endemic population to soldiers, US and British militaries developed new malaria discipline regulations that incorporated aspects of colonial anti–mosquito legislation as another intervention intended to diminish the contact between mosquitoes and soldiers.[21]

After a rise in mosquito populations in November 1942, a senior malaria control officer on Espiritu Santo recommended for "all members of the Armed Forces" the following "Measures for adoption by troops for malaria control":

> That head–nets and gloves, with leggings and high–top shoes, be worn by men on duty after sundown and before sunrise, such as guards on sentry duty, etc. This should likewise apply to men out of doors for any length of time during these hours. That there be no bathing or taking showers during this period.[22]

These recommendations also encompassed sleeping quarters and bed-nets, with directions to spray them with insecticide every evening.[23] A November 1943 Memorandum titled "Individual Measures to Prevent Malaria" extended these measures

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[20] Russell, "Introduction," p. 6

[21] See for example, "Memorandum From: James Sapero, Officer-in-Charge, Malaria Control, South Pacific Area, To: Commanding General, Base Buttons, RE: Removal of Imported Natives. 26 October 1942." 1942. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides. Folder 5 of 5 [Aug 16, 1942- Jan 16, 1942]. Container # 1 Arc# 5722964. P90-F: RG 313: NARA College Park, MD.; "Memo RE Tonkinese natives as malaria hazard"; Mount, Robert. "Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942 (Secret)." 1943. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. P90-F: RG 313: NARA College Park. pp.2,5

[22] "Memorandum from Lieutenant Mount to the Force Surgeon on Base Button, RE Measures for adoption by troops for malaria control. Nov. 24, 1942." 1942. Folder A6–5 (1–1) General Correspondence – Espiritu Santo, New Hebrides [Aug 16, 1942– Jan 16, 1942] [Folder 5 of 5]. Container 1 Arc# 5722964. EntryP90-F: RG313: NARA College Park.

[23] *Ibid.*

and specified the use of insect repellents:

> Ten to fifteen drops of repellent should be rubbed on hands, wrists, face, and neck at dusk, and will be repeated every three hours when exposed at night; …All tents should be sprayed before bedtime. Ten seconds spraying is adequate for a pyramidal tent; more is wasteful; Night raids and alerts: Shelters should be sprayed immediately after entering. Repellent will be taken to shelters and used as directed [above]; All personnel not housed in adequately screened quarters will sleep under mosquito bars properly attached; Swimming, and taking showers in unscreened bath houses, and other unnecessary exposure between the hours 1800 and 0630 are absolutely prohibited.[24]

In these regulations, malaria was only alluded to in the title, and malaria discipline was articulated as a long list of rules and steps to follow that significantly changed behavior and bodily practices of self. These regulations changed proper daily behavior and actions to now include new spatial and temporal limitations, additional chemicals, and techniques for the precise and repeating actions of applying those chemicals — without convincing reasons as to why they were necessary. Without a motivating reason, the re–application of a specified number of drops of repellent every three hours and leggings in all weather could have seemed like arbitrary rules from state-side commanders to soldiers actively on patrol and/or under fire.

Perpetual malaria discipline was explicitly made the responsibility of every soldier in a 1943 Forces-wide directive: "Good Malaria Discipline means that the individual protective measures . . . are *continually and consciously* carried out by each

[24] "Memorandum from Colonel Thomas Burgess Headquarters Forward Area APO #709 RE Individual Measures to Prevent Malaria, Nov. 24, 1943." 1943. Folder A 6–5 General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1 –1943]/[Folder 5 of 7]. Container 2: ARC# 5722964. P90-F: RG 313: NARA College Park.

member of an organization."[25] Malaria discipline was also included in the July 1944 "AG 710 Malaria Control Regulations," one of the primary documents establishing the authority and parameters of MECO, further codified its importance in control measures. These regulations stated:

> a. Sleep under bednets. b. Do not swim after 1800. c. Wear full–length trousers and sleeves after 1800. d. Use repellent when outside after 1800. e. Spray sleeping quarters, mess–halls, latrines, etc. at least once each evening. f. Keep areas well policed; free from tin cans, empty bottles, etc. g. Spray oil in fire–barrels and other artificial water catchments in which wigglers might grow. h. Drive on authorized roads only.[26]

The rhetoric of the directives may have changed from the awkward edicts about actions that soldiers should take in 1942, to behaviors that "are absolutely prohibited" in 1943, and to shorter, more direct orders in 1944, but they all neglected to include reasons for their necessity. All these regulations articulate a malaria that made the lives of soldiers more difficult: limitations were placed on movement, and the behavior and the ways they interacted with their environments were proscribed, particularly after sunset. Malaria discipline expanded traditional military discipline into more aspects of the lives of soldiers. But this expansion did more than increase the territories of malaria control; commanders were trying to change the articulation of what a proper soldier was. Good soldiers were now those soldiers who actively practiced malaria discipline. For this

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[25] "AG. 300.6 (Y–M): Memorandum Number 14: Individual Measures to Prevent Malaria, By Command of Major General Murray; Headquarters Forward Area APO #709, November, 24 1943." 1943. Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Oct 3, 1943 - Dec 1 -1943]/[Folder 5 of 7]. Container 2: ARC# 5722964. P90-F: RG 313: NARA College Park. Emphasis in original.

[26] "Malaria Control Regulations, AG 710 (Secret)." 10 July, 1944. 1-8. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/ [Folder 3 of 5]. Container # 1 Arc# 5722964. P90-F: RG 313: NARA College Park. The regulations against driving 'recreationally' and/or straying off authorized roads was viewed by malaria control officials as an especially important measure because tires created divots and tracks, especially in muddy conditions, which proved to be an especially habitably environment for mosquito larvae. However, it was not initially taken very seriously by the troops.

articulation of malaria discipline to succeed and the practices be normalized into everyday routines, soldiers would have to change their own understandings of what malaria was and why malaria discipline was necessary.

Command responsibilities

A British general involved in battles in Akrakan and Burma in 1944 and 1945 stated, "Good doctors are no use without good discipline. More than half the battle against disease is fought not by doctors, but by regimental officers."[27] For this general, malaria control required behavior change of enlisted men overseen by officers: ensuring health was a command responsibility. While malaria control regulations asserted "adequate malaria disciplines results from the conscious effort of every individual to practice these measures," these responsibilities were not initially widely taken up nor complied with.[28] This non-compliance prompted malaria control officers to increase the overseeing and monitoring of the troops' behaviors.

This sentiment resonated across Allied command. Brigadier General Howard issued the memo "Malaria Control" to all officers in the Allied Forces in September 1943 directing "Organization Commanders of all echelons of command and in all services, including Allied Forces, will at once take positive and effective steps to insure compliance with existing orders on malaria control, particularly the wearing of the

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[27] Mark Harrison, "Medicine and the Culture of Command: The Case of Malaria Control in the British Army During the Two World Wars," *Medical History* 40(1996). , p. 447

[28] Quoted in Harper, *et al.*, "Malaria and Epidemic Control," p. 61. See also "Letter from Corporal Frank Hackett to Base Malaria Control, APO - 292 RE Malaria." 30 Sept. 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. P90-F: RG 313: NARA College Park .

uniform."[29] Ongoing non–compliance caused static or increasing malaria rates, with troops still or again having symptoms and perpetuating the low numbers of healthy fighting troops. Brigadier General Howard identified the main causes for this problem: "In spite of repeated instructions, the negligence of many commanding officers has allowed unnecessary and unwarranted body exposure in their commands. The continuous high incidence of malaria is largely due to inadequate protection of the body."[30] The Brigadier General was not merely laying blame on the enlisted men for not better incorporating the malaria discipline regulations into their daily routines and practices; instead he indicted their commanding officers: "Violations of existing orders on the subject of malaria control will be considered by this Headquarters a demonstrated lack of ability on the part of the Commanding Officer to command, of which official cognizance must, and will, be taken."[31] The officers, in "all echelons of command and in all services" were taken to task for failures of malaria discipline due to not enough surveillance and enforcement of malaria discipline in their units. A follow–up memo for officers in the Air Force made this threat even more explicit: "THE UNIT COMMANDER – NOT HIS SUBORDINATES – IS AT FAULT IF THE MALARIA INCIDENCE IS HIGH IN HIS UNIT."[32]

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[29] "Memorandum "Malaria Control" from Headquarters Island Command APO #709 from Colonel Wilfred Higgins by Command of Brigadier General Howard. Sept. 2, 1943 (Secret)." 1943. Folder A6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Mar 1, 1943 –Oct 2, 1943] [Folder 6 of 7]. Container 2: ARC# 5722964; P90-F: RG 313: NARA College Park, MD.. Emphasis in original.

[30] *Ibid.*

[31] *Ibid.*

[32] "Memorandum No. 70 "Malaria Control in Units of the Thirteenth Air Force" (Secret)." November, 12 1943. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container 1, Arc# 5722964. P90-F: RG 313: NARA College Park, MD. Emphasis in original.

"It is a simple truth that, in an army, discipline is as important in fighting disease as in fighting the human enemy."[33] In *Discipline and Punish,* Foucault notes that "Discipline rewards simply by the play of awards, thus making it possible to attain higher ranks and places; it punishes by reversing this process. Rank in itself serves as a reward or punishment."[34] The ability of an officer to maintain and enforce malaria discipline became a valued quality and was included in promotions and performance evaluations. In the same way that ComSoPac's directives to commanders in the Pacific theater who were not complying with MECO's supply and personnel requests carried extra weight and threats of undesirable repercussions (discussed in chapter 2), Brigadier General Howard and Air Force commanders brought more authoritative weight to bear on the malaria discipline directives for officers and their command positions. For officers with ambition, these directives articulated malaria and malaria discipline in a way that was legible and substantive: malaria was a threat to promotion and rewards. However, this articulation was not similarly motivating for the majority of enlisted men to practice malaria discipline.

Inspection

The practices of surveillance and inspection that sanitary legislation codified in urban areas and colonial territories in the early twentieth century were also extended to the bodies of military personnel. In *Dismembering the Male*, Joanna Bourke argues that World War One was the first time physical "fitness" was deployed as a construct; for the

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[33] Russell, "Introduction," p. 3

[34] Michel Foucault, *Discipline & Punish: The Birth of the Prison,* trans. Alan Sheridan (New York: Vintage, 1977, 1991). , p. 181

first time men were evaluated and ranked according to their health and body types, (given categories such as A1, etc.).[35] Calisthenics were introduced into the British Armed Services as a method for conditioning soldiers into being properly fit for the military as well as into being optimal fighters.[36] Their physical "fitness" was evaluated and inspected regularly; their bodies surveilled. These inspections caused further alienation between the enlisted men and officers.

In the chapter "Docile Bodies" in *Discipline and Punish*, Michel Foucault locates discipline as central to the creation of the modern soldier. Discipline was a new focus on the individuality of bodies in a "retail" sense: "of exercising upon it a subtle coercion, of obtaining holds upon it at the level of the mechanism itself — movements, gestures, attitudes, rapidity: an infinitesimal power over the active body."[37] This attention to movement and "power over the active body," as well as the specific understanding of "fitness," and the institutionalization of inspection of the bodies of soldiers that Bourke discusses, continued in the Second World War more broadly, and into malaria control practices specifically.

In both the British and American militaries, malaria discipline was made a regulation, the violation of which was an "infraction of military law and [was] to be dealt with accordingly."[38] The heightened scrutiny on officers about the malaria discipline in their units created an increased emphasis on inspection. The 1943 Air Force Memo

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[35] Joanna Bourke, *Dismembering the Male: Men's Bodies, Britain, and the Great War* (Chicago: University Of Chicago Press, 1996). pp. 171-209.

[36] *Ibid.*

[37] Foucault, *Discipline & Punish*, p. 137

[38] "Malaria Control Regs AG 710."

referenced above directed “Routine inspections are as eminently important as the entire malaria control program and should be considered as an integral part of the program. For without thorough inspections of the area, the equipment and the personnel, it is impossible to enforce the demands of the malaria control system.”[39] Inspections were to be carried out by officers.

This emphasis on inspections also necessitated increasing the inspection infrastructure within MECO and malaria control units. Initially, inspections were the responsibility of the Island Malariologists, but eventually a position of the Malaria Discipline Inspector was created.[40] Malaria discipline reports were included in the Island Malariologist’s monthly malaria reports about control activities on a base (see chapter 3). In an April 1944 Malaria Report from Bougainville Island, the authors note that malaria discipline inspections were being performed nightly, and that the “Bednets inspected are in a good state of repair, and since the decrease in combat activity, all troops are again using bednets except those on patrols where the use of a bed–net is impossible.”[41] These nightly inspections also noted that while most units were complying with the clothing regulations, some were not enforcing the regulations about proper clothing strictly enough “and this laxity has been immediately reported to Commanding Officers

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[39] “Memo 70 “Malaria Control in the 13th Air Force”,” p. 3

[40] “Memorandum from Fred Butler, Malaria and Epidemic Control Officer, South Pacific Area, To: Malaria Control Officer, Navy 140; March 31, 1944 (Secret).” 1944. Folder A6–5(1–1) General Correspondence – Espiritu Santo, New Hebrides [Folder 3 of 5] [Dec 20 1943 – Aug 22 1944]. Container 1: Arc# 5722964. EntryP90-F: RG313: NARA College Park.

[41] “April Malaria Report from Major Frederick Farley 23rd Malaria Survey and the 37th Malaria Control Unit to Paul Harper (MalComSoPac); 1 May, 1944 (Secret).” 1944. Folder A 6-5 (4-1) General Correspondence - Russell Islands, British Solomon Islands [July 18, 1943 - Jan 18, 1944] [Folder 3 of 4]. Container 1: Arc# 5722964. EntryP90-F: RG313: NARA College Park., p. 1

concerned."[42] On Espiritu Santo Island, malaria discipline inspectors were not intended to be adversarial to the soldiers: "Inspections [were] made in as friendly a manner as possible," with the inspector emphasizing that they were there to lower malaria transmission and "to aid the unit in overcoming its hazards and shortcomings in malaria mosquito control by suggesting remedies or methods for avoiding infractions of regulations."[43] These inspectors were trying to work with these units by translating why malaria control measures were needed.

But no matter how "friendly a manner" these inspections were carried out, one of the responsibilities of the Malaria Discipline Inspector was writing up soldiers violating the malaria control regulations. The Violation of Malaria Discipline form (Image 4.1) is intended for Commanding Officers, notifying them that a "member of your command" was violating a central malaria discipline regulations concerns (a-d):

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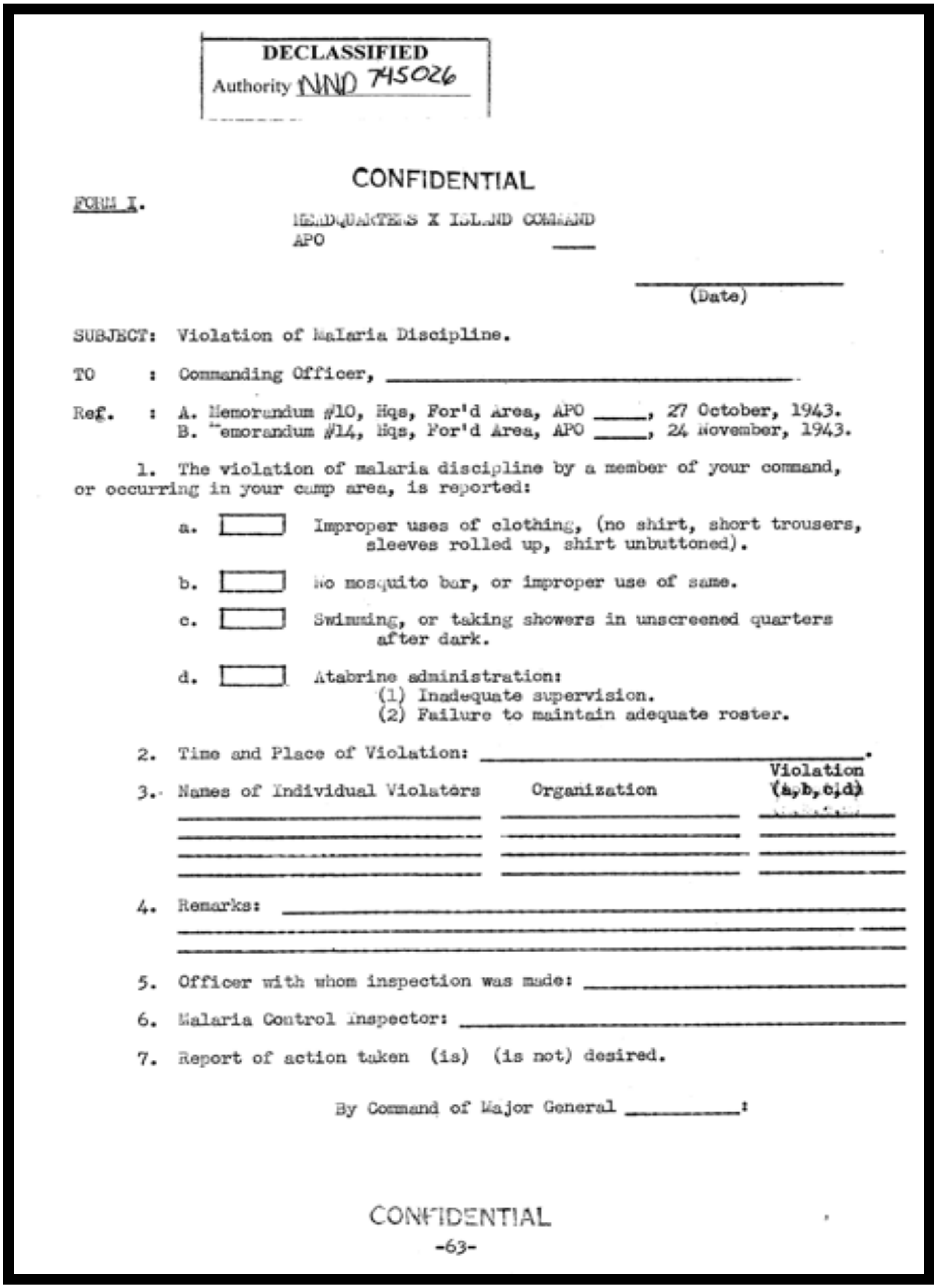
[42] *Ibid.*

[43] "Report of the Base Malaria Control Inspector by William Fletcher in Report of Current Malaria and Epidemic Control Activities for Espiritu Santo; Nov. 1944 (Secret)." 1944. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, Nw Hebrides [Oct 1944-Dec 1944]/ [Folder 4 of 11]. Folder: A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1): Monthly Malaria Reports - Espiritu Santo, New Hebrides: Container #4 ARC# 5722964. EntryP90-F: RG313: NARA College Park, p. 8



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CONFIDENTIAL

FORM I.

HEADQUARTERS X ISLAND COMMAND
APO ____

____
(Date)

SUBJECT: Violation of Malaria Discipline.

TO : Commanding Officer, ______________________.

Ref. : A. Memorandum #10, Hqs, For'd Area, APO ____, 27 October, 1943.
B. Memorandum #14, Hqs, For'd Area, APO ____, 24 November, 1943.

1. The violation of malaria discipline by a member of your command, or occurring in your camp area, is reported:

a. [ ] Improper uses of clothing, (no shirt, short trousers, sleeves rolled up, shirt unbuttoned).

b. [ ] No mosquito bar, or improper use of same.

c. [ ] Swimming, or taking showers in unscreened quarters after dark.

d. [ ] Atabrine administration:
(1) Inadequate supervision.
(2) Failure to maintain adequate roster.

2. Time and Place of Violation: ______________________.

3.

Names of Individual Violaters	Organization	Violation (a,b,c,d)

4. Remarks: ______________________

5. Officer with whom inspection was made: ______________________

6. Malaria Control Inspector: ______________________

7. Report of action taken (is) (is not) desired.

By Command of Major General ________:

CONFIDENTIAL

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Image 4.1. Form I. The Violation of Malaria Discipline, from Harper, et al., "Malaria and Epidemic Control," p. 63

Similar to the colonial Anti–Mosquito Legislation I discussed earlier, inspections in all of the Services involved the entering of living quarters: Malaria discipline inspections required malariologists to “make spot inspections for violations” by walking “through the camp after dark, taking the names of any man improperly dressed, inspecting a few bed nets, and inquiring about supplies of repellent and the atabrine roster.”[44] The Air Force also required inspection to include the monitoring of any items in which water could collect like cans and coconut shells, the proper rolling of tent flaps, the cutting and maintenance of grass and undergrowth, installation and maintenance of screens, the maintenance of spraying equipment, the grading of roads and paths for proper drainage, clothing checks, the inspection of nearby native villages.[45]

The proper use and storage of bed nets as well as the spaces and practices of sleeping were of special concern for malaria control inspectors:

> to obtain full benefit from the use of bed nets, organization commanders will take necessary action to insure that bed nets are:
> a. Inspected regularly for holes and tears and are kept in perfect repair.
> b. Suspended by the strings present on the ends and in no instance stretched over the outside of frames, T–frames or other devices.
> c. Suspended from a height that will allow the user to tuck under his blanket only the cloth border of the bar or an equivalent portion of other type bars; the sides of the bed net to be securely tucked under the blanket or mattress all around the bed when in use. (Sides of bed net should not be permitted to sag.)
> d. Searched inside for mosquitoes every night after being lowered.
> e. Folded when not in use, to prevent mosquitoes from resting inside the folds. (To fold, grasp both sides of the net together, pull out and lay both sides on top of the net. Do not detach one end and hang the net on the floor or head of the bed).
> Personnel should be cautioned not to sleep with any part of the body

[44] *Ibid.*, p. 61

[45] “Memo 70 “Malaria Control in the 13th Air Force”,” pp.3-4

> against the bed net. As an added precaution, mosquito repellent should be used on those portions of the body which may come in contact with the net during the course of the night.[46]

I include this list in full to draw attention to its extensiveness: directives a. - e. gave specific instructions on practices that needed to be enacted before sleeping, followed by prescriptions for how soldiers should sleep. These extensive directives extended the spaces and times of surveillance over the bodily practices of soldiers.

While bed checks were a common occurrence during basic training, the corporeal practices of sleeping soldiers were not. Also, enlisted men did not expect this heightened level of concern about their sleeping in active combat zones. In trying to create widespread malaria discipline, commanders wanted these disciplinary regulations to force changes to the active bodies of soldiers and their understandings about the need for specific behaviors in particular places and at particular times. Malaria discipline regulations tried to articulate malaria control within other bodily and spatial regimes familiar to enlisted men; those of precision. For Foucault, “Precision and application are, with regularity, the fundamental virtues of disciplinary time.”[47] In discussing the changing methods of teaching soldiers to march, Foucault identifies a difference between the older ‘time-table’ constructs of marching instructions and a newer model of a

> web that constrains them or sustains them throughout their entire succession. A sort of anatomo-chronological schema of behaviour is defined. The act is broken down into its elements; the position of the body, limbs, articulations is defined; to each movement are assigned a direction, an aptitude, a duration; their order of succession is prescribed. Time penetrates the body and with it all the meticulous controls of power.[48]

[46] “Malaria Control Regs AG 710,” pp.5-6
[47] Foucault, Michel. 1977. Page 151.
[48] Foucault, Michel. 1977. Page 152.

Foucault, soldiers internalized and naturalized changes to the manners and tempo at which they moved their bodies.

While Foucault was discussing the movements of marching, malaria discipline can be articulated within this "anatomo-chronological schema of behaviour" as extending the prescriptions of bodies in time and space. The malaria discipline directives were trying to articulate a need for different relationships between time and behavior (when one can bathe or swim, cover exposed skin, and visit native villages) as well as prescriptions for how to sleep, when and how many drops of repellent to use, how long to spray an area, and the need to become aware of the potentials areas in one's environment for mosquitoes larvae (and in the 1944 directive, 'wigglers'). These regulations can be understood an enrolling sleep in the practices of self that needed precision, as well as expanding the spaces where this precision was required, all under/within the framework of discipline.

Information Campaign

The Allies' malaria discipline regulations for all fronts were initially designed by military higher–ups, not malaria control officers. Some of the initial propaganda disseminating information about malaria and malaria discipline directly reiterated command directives:

Image 4.2: Photograph of a sign from the malaria control campaign in Advance Section, Ledo, Assam, India, taken 1945. From "From 1800 to 1700 Hrs., Long Trousers, Long Sleeves, Shirts Buttoned, Use Repellent, Use Mosquito Net, By Order of Commanding General." 29 August 1945. U.S. Army. Images from the History of Medicine, National Library of Medicine.

Commanders wanted troops to be so "indoctrinated" into malaria discipline regimes that "regardless of circumstances, they [would be] compelled to keep their shirt sleeves rolled down and their trousers tucked into their boot tops, and to use properly their mosquito bars during sleeping hours…. The soldier must be so disciplined that he will take malaria suppressive treatment regularly under any and all circumstances without supervision."[49] As I've mentioned, troops initially resisted complying with these orders and enacting this level of discipline. They were not convinced by orders and regulations that malaria necessitated such dramatic changes in their bodily practices. Many may have never heard of the disease before; they may not have believed that it was mosquito bites that caused their chills and illnesses.[50] Other methods and articulations of malaria were needed to convince them that changing their behavior was necessary for lowering malaria transmission rates.

The information campaign about malaria control and malaria discipline came to be seen as a central component of malaria control efforts by both American and the British malaria control officers. In his Forward to the Army's history of malaria control efforts in WWII, Surgeon General Leonard Heaton noted "For the troops, training programs and training media had to be prepared and presented, for as always, much of any success or failure depends upon the knowledge and motivation of the individual

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[49] Emory C. Cushing, *History of Entomology in World War II* (Baltimore: The Lord Baltimore Press, 1957). , p. 112

[50] Thomas A. Hart and William H. Hardenbergh. "The Southwest Pacific Area." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterX.htm, p. 514

soldier."[51] British authorities agreed, noting "Energetic propaganda is of the first importance – cinema films, newspaper articles, fireside talks, lectures, road signs, and so on must all be used for this. Courses of instruction for anti–malaria personnel are also essential."[52] The US military began their own "energetic propaganda" campaign in the summer of 1943 by "secur[ing] the cooperation of the Special Services Division (later Morale Services Division)" to emphasize "the prime military importance of malaria."[53] Also, as MECO established greater authority over malaria control practices, they took over responsibility for training all soldiers in the Pacific about the dangers of malaria (see Chapter 3). In addition to the training courses on bases run by the malaria control units, MECO's staff at headquarters began developing an information campaign to articulate malaria as a serious threat and malaria discipline as important to the war effort.[54]

MECO and the Special Services Division's information campaigns began with education: "It may readily be understood that it requires considerable understanding coupled with explanatory instruction to adequately disseminate such a concept [as malaria discipline] among military forces. It required time, patience and cooperation from those in command."[55] Cooperation from officers about disseminating information was an

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[51] Leonard Heaton. "Forward." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, DC: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/forewordrev.htm.

[52] "Directive on Malaria, issued by Allied Force Headquarters. Adv. Adm. Ech., C.M.F. Ext. 130. 3830 M. 24 Jan. 44." 1944. Folder: Notes, reports, maps and pamphlets re malaria in Algeria and Italy 1943;1944. Archives and manuscripts Archives and manuscripts 1944.Available at Closed stores Arch. & MSS (Shelfmark: RAMC/651/2:Box 134). The Wellcome Library, London. , p. 1

[53] McCoy. "War Department Provisions for Malaria Control." p. 51

[54] Paul A. Harper*, et al.* "New Hebrides, Solomon Islands, Saint Matthias Group, and Ryukyu Islands." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm, p. 451

[55] "Epidemic Control on Espiritu Santo," p. 24

initial stumbling block due to a prohibition against discussing the details of malaria with their troops.[56] Once this prohibition was lifted, malaria could be the explicit focus of propaganda. The educational information campaigns of MECO and the Special Services division focused on changing enlisted men's everyday understandings of malaria and providing compelling reasons why everyone needed to work to stop its transmission.

In order to create these changes, the designers of the information campaigns articulated their message about malaria with methods and media beyond orders and lists of disciplinary regulations, and they incorporated the suggestions and work of enlisted men and NCOs. The campaign deployed printed materials such as pamphlets, newspaper cartoon strips, calendars, roadside posters and signs, and reminders on ration containers and matchbooks, as well as other medium including "cartoon moving picture films" and radio broadcasts.[57] These campaigns worked to present a different articulation of malaria and the threat it presented to individual soldiers, the overall war effort, as well as of why soldiers needed to practice discipline against it. After briefly engaging the radio and film campaigns, I will focus my analysis on the print materials first engaging articulations of

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[56] Hart and Hardenbergh, "Southwest Pacific Area," p. 514. While this prohibition was lifted, other malaria control information was kept out of circulation: In July 1943, US Major General Wallace issued a memorandum to all forces in the South Pacific that "immediate steps be taken by all commanders to safeguard all information pertaining to Malaria Control in the theater." ("Malaria Control Regs AG 710," p. 5) These measures were to ensure that knowledge about incidence rates and specific malaria control measures did not reach civilians, whether "through interviews, correspondence, or publications." (*Ibid.*) In order to monitor correspondences, authorizations were made for MECO "to censor mail." ("Memorandum from John Boyd, Malaria and Epidemic Control Officer, SoPacArea to The Chief Censor regarding (a) Chief Censor's Memorandum dated March 28 1944; 12 April 1944. (Secret)." 1944. Folder A6–5 (1–2) General Correspondence – Headquarters Malaria and Epidemic Control, South Pacific Area [Mar 4 1944–Oct 9, 1945]. Container 1: Arc# 5722964. EntryP90-F: RG 313: NARA College Park.)
Knowledge about the impact of malaria and strategies for controlling mosquito populations and malaria infections was considered so important for the war effort that "all Malaria reports, and correspondence concerning treatment or prevention of Malaria, will be classified 'Secret." "Malaria Control Regs AG 710," p. 5

[57] McCoy, "War Department Provisions," p. 51

malaria and then those of malaria discipline. This is a bit of an artificial division as many images address both. Also, I am not tracing a linear progression through the information campaign: many themes and articulations were produced and disseminated concurrently, presenting servicemen with multiple articulations and messages about malaria and malaria discipline.

Radio and Film

The US military made extensive use of the radio for disseminating malaria control information.[58] On every Pacific theater base, every night, Armed Forces Radio aired a "brief" broadcast about the importance of using insect repellent, rolling down sleeves, and other aspects of malaria control.[59] Many troops colloquially re-named Armed Forces Radio the "Mosquito Network" because of the frequency of these announcements.[60] The radio station on Guadalcanal played "a program of recorded music known as the Atabrine Cocktail Hour [that] began each evening with a plug for malaria or dengue control."[61] In addition to these short announcements, the developers of the information campaign created a 20 minute-long recording "Know Your Enemy—Malaria" that was broadcast over radio and base loudspeakers.[62] "Know Your Enemy—Malaria" was intended as a auditory reminder of the malaria orientation courses servicemen had taken and

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[58] Thomas A. Hart, "The Army's War Against Malaria," *The Scientific Monthly* 62, no. No. 5 (1946, May).; Harper*, et al.*, "New Hebrides," p. 454; Martin Hadlow, "The Mosquito Network: American Military Radio in the Solomon Islands During World War II," *Journal of Radio Studies* 11, no. 1 (2004).

[59] Harper*, et al.*, "New Hebrides," p. 454

[60] Harper*, et al.*, "New Hebrides," p. 454; Sport Murphy. "Malaria Pinup Calendars, Frank Mack," In *Hidden Treasure: The National Library of Medicine*, edited by Michael Sappol, New York: Blast Books, 2012. , p. 240

[61] Harper*, et al.*, "New Hebrides," p. 454

[62] McCoy, "War Department Provisions," p. 52

emphasized the importance of "individual means of malaria prevention" and how much malaria imperiled the war effort.[63] Both the daily and longer-form radio broadcasts extended the spaces where malaria and the importance of malaria discipline were articulated to the troops. These messages, by the nature of their medium, permeated the air throughout base camps; in mess halls, sleeping areas, offices, etc.

In addition to radio broadcasts, the Army Pictorial Service produced 50 cartoon trailers to portray the importance of individual practices of malaria discipline that were shown as trailers before movies.[64] Many of these cartoons were part of the Private Snafu Series that were common components of the Army-Navy Screen Magazine pieces were shown before films.[65] These Snafu Series cartoons were four minutes long and "depicted in humorous fashion the difficulties experienced by Private Snafu when he neglected antimalaria precautions."[66] The most well known of these is "Private Snafu vs. Malaria Mike" which first appeared in Army-Navy Screen Magazine No. 23, March 1944, but others included "Target Snafu" from October 1944 and "Its Murder, She Says" from May of 1945. With his rank and through humor, Private Snafu was able to articulate malaria as a concern for enlisted men, one that could negatively impact their lives during and after the war.

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[63] *Ibid.*

[64] *Ibid.*, pp.52-55. For an excellent analysis of films made for the Allied anti-malaria campaigns of WWII, see Marianne Fedunkiw, "Malaria Films: Motion Pictures as a Public Health Tool.," *Am J Public Health* 93, no. 7 (2003 Jul). For the use of films in broader malaria and global health campaigns see: Cartwright, Lisa and Brian Goldfarb. "Cultural Contagion: On Disney's Health Education Films for Latin America," In *Disney Discourse: Producing the Magic Kingdom*, edited by Eric Smoodin, 169–80. New York: Routledge, 1994.; Kirsten Ostherr, *Cinematic ProphylAxis: Globalization and Contagion in the Discourse of World Health* (Durham: Duke University Press Books, 2005).; Claudia Springer, "Military Propaganda: Defense Department Films From World War II and Vietnam," *Cultural Critique* 3 (1986).

[65] McCoy, "War Department Provisions," p. 52

[66] *Ibid.*

Malaria Control Print Campaign

The Mosquito Network and Private Snafu were only part of efforts to expand the spaces where malaria was articulated to servicemen; Theodor Geisel (Dr. Seuss) and Munro Leaf created immensely popular malaria control campaign images while working in the US Air Forces' First Motion Picture Unit.[67] Also, the Special Services created three cartoon shorts and fifteen posters by early 1944.[68] They printed and disseminated twenty-five thousand copies of each poster.[69] MECO produced their first poster in August 1943 using the 956th Engineering and Topography Company, 4th Photo Reconnaissance & Map Group.[70] Posters were produced at a ratio of one per 200 men and made in two sizes: 18" x 20" posters were put up in "large mess halls and outdoors on trees and buildings"; and 8"x 9" posters which were displayed "on bulletin boards, in small mess halls and latrines."[71] The dangers of malaria and the need for malaria discipline were prolifically articulated throughout each base.

By 1944, MECO had a dedicated photographer and cartoonist.[72] Cartoons about malaria and malaria discipline were included in the weekly newspaper that was mimeographed on New Caledonia.[73] One 7.5" x 7" monthly calendar was printed each month for every five men.[74] On Guadalcanal, malaria control officers were "sticking

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[67] Richard H. Minear, *Dr. Seuss Goes to War: The World War II Editorial Cartoons of Theodor Seuss Geisel* (New Press, 1999). McCoy, "War Department Provisions," p. 51

[68] McCoy, "War Department Provisions," pp.51-52

[69] *Ibid.*

[70] Harper*, et al.*, "Malaria and Epidemic Control," p. 189

[71] *Ibid.*

[72] *Ibid.*; Harper*, et al.*, "New Hebrides," p. 451

[73] Harper*, et al.*, "Malaria and Epidemic Control," pp.189-90

[74] *Ibid.*; Harper*, et al.*, "New Hebrides," p. 451

them by one corner to all" manuals distributed in malaria control courses.[75] The cartoons and calendars "were found in nearly every tent and quonset hut in the area."[76] As a result of this popularity, requests for additional copies of posters and in particular calendars, quickly and frequently overwhelmed supplies, sometimes by the thousands.[77] Visual representations of malaria and malaria discipline became increasingly prevalent throughout all areas of base and the everyday experiences of servicemen.

In his canonical work "Rhetoric of the Image," Roland Barthes analyzed the processes of meaning-making in a pasta ad, stating meanings in advertisements are "undoubtedly intentional," with intended meaning being "transmitted as clearly as possible" so that "the advertising image is *frank*, or at least emphatic."[78] The visual culture within public health campaigns similarly tries to employ "intentional" and "emphatic" meanings; whether the focus is venereal disease, tuberculosis or malaria, public health posters try to explicitly and emphatically communicate information about

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[75] "Memorandum from James Douglas Headquarters APO 709, To: Lt. Comdr. Butler; 27 October 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. EntryP90-F: RG 313: NARA at College Park.

[76] Harper*, et al.*, "New Hebrides," p. 451

[77] See for example: "Douglas Memo, October 1943"; "Memorandum From James Douglas Headquarters APO 709; To Mr. Amick. 27 November 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. EntryP90-F: RG313: NARA College Park; "Memorandum From Paul Harper, To Dr. Butler. 1 December 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. EntryP90-F: RG313: NARA College Park; "Memorandum from Malaria Control Officer, Navy 140 James C. Riffe Lt. Comdr, To: Malaria and Epidemic Control Officer, South Pacific Area, Navy 131; 3 August 1944." 1944. A 6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/[Folder 3 of 5]. Container # 1 Arc# 5722964. P90-F: RG 313: NARA College Park, MD.; "Memorandum From R. Johnson Base Malaria Control Unit Navy 60, To Dr. Boyd, Malaria & Epidemic Control Headquarters, Navy 131. 5 June 1944." 1944. Folder A6-5 (4-1) General Correspondence - Russell Islands, British Solomon Islands [Jan 24, 1944- Nov 19 1944] [Folder 2 of 4]. Container 1: Arc# 5722964. EntryP90-F: RG313: NARA College Park.; McCoy, "War Department Provisions," p. 51

[78] Roland Barthes. "Rhetoric of the Image," In *Visual Culture: the Reader*, edited by Jessica and Stuart Hall Evans, London: SAGE Publications Ltd, 1999. , pp.33-34

the disease, usually with the aim of getting people to change their behavior.[79] Stuart Hall has argued that "visual discourses already have possible positions of interpretation (from which they 'makes sense') embedded in them, and the subjects bring their own subjective desires and capacities to the 'text' which enable them to take up positions of identification in relation to its meaning."[80] The Special Service Division and MECO's information campaigns focused on many of the concerns of malaria discipline inspectors: changing the behavior of soldiers to wear the proper clothing as well as refrain from swimming, bathing, and visiting native camps between sunset and sunrise; the proper techniques of sleeping; and the proper use of bednets and repellents. But, like in the Private Snafu cartoons, they did so from the position of servicemen.

The planners of the British malaria control information campaign in the Mediterranean explicitly laid out how to carry out anti–malaria propaganda in the pamphlet "Anti–Malaria Campaign."[81] The purpose of these campaigns was "to supplement [the malaria control classes] and keep the details constantly before all ranks of the Army."[82] For example, the following poster invokes malaria discipline regulations but also places malaria discipline as a responsibility to other servicemen:

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[79] See for example: Roger Cooter and Claudia Stein. "Visual Imagery and Epidemics in the Twentieth Century," In *Imagining Illness: Public Health and Visual Culture*, edited by David Serlin, 169–92. Minneapolis: University of Minnesota Press, 2010.

[80] Stuart Hall. "Introduction to Part III," In *Visual Culture: the Reader (Published in Association With the Open University)*, edited by Jessica and Stuart Hall Evans, London: SAGE Publications Ltd, 1999. , pp. 310-11

[81] "Anti-Malarial Campaign Booklet for the Central Mediterranean Forces." 1945. Printing & Stationery Services, CMF. Issued with GRO Serial 16 of 1945. RAMC/2063/38, Box 438. The Wellcome Library, London.

[82] *Ibid.*, p. 8

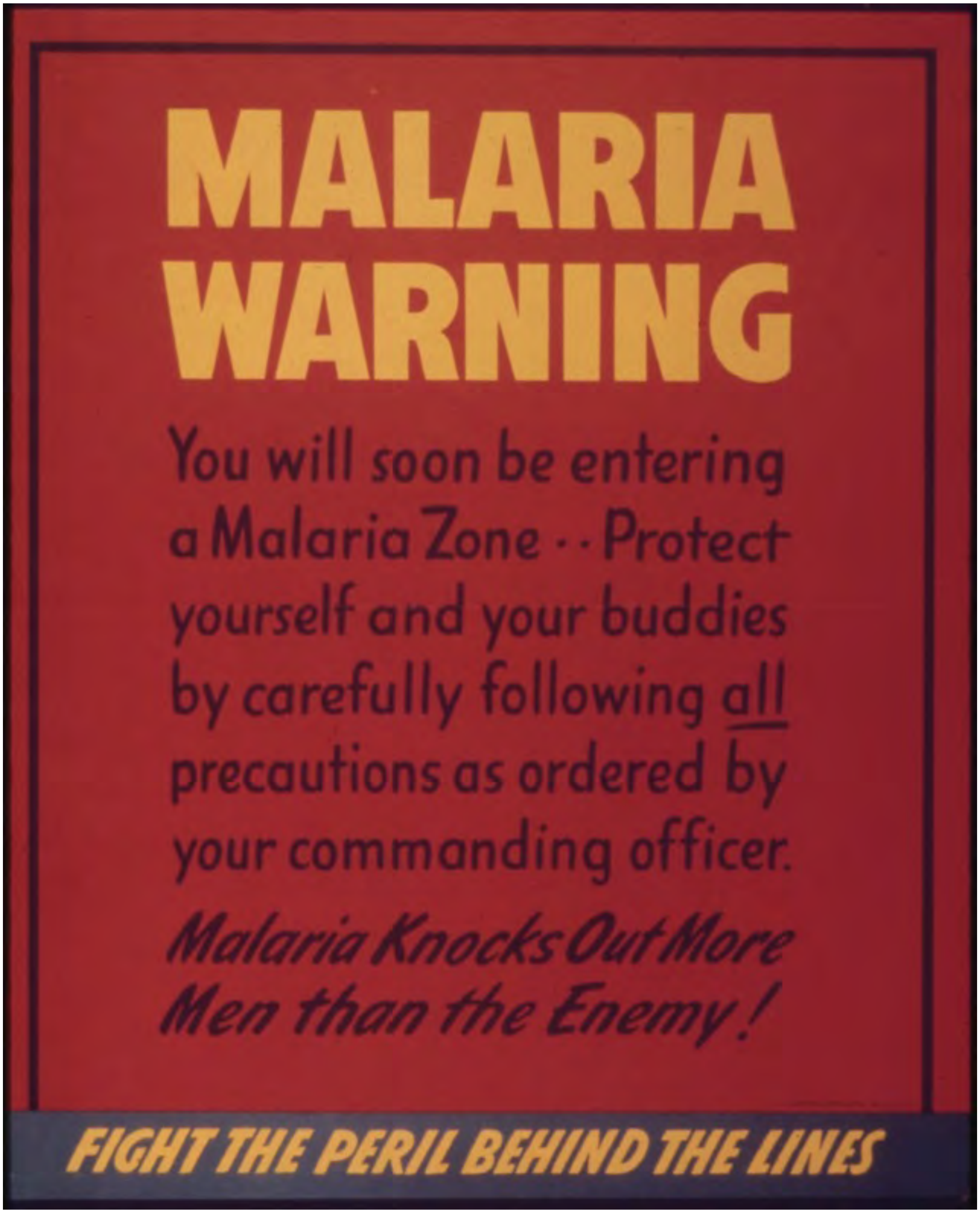

Image 4.3: "Malaria Warning," 1941. "Malaria Warning." 1941-1945. Office for Emergency Management. Office of War Information. Domestic Operations Branch. Bureau of Special Services. (03/09/1943 - 09/15/1945). Series: World War II Posters, compiled 1942 - 1945 (ARC identifier: 513498). Record Group 44: Records of the Office of Government Reports, 1932 - 1947 (ARC identifier: 373). National Archives at College Park, College Park, MD.

This poster works to expand the spaces of combat, articulating malaria as occupying territory (Malaria Zone) as well as penetrating past combat areas into Allied-controlled areas (Fight the Peril Behind the Lines). Troops were also reminded of malaria's power (Malaria Knocks Out More Men than the Enemy!).

Stickers were made for vehicle windshields directing drivers to do their part to inhibit mosquito populations. One sticker stated "Stay on Authorized Roads--Malaria Mosquitoes Breed in Road Ruts--Do Your Part to Stop It," while another emphasized the link between malaria and its impact on the war:[83]

Image 4.4: Windshield Sticker. "Prevent Malaria Shorten the War." 1945. Government Printing Office. Folder: Malarial Control. Container # 2640. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945/Malaria Control Det 2655. 1944-45 THRU MED 1303. Record Group: 0492 Mediterranean Theater of Operations, United States Army/Records of the Special Staff/Medical Section, Office of the Theater. NARA College Park.[84]

These stickers expanded the spaces where troops should be thinking about malaria and malaria discipline into vehicles as well as implicated driving practices as important to the

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[83] McCoy, "War Department Provisions," p. 55

[84] While this particular sticker was dated 1945, it and "Stay on Authorized Roads--Malaria Mosquitoes Breed in Road Ruts--Do Your Part to Stop It," were printed and distributed earlier in the war as well. Similarly, the publications dates on many of the images I use below do not always indicate the year they were first produced, but rather the available digital version.

war effort.

But the organizers of malaria control in both the British and US military felt it was essential to not just 'talk at' soldiers, but also to get them willingly involved. In order to engage the interest and participation of soldiers, the authors of the "Anti–Malaria Campaign" pamphlet recommended, "poster competitions should be organised, and the most suitable entries may possibly be reproduced in quantity."[85] In addition, they argued for the value of articles in military publications and that "frequent lectures, fireside talks, and 'pep' talks should be arranged."[86] These recommendations articulated a need for the spaces and personnel involved in malaria discipline advocacy to be expanded. Not only did malaria discipline need to advocated for in print media, formal lectures, and informal discussions, but the creative efforts of enlisted men should also be used to articulate malaria discipline to their community.

Two of the most successful campaigns in promoting malaria control were the result of enlisted men who 'took up' designing campaigns of their own and who were then promoted into full time propaganda operations: Frank Mack and Frank Hackett. Each articulated malaria as an enemy to the war effort and a threat to the future health and happiness of all servicemen. They also articulated malaria discipline from the position of enlisted men and worked to have malaria and malaria discipline "make sense" to the troops.[87] Hackett developed a textual narrative that appealed to servicemen to respect their fellow troops and to think of their lives after the war. Mack created weekly

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[85] "Anti-Malarial Campaign Booklet," p. 8
[86] *Ibid.*
[87] Hall, "Introduction to Part III," pp.310-11. See also note 79 above.

cartoons and monthly calendars that featured the character of Malaria Moe and "with luscious pin–up damsels" to encourage men to practice malaria discipline.[88] I will analyze Hackett's work and then analyze's Mack's work within the larger visual culture information campaign.

Frank Hackett was "the Malaria N.C.O." for a Gun Battery unit on Russell Island. Hackett sent a letter (endorsed by his Captain) to the head malariologist on his base on September 30, 1944, writing that while the Base Malaria Control Units were "effectively carr[ying] out] anti-mosquito measures, Malaria Discipline on the part of all servicepersonnel, [sic] has fallen flat."[89] He cited a lack of enforcement of malaria discipline as one reason for this failure, with the other being "the men have not been sold on Malaria Discipline."[90] Hackett knew "from personal experience, that the men can sold on Malaria Discipline; Particularly if one or two of their own number are the salesmen."[91] He "inclosed" one of his "'sales' talks," that he suggested "perhaps [could] be used to help some other Malaria N.C.O. on his sales campaign. My endeavor is to make everyone conscious of the need for Malaria Discipline. It is my firm belief that this can, and must, be done."[92]

In passing Hackett's recommendations further up command, Island Malariologist, Lt Colonel John McCarthy praised him as "highly successful in getting across a

[88] Murphy, "Malaria Pinup Calendars," p. 240
[89] "Hackett's letter to Base, Sept. 1944."
[90] *Ibid.*
[91] *Ibid.*
[92] *Ibid.*

campaign of malaria discipline."[93] After Hackett was given command of a local control unit, monthly malaria cases decreased from 25% of the soldiers to about 1%.[94] McCarthy credits this success to Corporal Hackett being able to have his men be "sold" on malaria discipline.[95] "In view of the foregoing, it is strongly recommended that the enclosed 'sales talk' be adopted for distribution in pamphlet form to all units in, or about to enter, a malarious area."[96] Hackett believed that malaria was not being articulated well enough to enlisted men, and they weren't convinced it was necessary. He also understood that more enforcement and lectures from above were not going to improve malaria discipline among servicemen. Malaria discipline would only work if it was translated and articulated by "one or two of their own."

Hackett's "sales talk" was six typewritten pages and directly addressed its reader from a position of commonality. He repeatedly used "us" and "we" to articulate who malaria affected and who was responsible for taking precautions against mosquito bites. He wrote colloquially; "Failure to practice Malaria Discipline will, in the slang of our day, leave us wide open, to an attack of Malaria."[97] And he used the popular character of G.I. Joe to explain that malaria could provoke symptoms fifteen years after the war.[98] The "dream" of Joe returning home to his farm became a "nightmare" after relapses of

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[93] "Memorandum from Lieutenant Colonel John McCarthy to Base Malaria Control, APO 292; 2 October 1944 RE Frank Hackett's Malaria Control and Malaria Discipline (Secret)." 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. P90-F: RG 313: NARA College Park.

[94] *Ibid.*

[95] *Ibid.*

[96] *Ibid.*

[97] "Malaria Control and Malaria Discipline by Corporal Frank Hackett. September 30 1944." 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. EntryP 90-F: RG 313: NARA College Park, p. 1

[98] *Ibid.*, pp.1-2

malaria.[99] Because of these relapses, Joe would "not be able to realize the full quota of health and happiness, which is his just reward for the hardships he has endured."[100]

In Hackett's articulation, malaria discipline required the "full co-operation of the men . . . which is to the mutual Benefit of all." This benefit could only be reached if "all the men, all the time" practiced malaria discipline.[101] The benefits everyone gained from malaria discipline included the freeing-up of valuable medical resources for combat casualties because there would be fewer malaria patients in hospitals, and the work of the Malaria Control Squads who have had to "spray a jungle swamps" and become "entangled in vines and fallen on our faces, . . . sunk in mud and water up to our shoulders" too many times to recall would be appropriately respected and not be for naught.[102] The Squads were working towards "the elimination of all mosquito breeding," which would be to the benefit to all, but could not be achieved unless all servicepersonel did their part by practicing malaria discipline.[103] Hackett concluded that "we owe it to our country, our loved ones' and ourselves [to] practice Malaria Discipline now, and always, until we are returned to non-Malarious Areas."[104]

Hackett's pamphlet included a list of the "few rules which we must follow. And they require only a few minutes of our time each night:"[105]

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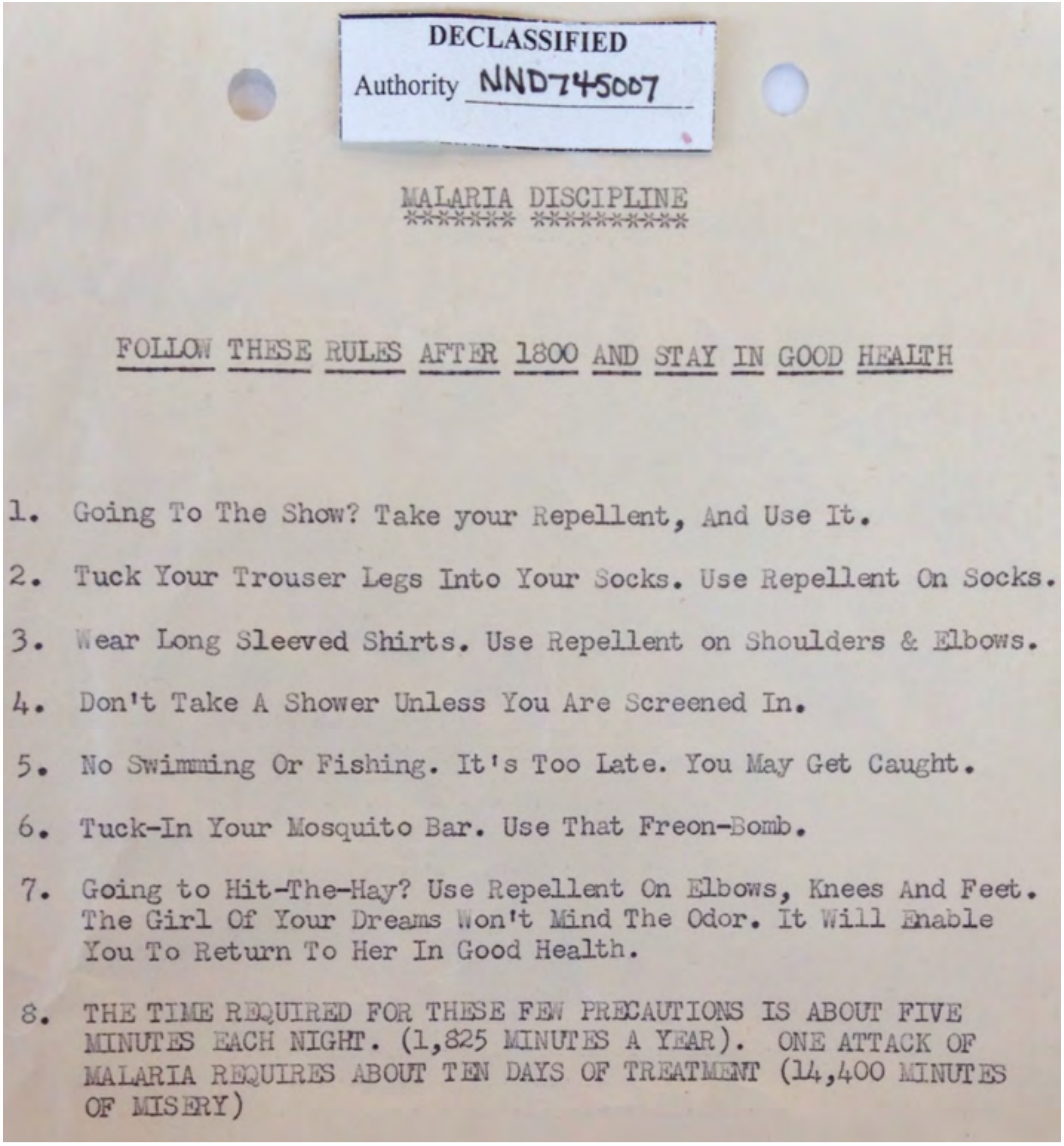
[99] *Ibid.*
[100] *Ibid.*, p. 2
[101] *Ibid.*, p. 3
[102] *Ibid.*, p. 4
[103] *Ibid.*
[104] *Ibid.*, p. 5
[105] *Ibid.*



DECLASSIFIED
Authority NND745007

MALARIA DISCIPLINE
******* *********

FOLLOW THESE RULES AFTER 1800 AND STAY IN GOOD HEALTH

1. Going To The Show? Take your Repellent, And Use It.
2. Tuck Your Trouser Legs Into Your Socks. Use Repellent On Socks.
3. Wear Long Sleeved Shirts. Use Repellent on Shoulders & Elbows.
4. Don't Take A Shower Unless You Are Screened In.
5. No Swimming Or Fishing. It's Too Late. You May Get Caught.
6. Tuck-In Your Mosquito Bar. Use That Freon-Bomb.
7. Going to Hit-The-Hay? Use Repellent On Elbows, Knees And Feet. The Girl Of Your Dreams Won't Mind The Odor. It Will Enable You To Return To Her In Good Health.
8. THE TIME REQUIRED FOR THESE FEW PRECAUTIONS IS ABOUT FIVE MINUTES EACH NIGHT. (1,825 MINUTES A YEAR). ONE ATTACK OF MALARIA REQUIRES ABOUT TEN DAYS OF TREATMENT (14,400 MINUTES OF MISERY)

Image 4.5: Frank Hackett's Malaria Discipline Rules included in, "Malaria Control and Malaria Discipline by Corporal Frank Hackett. September 30 1944." 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. Entry P 90-F: RG 313: NARA College Park, p. 6

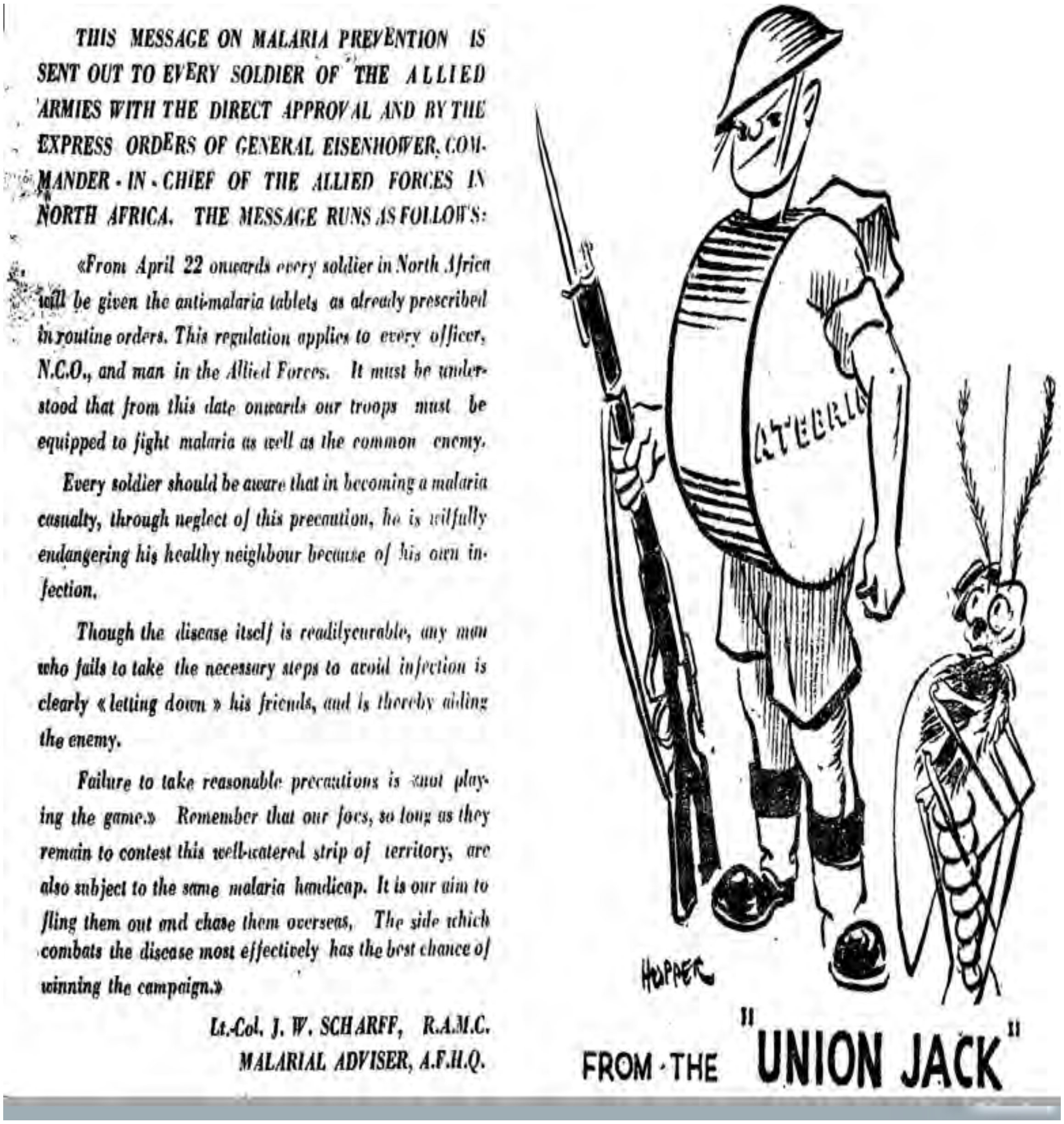
In this list, Hackett articulated a different malaria discipline than those of the regulations. His "sales pitch" incorporated the regulations but was aimed at a specific subject; the viewer of this poster was addressed directly as a individualized subject. Rather than a more generalized, implied "take repellent to the movies" or "only use screened showers" the individualized subject of Hackett's "sales pitch" was explicitly given the responsibility of carrying out malaria discipline ("Take *your* repellent,") and assigned the consequences for not acting accordingly ("*You* may get caught").

The pamphlet and list were aligned with other efforts to expand the spatial and temporal considerations of malaria discipline: He advocated that servicemen "detach" this list and "post it in a conspicuous place. Put it near a picture of the folks back home. Read the rules and memorize them. Let the practice of them become second nature to you. Malaria Discipline is an insurance policy on our health. It is a fool-proof formula."[106] In recommending the list be placed next to pictures of family, Hackett wanted to create motivations for practicing malaria discipline. Referencing "folks back home" provides motivation for making these practices "second nature" and also a solid justification for their necessity. The practicing of malaria discipline now became directly connected to the family stateside and a time after war.

Hackett was able to articulate reasons why malaria was dangerous and malaria discipline was worth practicing that seemed reasonable to enlisted men. His "sales talk" incorporated many themes that became common in the visual culture information campaign. Similar to Hackett's references to respecting the work of Malaria Control Squads and ensuring the rights of combat casualties to receive quick medical attention through keeping malaria casualties out of hospitals, designers of the information campaigns made "a concerted effort … to make personal precautions a matter of military honor."[107] Honor and responsibility were themes in this message in the Union Jack a

[106] *Ibid.*, p. 5
[107] Harrison, "Medicine and the Culture of Command," p. 452

newspaper for those in the British Arms Service:


THIS MESSAGE ON MALARIA PREVENTION IS SENT OUT TO EVERY SOLDIER OF THE ALLIED ARMIES WITH THE DIRECT APPROVAL AND BY THE EXPRESS ORDERS OF GENERAL EISENHOWER, COMMANDER-IN-CHIEF OF THE ALLIED FORCES IN NORTH AFRICA. THE MESSAGE RUNS AS FOLLOWS:

«From April 22 onwards every soldier in North Africa will be given the anti-malaria tablets as already prescribed in routine orders. This regulation applies to every officer, N.C.O., and man in the Allied Forces. It must be understood that from this date onwards our troops must be equipped to fight malaria as well as the common enemy.

Every soldier should be aware that in becoming a malaria casualty, through neglect of this precaution, he is wilfully endangering his healthy neighbour because of his own infection.

Though the disease itself is readilycurable, any man who fails to take the necessary steps to avoid infection is clearly «letting down» his friends, and is thereby aiding the enemy.

Failure to take reasonable precautions is «not playing the game.» Remember that our foes, so long as they remain to contest this well-watered strip of territory, are also subject to the same malaria handicap. It is our aim to fling them out and chase them overseas. The side which combats the disease most effectively has the best chance of winning the campaign.»

Lt.-Col. J. W. SCHARFF, R.A.M.C.
MALARIAL ADVISER, A.F.H.Q.

Image 4.6: "Message on Malaria Prevention From the "Union Jack" 1942 - 1945." 1942-1945. RAMC 651/3; Papers of Lieutenant Colonel H.D. Chalke, Scrapbook of Newspaper cuttings RE public health in the Central Mediterranean Force, mainly RE campaigns against malaria and venereal disease. The RAMC Muniment Collection in the care of the Wellcome Library, Wellcome Images.

Soldiers who were "neglectful" of their malaria precautions were "willfully endangering" and "clearly 'letting down' their friends.'" These actions would be "thereby aiding the enemy." Malaria was articulated as an obstacle to both sides, and so practicing malaria control would be a weapon to gain advantage against the Axis powers.

One way the education and information programs prompted every soldier "to take responsibility for his own health"[108] was by articulating malaria as a serious enemy and malaria discipline as a duty to oneself and one's fellow soldiers. References to and representations of personal honor, patriotism, duty, family, and middle-class heteronormative idealizations were regularly invoked to motivate soldiers to practice malaria discipline. Malaria's seriousness was articulated through representations of anthropomorphized mosquitoes who were an active military enemy that occupied territory, were able to sneak "behind the lines" and hurt soldiers, and were an ally to the Axis powers but also more powerful than the Japanese or German militaries. In these representations of powerful and malevolent anthropomorphized mosquitoes, Japanese soldiers were often de-humanized.

Frank Mack incorporated all of these themes in his popular cartoons and calendars. He was initially a PFC (private first class) in the Air Force, but while stationed on Espiritu Santo he began drawing cartoons for MECO. Commander Fred Butler, the head Malaria and Epidemic Control Officer requested Mack's reassignment to malaria control in March, 1944.[109] Butler hailed Mack as "our Cartoonist," and noted that "This approval [for reassignment] may require some persuasion, and all attention you can give this will be appreciated. It is certain that Mack is of far more value to the area in

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[108] Harrison, "Medicine and the Culture of Command," p. 438

[109] "Memorandum from Fred Butler to Fred Long RE PFC Frank L. Mack, 36148670, US.; 3 March 1944." 1944. Folder A6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Nov 24 1943 – Mar 4 1944] [Folder 4 of 7]. Container 2: ARC# 5722964. EntryP 90-F: RG 313: NARA College Park.

preparing educational and propaganda matter for malaria control than he could possibly be as a PFC in a bombardment squadron."[110] Mack's 'value' in creating propaganda cartoons and calendars earned him a commendation in 1945:

> For the past twelve months the South Pacific DIALY NEWS had been using Malaria Control cartoons drawn by you to impress upon members of the Armed Forces in the South Pacific Area the need for protection against mosquitoes. You have shown a high degree of originality in putting over this idea, and the two characters you created, DENGUE DAN and MALARIA MOE, are known by practically every soldier, sailor and marine who has ever been in this Area. Very capably you accomplished the task of encorporating [sic] the entertainment feature into a serious theme, so that all hands would enjoy the cartoons while receiving the lesson of mosquito–protection in a sugar–coated pill. I heartily commend you on a job well done.[111]

The "entertainment feature" was central to Mack's work. Similar to Private Snafu, Malaria Moe was a humorous representation of a "regular" soldier who often did the wrong thing and didn't practice malaria discipline:

[110] *Ibid.*

[111] *Ibid.*

Image 4.7: "'Malaria Moe' #34 Sleep under a Net." 194-. Frank Mack. Malaria and Epidemic Disease Control, SoPac No. 34. Reeve 88266-27 National Museum of Health and Medicine Flickr.

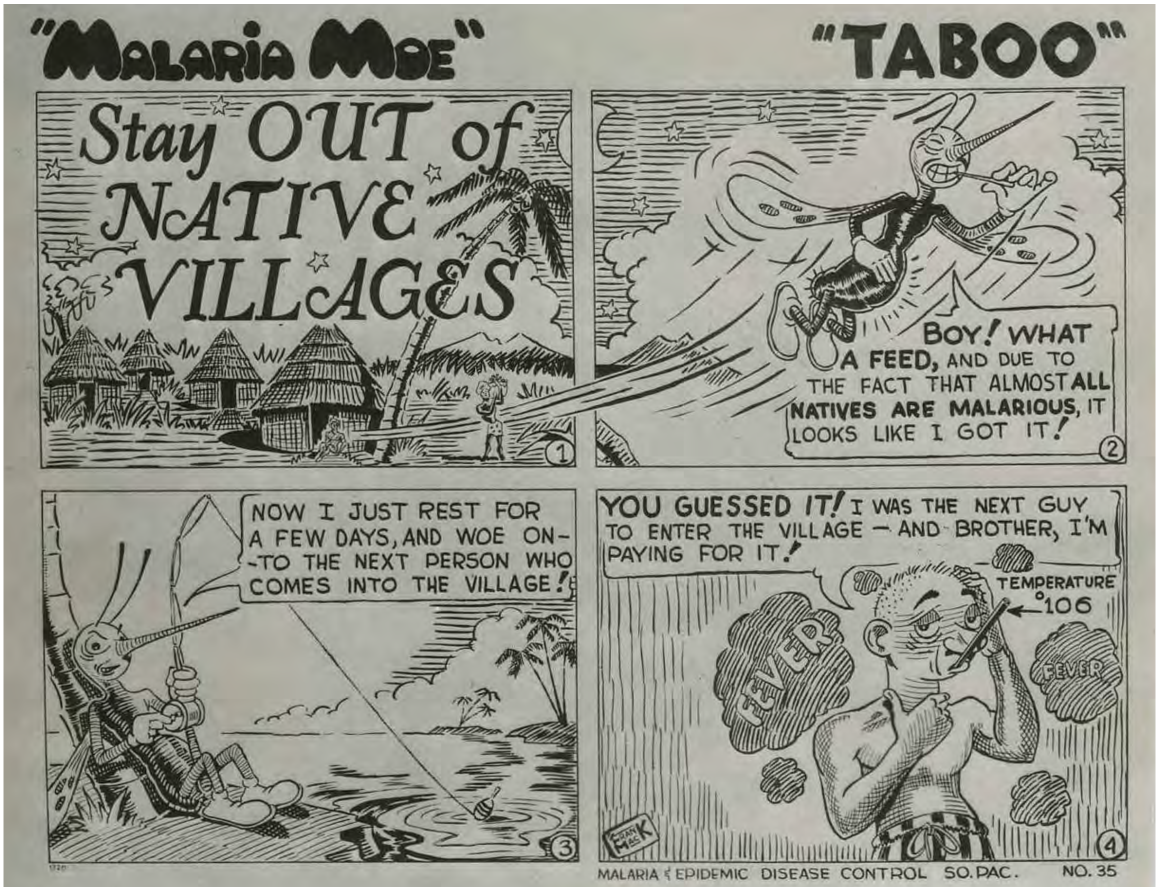

Image 4.8: "'Malaria Moe' #35 Taboo." 194-. Frank Mack. Malaria and Epidemic Disease Control, SoPac No. 35. Reeve 088266-28 National Museum of Health and Medicine, Otis Historical Archives; Flickr.

In both of these strips, Moe is a "dope" who doesn't practice malaria discipline and ends up "paying for it" through the bites of a single malaria carrying mosquito (Taboo) or a swarm of them (Sleep under a net). These strips represented two aspects of malaria discipline that servicemen most resisted complying with: Not visiting local villages and using their sleeping nets.

Malaria Moe wasn't used exclusively to show soldiers what not do; he also appeared in this strip explaining malaria discipline:

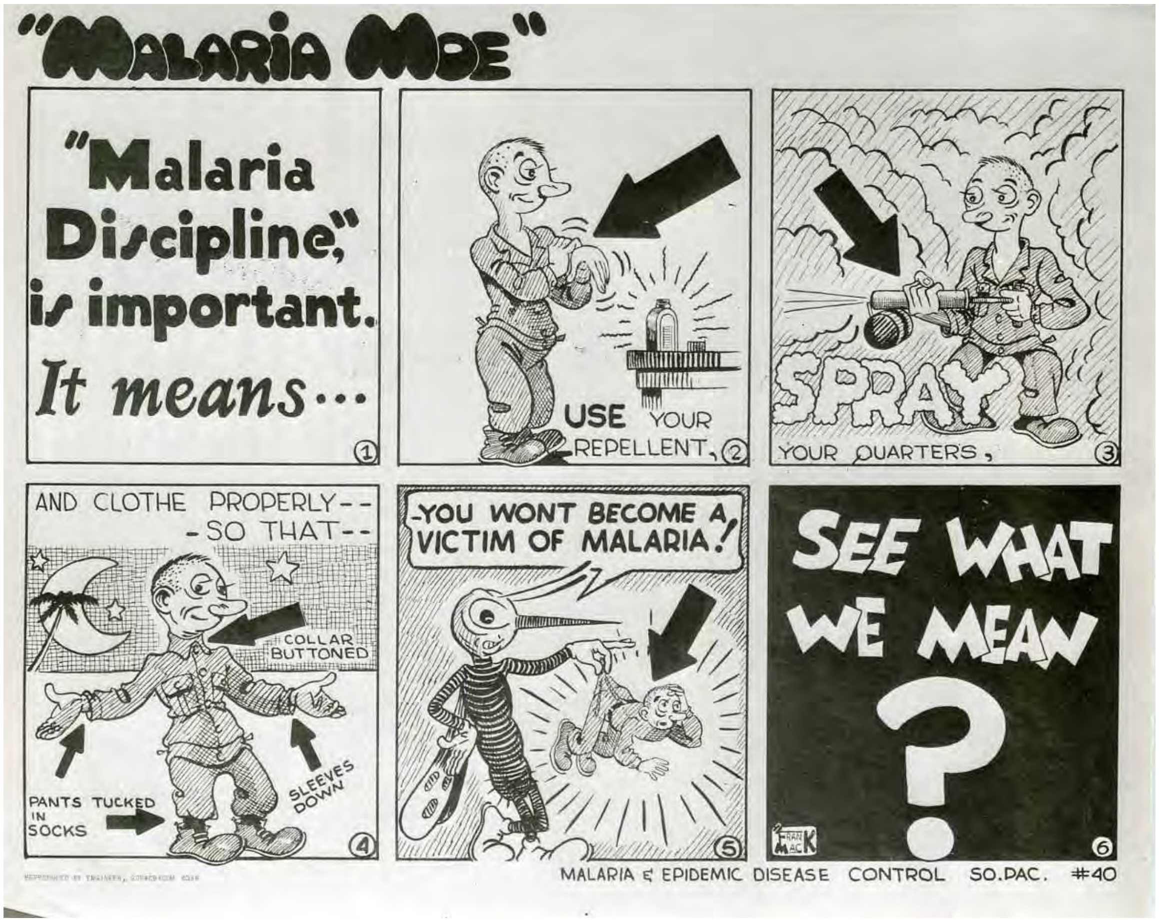

Image 4.9: "'Malaria Moe' Malaria Discipline #40." 194-. Frank Mack. Malaria and Epidemic Disease Control, South Pacific No. 40 SOPACBACOM 2056. 088266-33. National Museum of Health and Medicine, flickr.

Here, three practices of malaria discipline are represented with text and images, linked with direct consequences of not doing them. These Moe strips provided clear, easy to follow, and often amusing articulations of cause and effect.

Malaria as an Enemy

A common trope throughout the information campaign, across all media, was the articulation of malaria as a direct threat to military efforts. The British "Anti–Malaria Campaign" pamphlet began by asserting:

MALARIA is one of the most important health problems in the

> Mediterranean Theatre of War. In Italy, malaria risks have been greatly increased as a result of the interruption of civilian anti–malaria work, and the flooding of large tracts of land by the enemy. Malaria casualties among British troops operating in the theatre last year [1944] amounted to 40,000.[112]

Here, malaria was directly implicated as an effective military tactic that "the enemy" used against the British. Similarly, the educational pamphlet, "Malaria, Mosquitoes, and Men" produced by MECO for its training courses for general servicemen, explicitly linked malaria with the Axis powers in the answer to the query "Is all this talk about malaria important?"[113]

> Yes. You can be as dead from malaria as from shrapnel. You can be made an invalid from malaria for prolonged periods. Malaria can make you weak, puny and good for nothing. Malaria in an army can spoil a campaign. This is fact, not fiction. The Japs know it and so do the Germans. They try to prevent malaria. Whenever they do a better job of malaria control than we do, they stand a good chance of winning a battle.[114]

This response articulates malaria as a weapon that could incapacitate either side: whoever more effectively wielded (or controlled) this weapon would have a great advantage.

In the *Union Jack* insert and the quoted text from "Anti-Malaria Campaign" and "Malaria, Mosquitoes, and Men" cited earlier, malaria was articulated as a neutral enemy, equally impacting all fighting forces in the war. Similarly, in this billboard at a field hospital in Papua New Guinea, the human skulls reminded soldiers that malaria has the same impact as any other kind of combat:

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[112] "Anti-Malarial Campaign Booklet," p. 1

[113] Allied Forces. South Pacific Area. Malaria and Epidemic Disease Control. "Malaria Mosquitoes and Men. Malaria Training Manual, No. 3, 1944 NAVMED 143." 1944. United States. Government Printing Office. History of Medicine Division of National Library of Medicine. NLM Unique ID: 23460100R. , p. 8

[114] *Ibid.*

Image 4.10: "These Men Didn't Take Their Atabrine." 1945. Put up at the 363rd station hospital in Papua, New Guinea. National Museum of Health and Medicine, flickr.

But more commonly in malaria control campaigns, malaria was militarized into an ally to the enemy or another enemy in its own right. Sometimes malaria and the Axis had equal power, but other times malaria was presented as the more powerful enemy.

The "Anti–Malaria Campaign" pamphlet emphasized the seriousness of malaria's threat:

> Malaria can ruin your health permanently; it can destroy the fighting efficiency of any army. . . . If preventive measures are neglected the disease can kill or injure any individual as surely as a bullet; our ability to fight it successfully demands as high a degree of training and discipline as does the technique of modern warfare. . . . *In some ways malaria is more formidable than the human enemy*. Its sphere of activity may cover the whole theatre of operations. It is always threatening you and you can

> never afford to relax your watch. A battle, even a campaign, can be lost without a bullet being fired. History records many instances.[115]

In this pamphlet, malaria was clearly an enemy; a “formidable,” militarized enemy with a “sphere of activity” and wide–ranging “theatre of operations.” The danger and threat of malaria was ever–present and required great vigilance. The passage ends with a reminder that artillery were not always the deciding factor in victory, further reinforcing the importance of personal diligence in maintaining malaria discipline.

Mosquitoes as the Enemy

In addition to emphasizing that malaria was a “formidable” enemy, the information campaign commonly collapsed the malaria parasite and the symptoms it caused onto the malaria vector: the mosquito. The mosquito thus became overdetermined with meaning, a metonymy of the parasite it carried and transmitted. This metonymy also transferred malaria’s status as a enemy to mosquitoes. The information campaigns made mosquitoes a central focus and often represented them as an enemy that was explicitly, intentionally, and actively working against Allied troops.

Historian Edmund Russell has argued that anthropomorphizing the malaria mosquito into an active and deliberate enemy has been a common trope during wartime.[116] This theme continued in the Allies’ visual culture campaign articulating the dangers of malaria. The mosquito was often represented as an anthropomorphized and

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[115] “Anti-Malarial Campaign Booklet,” p. 3 Emphasis added.

[116] Edmund P. Russell, “”Speaking of Annihilation”: Mobilizing for War Against Human and Insect Enemies, 1914-1945,” *The Journal of American History* 82, no. 4 (1996).; Edmund Russell, *War and Nature: Fighting Humans and Insects With Chemicals From World War I to Silent Spring (Studies in Environment and History)* (Cambridge University Press, 2001-02-12).

militarized foe who required as much attention as the human enemies: The pamphlet MECO distributed to servicemen "Malaria Mosquitoes and Men" noted, "In malarious places it is just as necessary to beat the mosquito [as it is] to beat the enemy."[117] The enemy included both mosquitoes and the Axis forces.

The information campaigns commonly articulated malaria mosquitoes as a spatially-situated enemy who actively occupied its territorial holdings, as in this road sign:

Image 4.11: "Enemy Territory Mosquitoes Attack Here." 194-. Signal Corps, U.S. Army. National Museum of Health and Medicine, Otis Historical Archives, flickr.

Soldiers were repeatedly reminded that mosquitoes were actively trying to do them harm.

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[117] Allied Forces. South Pacific Area. Malaria and Epidemic Disease Control, "NAVMED 143," p. 8

The mosquitoes represented in the information campaigns didn't only occupy their own territory but regularly infiltrated past "the lines" of combat; their range of flight expanded the spaces of war and regularly created "peril behind the lines."

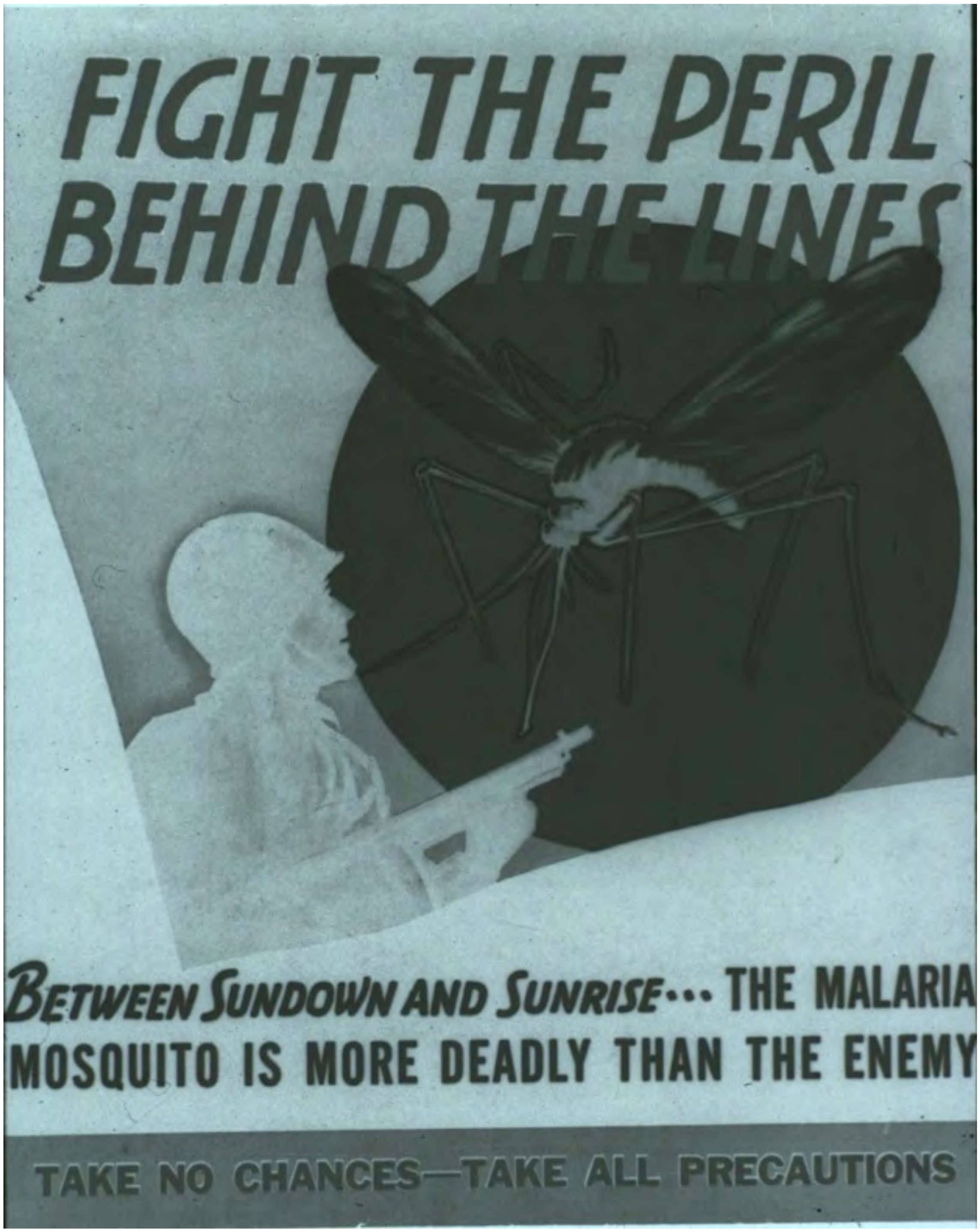

Image 4.12: "Fight the Peril Behind the Lines." 1943. U.S. G.P.O. Images from the History of Medicine (NLM).

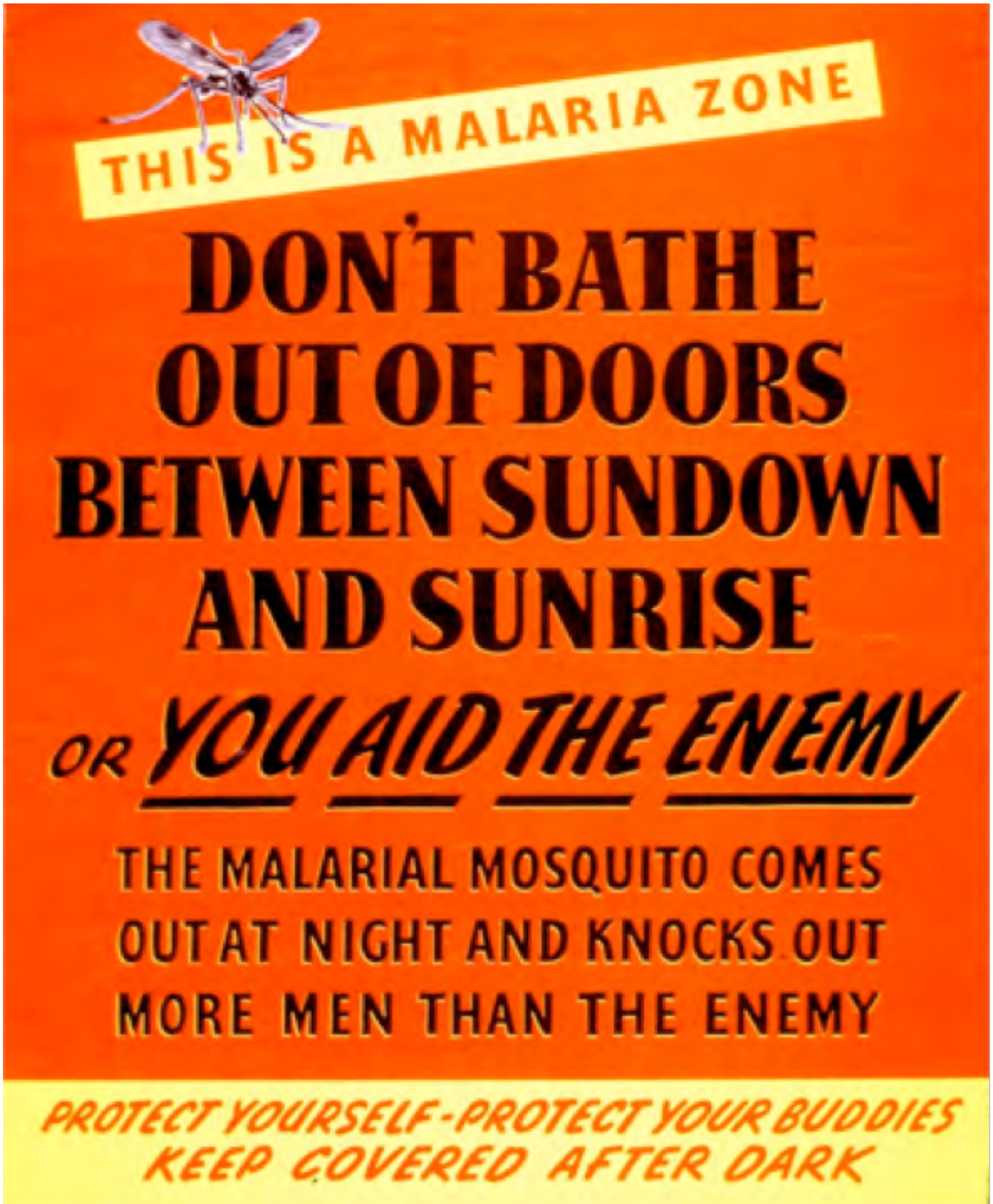

Image 4.13: "This is a Malaria Zone Protect Yourself, Protect Your Buddies, Keep Covered After Dark." 19--. United States? Images from the History of Medicine (NLM).

All three of these images (images 4.11, 4.12, 4.13) emphasized the spatial aspects of malaria transmission and in so doing expanded the territories of combat to include these zones of transmission. The blue “Fight the Peril behind the Lines” and red “This is a Malaria Zone” posters also specified the temporal parameters of combat: malaria mosquitoes were represented as large and powerful enemies at night. These two posters explicitly articulated the malaria mosquito as a foe more effective at causing Allied casualties than the Germans and Japanese armies. In both, the impressive power of the mosquito was represented through its disproportionally large size.

In addition to distorting their size, mosquitoes were often anthropomorphized into sentient beings with malicious intent and knowledge about the Allied’s tactics, which they would use to their advantage. As in the Malaria Moe strips presented earlier (images 4.7-9), mosquitoes were commonly given dialogue and often clothed. In the following Malaria Moe strip, an anthropomorphized mosquito emphasized to soldiers that they needed to take the threat and power of mosquitoes seriously, using tanks and bullets as analogies:

Image 4.14: "'Malaria Moe' #41." 194-. Frank Mack. Malaria and Epidemic Disease Control, South Pacific No. 41. Reeve 088266-34. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr.

Mack's mosquito spoke as a representative of a larger fighting force — "we mosquitoes," "our bite" — that targeted undisciplined men "behind the lines." There were no safe spaces from this dangerous enemy, only best practices. In the "Malaria Moe" strip called "Moe gets the, 'word,'" the malaria mosquito is not just in combat areas, but areas around camp in tin can dumps as well as fire pits:

Image 4.15: "'Malaria Moe' #38 Moe Gets the 'Word'." 194-. Frank Mack. Malaria and Epidemic Disease Control, South Pacific. SOPACBACOM 2056. Reeve 088266-31. Source collection: OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr.

Mack's malaria mosquito was actively working to deceive and undermine the Allied war efforts by discouraging a soldier from practicing malaria discipline. Moe was reminded that there were no areas outside of danger and peril caused by malaria mosquitoes.

Dehumanizing the Japanese

In emphasizing the strength and power of malaria mosquitoes, the malaria discipline information campaign often highlighted that malaria caused more casualties than the human enemy (see images 4.12 "Fight the Peril Behind the Lines" and 4.13

"This is a Malaria Zone"). This threat was represented though anthropomorphizing mosquitoes in all theaters of combat. But in the visual culture of the information campaigns tailored to soldiers stationed in the South Pacific, these depictions were paired with representations of the Japanese military and culture as non-human or less-than-human. Sometimes the malaria mosquito and Japanese military were presented as equivalencies, as in this poster by Lynn Brudon:

Image 4.16: "Hiroskito Speaking. Japan Expects Every Saboteur to Do His Duty." 1945. Lynn Brudon, United States. REEVE 088546-6. National Museum of Health and Medicine. flickr

In this poster, the mosquitoes are in the service of the Japanese, led by a Japanese soldier identified as Hiroskito. His Japanese-ness is signified through his face, his 'pidgin' English, the small flag attached to his hat, the circles on his wings that resemble the flag, the circle he is standing in front of, and the sword attached to his waist. He is also clearly a hybrid of insect and man, as indicated by his name (a portmanteau of Hirohito and mosquito), with the arms, shoulders, head, and neck of a human and the thorax, wings, and legs of a mosquito. Not only are the Japanese and malaria mosquito collapsed into a single enemy, but not taking the prophylactic medication atabrine (an aspect of malaria discipline) is equated with sabotage.

This collapsing of mosquitoes and the Japanese soldier was repeated in yet another poster that also placed responsibility for the presence of the mosquito squarely on the actions of soldiers:

Image 4.17: "Man-Made Malaria: 6 Mosquitoes in 10 Breed in Water (Navymed 364)." 1945. Navy, Bureau of Medicine and Surgery. Government Printing Office. Images from the History of Medicine (NLM).

As with the Lynn Brudon poster above, here the allegiances between the Japanese and mosquitoes are also signaled by the iconography of the flag on its wings. Soldiers have caused the majority of malaria-carrying mosquitoes with carelessness and undisciplined behavior. Actions (or inactions) helped mosquitoes, and equally aided the Japanese.

The allegiance between mosquitoes and Japanese against the US was a common theme. In the following images by Frank Mack, the figure of Uncle Sam with his iconic American Flag outfit is holding a malaria mosquito and a Japanese soldier tied to a bomb:

Image 4.18: "July 1944 Calendar." 1944. Frank Mack. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineer Section, HQ. S.O.S. 1508. Folder: Malarial Control - General 1943-45. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945; Malaria Control Dept 2655. 1944-45 THRU MED 1303, 1944-45 THRU MED 1303; Container #2563. Record Group: 0492 Mediterranean Theater of Operations, United States Army; Records of the Special Staff; Medical Section, Office of the Theater. NARA College Park.

The calendar also substitutes an exploded shell stands in place for the number four, suggesting that the fuse that Uncle Sam is holding a match to will ignite and kill these enemies on July 4th. In this next image, Uncle Sam again is shown restraining a mosquito and Japanese soldier, this time with his hands alone. The soldier held by Uncle Sam resembled General Hideki Tojo:

Image 4.19: “Enemies Both! It’s Your Job to Help Eliminate Them (Color).” 1944. Frank Mack. Navy, Bureau of Medicine and Surgery, NAVMED 145-D: U.S. Government Printing Office.

This grouping of the mosquito and Japanese soldier and extreme the exaggeration of the mosquito's size conflated their threat and marked them as equals, suggesting that they should be understood as equally dangerous. The swastika pin on Tijo's right arm also marked the malaria mosquito as enemy working with all the Axis powers.

This next poster continues the distortion of the size of the mosquito and extends it further:

Image 4.20: "Is Your Organization Prepared to Fight Both Enemies?" 1945. Navy, Bureau of Medicine and Surgery, NAVMED 365: United States. Government Printing Office. Images from the History of Medicine.

The mosquito was represented as significantly larger than the caricature of a Japanese soldier, with two of the mosquito's legs extending beyond its frame. This discrepancy in size reflected the discrepancy in damage the red cards convey, that for every casualty caused by the Japanese, malaria caused eight.

All five of these posters articulated explicit connections between the Japanese army and malaria mosquitoes. The first ones conflated them completely, with the mosquito having caricatures of Japanese features. The two that followed used the figure of Uncle Sam to tie mosquitoes and Japanese soldiers together as enemies. The Japanese were dangerous and continued to be a threat, but they and their power were overtaken by the malaria mosquito, as the last poster in this group suggests. These posters worked to show (and remind) servicemen about the danger of malaria, articulating motivations for practicing malaria discipline.

Malaria Discipline

In addition to articulating the damage malaria and malaria mosquitoes could cause, the information campaigns also focused explicitly on malaria discipline. One method of encouraging malaria discipline was through disassociation, i.e. making soldiers who failed to adopt good habits look foolish:

Image 4.21: "Don't be a Dummy-- Avoid Malaria Keep Covered, Use Repellent!" 1944. Government Printing Office. Images from the History of Medicine (NLM).

Here mosquitoes performed military drills on a captured and hapless soldier to improve their techniques. The soldier's lack of appropriate clothing at night (and implied lack of insect repellent) marked him as a soldier lacking malaria discipline, and thus acting like a "dummy." Service personnel were again reminded that mosquitoes didn't respect traditional spaces of battle and that they needed to practice malaria discipline "behind the lines."

In this Lynn Brudon poster, not taking malaria discipline seriously is articulated with incomprehensible and foolish Japanese logics:

Image 4.22:"Some Things Are Hard to Understand." 1945. Brudon, Lynn. United States. REEVE 088546-8. National Museum of Health and Medicine. flickr

It is worth repeating that convincing soldiers to practice malaria discipline was seen as a sales pitch. The job of the information campaign around malaria discipline was one of marketing and advertising, designed to compel enlisted men to change their behavior. In analyzing how visual discourses produce meaning, Stuart Hall has asserted the "broader cultural 'effects' [of visual discourses] have to be seen in terms of how meaningful discourses construct what is held to be 'normative', which of course regulates conduct, but in ways which cannot be reduced to or empirically measured as a behavioural impulse."[118] Brudon's poster represented a reality where practicing malaria control was natural, logical, and American; malaria discipline was the normative behavior. It made sense to do so in ways that should have been easy to understand, and so, not adhering to malaria control practices became as silly as ill-constructed Japanese cabinets. Malaria discipline was equated with good American common sense; malaria discipline was Self and not doing so becomes Other. Similarly in Mack's Malaria Moe strips, Moe was understood as foolish, not the figure subjects would want to identify with.

In continuing the work of articulating malaria discipline as normative, another campaign strategy was to make correctly practicing malaria discipline attractive:

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[118] Hall, "Introduction to Part III," pp.310-11

Image 4.23: "Advice to British Soldiers About Malaria. Coloured Pen Drawing By Copp, Ca. 1944." no. 5435i.1944. The Wellcome Library, London.

The suggestion here was that soldiers would want to identify themselves with the suave looking soldier on the bottom. He was given the entire bottom half of the poster, rather than the smaller characters who share the top half of the panel. His sophistication was indicated by the neatness of his dress, the pipe, as well as the cursive writing that surrounds his body: Note the block printing under the inept soldiers above him. Properly practicing malaria discipline was made to 'make sense' in this poster through constructing and drawing upon a 'normative' assumption that all men would want to identify with the soldier represented on the bottom half.

These posters, strips, and calendars were technologies of persuasion that tried to "sugarcoat" and "sell" soldiers on incorporating and naturalizing the practices of malaria discipline into their lives. So far, I've discussed the dis-incentives that Malaria Moe and Lynn Brudon's posters provided as well as the debonair qualities of malaria discipline. These posters and cartoon strips used images of men and mosquitoes. But, perhaps the most well-known malaria discipline images from World War II featured representations of women and female mosquitoes.

Theodor Geisel (Dr. Seuss) worked only briefly on malaria discipline during his time working for the War Office, but he created some of the most well known and iconic malaria discipline campaigns with Monroe Leaf.[119] Unlike Mack's gendered masculine mosquitoes, Geisel's materials drew upon the role of female mosquitoes as the vector malaria transmission:

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[119] Philip Nel, "Children's Literature Goes to War: Dr. Seuss, P. D. Eastman, Munro Leaf, and the Private Snafu Films (1943–46)," *The Journal of Popular Culture* 40, no. 3 (2007).; See also McCoy, "War Department Provisions," p. 51; Minear, *Dr. Seuss Goes to War*; Rachel Elise Wacks, ""Don't Strip Tease for Anopheles": A History of Malaria Protocols During World War II," The Florida State University, Master's thesis, 2013; Beaubien, Jason, "How the US Stopped Malaria, One Cartoon At a Time." *NPR*, December 12, 2012.

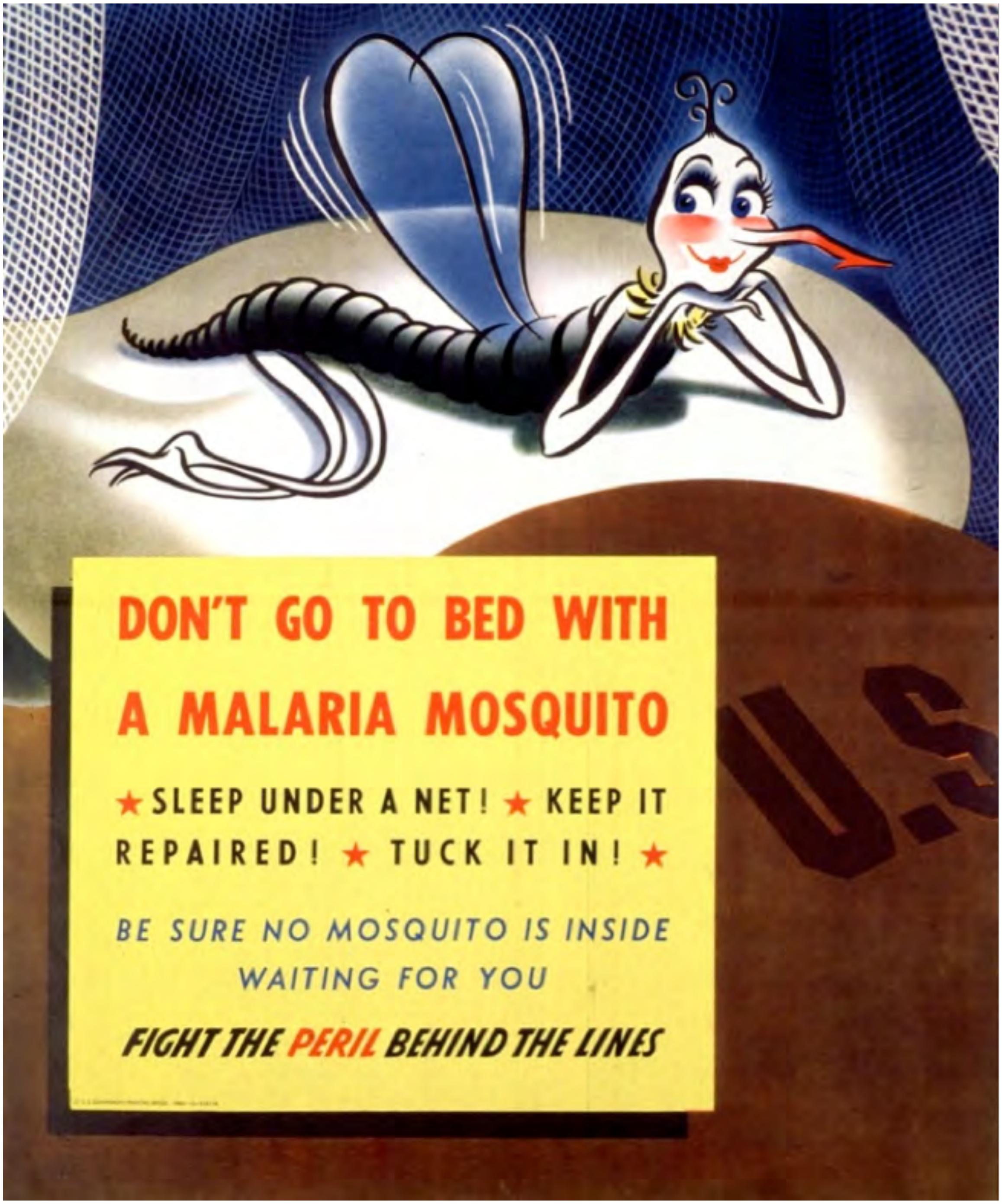

Image 4.24: "Don't Go to Bed With a Malaria Mosquito." 1944. U.S. G.P.O. Images from the History of Medicine.[120]

This poster harkened more to venereal disease ad campaigns in which images of beautiful, sexy women represented danger. Here, the female mosquito had already made

[120] This poster is widely believed to be created by Geisel but hasn't officially been credited to him.

it "behind the lines" into a soldier's sleeping tent. Servicemen were reminded that she may have the (animated) mosquito's equivalent of a cocktail dress and make-up, but only "peril" will come from a soldier sleeping with this waiting lady.

In perhaps the most well-known anti-malaria cartoon, "This is Ann," the Anopheles Mosquito is given the sobriquet of Ann. Created at the request of the Surgeon General in the Summer of 1943 for troops in the South Pacific, Geisel drew the images and the text was produced by Munro Leaf, although they are not credited "because [they] were both in uniform."[121] As an author in the Army's history of malaria control in WWII notes, "This is Ann" was "well received and widely publicized and distributed. Several million copies were printed before the end of the war."[122] "This is Ann" appeared in multiple forms: a booklet and on the backside of a November 1943 NewsMap edition:[123]

[121]Geisel, Theodor. "Handwritten note." Folder: US Army - Drawings "This is Ann" Booklet about protection against/ Malaria, illustrated by TSG. Published by War Department/ [2926] MSS. 230; Box 1; Folder 36. UC San Diego Library Special Collections.; See also Nel, "Children's Lit Goes to War."

[122] McCoy, "War Department Provisions," p. 51

[123] *Ibid.*

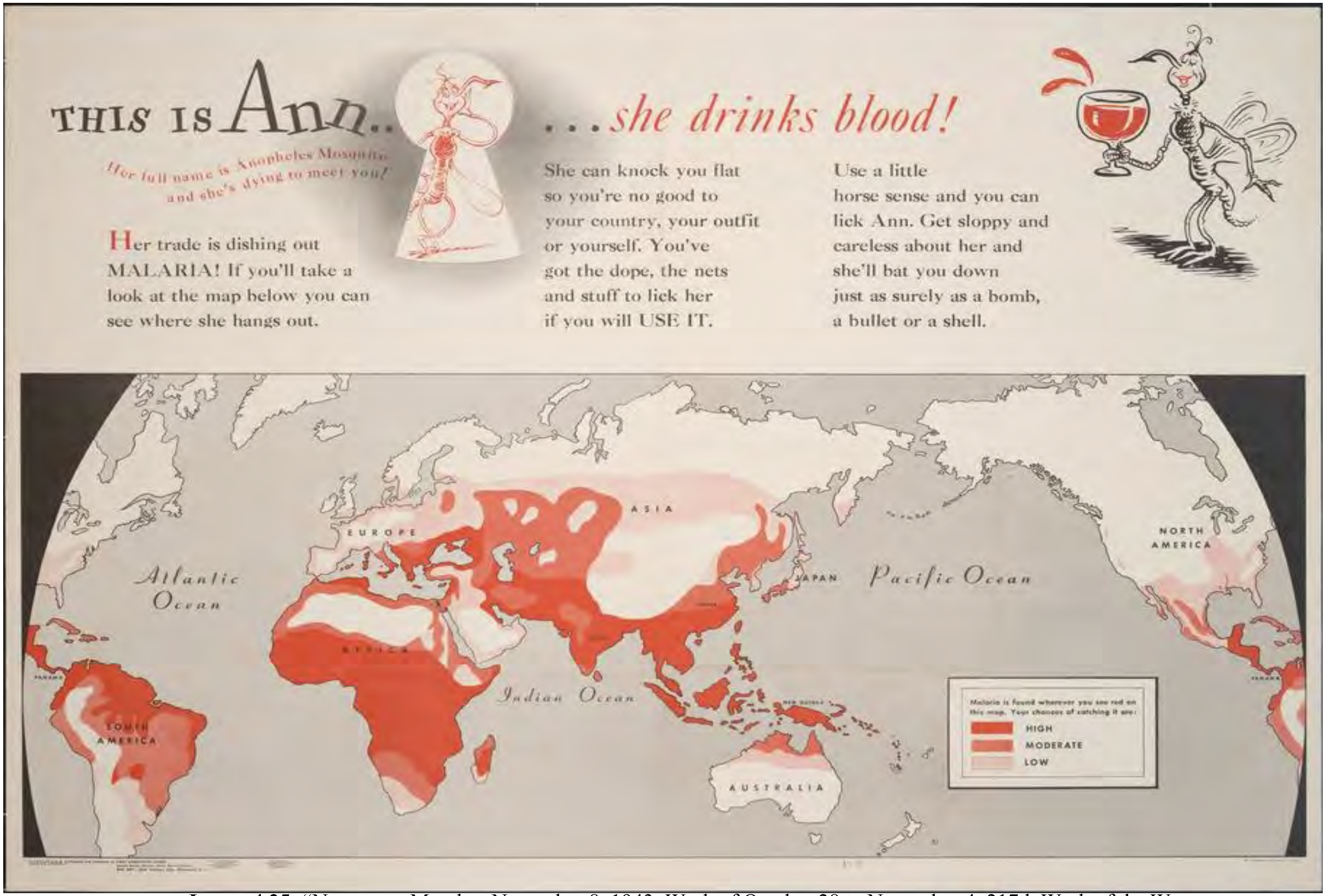

Image 4.25: "Newsmap. Monday, November 8, 1943: Week of October 28 to November 4, 217th Week of the War, 99th Week of US Participation." 1943. United States. Army Orientation Course. UNT Digital Library.

Like the "Malaria Moe" strip in which the mosquito stated that his bite was as serious "as any weapon in the book" and could send soldiers to the hospital "as quick as a bullet," here Ann's power is equalled to that of "a bomb, a bullet, or a shell."[124] Her reign, power, or domain was spread all over the globe, with the areas in which she was most powerful marked in red. Also, the red text of "she drinks blood" and the blood in the goblet the mosquito is holding were both also the same shade as the areas identified as where "your chances of catching it" were high.[125] The red coloring identified areas where Ann drank the most blood; the globe was marked by her attacks. This map and accompanying text articulated for its readers the places where malaria discipline most needed to be practiced.

The more common form of "This is Ann" was a fourteen-centimeter, thirty-two page booklet. Its small size meant soldiers could easily stuff it in a pocket or pack to be read and re-read. In designing the "This is Ann" campaign, Leaf has said he believed "GIs would read a comic book, particularly one that was a little racy, whereas they wouldn't read olive-green manuals of which they had hundreds."[126] Leaf and Geisel wanted soldiers, regardless of education level, to have a better understanding of the connection between mosquitoes and malaria.[127]

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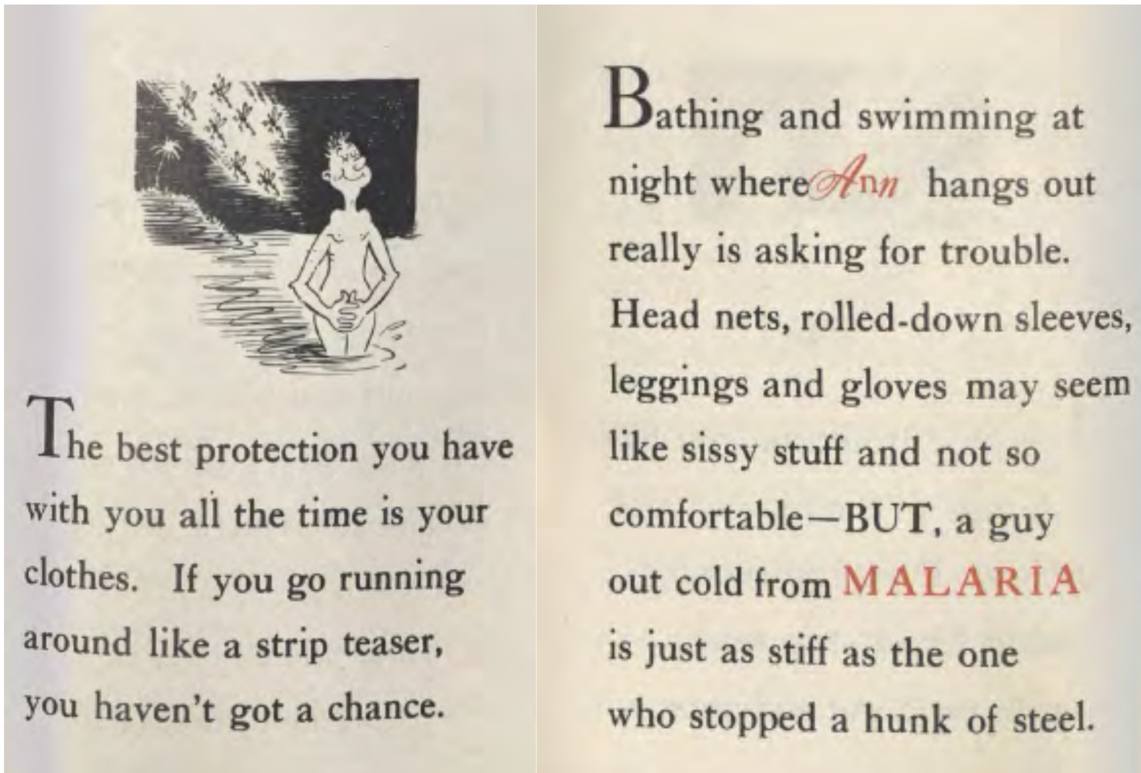
[124] *Ibid.*
[125] *Ibid.*, p. Sequence 2
[126] Nel, "Children's Lit Goes to War," p. 470
[127] *Ibid.*

Image 4.26 and 4.27: *This is Ann: She's Dying to Meet You.* Theodor S. Geisel and Munro Leaf. (Washington D.C.: United States War Department, U.S. Government Printing Office, 1943). UC San Diego Library Special Collections.

In both presentations of "This is Ann," Geisel and Leaf used a familiar figure in the dangerous woman to engage the attention of soldiers. Leaf and Geisel intended Ann to be "racy": In the text she is described as "a real party gal," who "really gets around" and "drinks blood."[128] Ann's promiscuity might have made her popular, but she was dangerous and potentially grotesque, two themes familiar to solders from venereal disease posters. Similar to Hackett's pamphlet, "This is Ann" told enlisted men that malaria control and malaria discipline were not just the job of the "anti-Malaria combat units [who] carry on a steady battle by draining and filling ditches and pools where

[128]*Ibid.*

Anopheles mosquitoes breed. . . . [because] in many places we have to go in this war [these units] can't do any more than help."[129] Geisel and Leaf described and depicted the components of malaria discipline that was the responsibility of every soldier.



The best protection you have with you all the time is your clothes. If you go running around like a strip teaser, you haven't got a chance.

Bathing and swimming at night where Ann hangs out really is asking for trouble. Head nets, rolled-down sleeves, leggings and gloves may seem like sissy stuff and not so comfortable—BUT, a guy out cold from MALARIA is just as stiff as the one who stopped a hunk of steel.

Images 4.28 and 4.29: Pages from *This is Ann: She's Dying to Meet You.* Theodor S. Geisel and Munro Leaf.

Geisel and Leaf used humor and simple, informal language to articulate the power of malaria mosquitoes and the importance of practicing malaria discipline for soldiers. They were reminded that malaria was as deadly an enemy as a bullet or shrapnel, and malaria discipline wasn't silly or "sissy" but essential. Not practicing malaria discipline was foolish behavior and it was important to integrate all aspects of the practice. Geisel and Leaf explained the behavioral changes every soldier needed to make such as wearing

[129] *Ibid.*

gloves and long-sleeved shirts, avoiding Native camps at night, and using bed nets:

Image 4.30: Pages from *This is Ann: She's Dying to Meet You.* Theodor S. Geisel and Munro Leaf.

But as with the earlier interventions into sleeping practices I discussed above, soldiers needed to consciously set up sleeping nets and position their sleeping bodies properly:

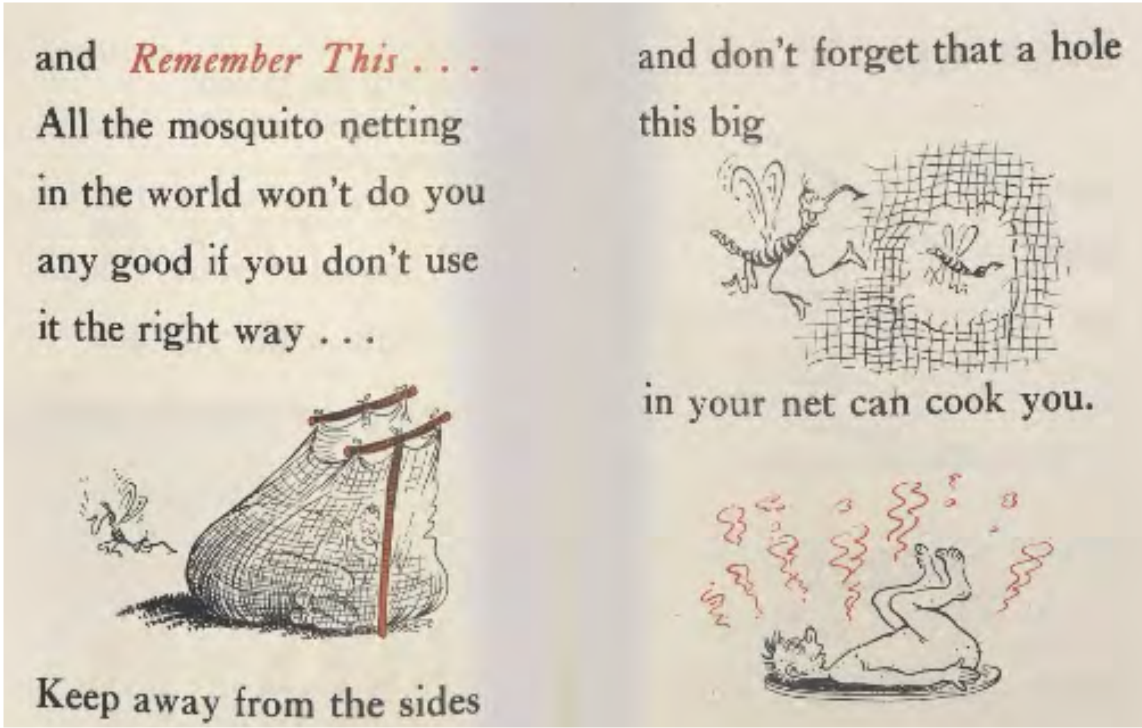
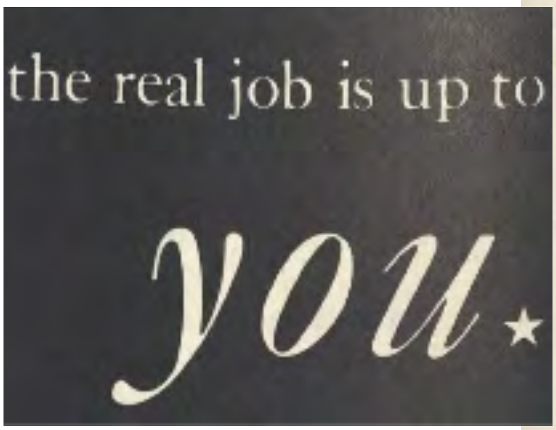


Image 4.31: Pages from *This is Ann: She's Dying to Meet You.* Theodor S. Geisel and Munro Leaf.

These panels use images and text to create a visual cause and effect relationship between malaria transmission and sleeping practices. Even though they are small and silly-looking, mosquitoes take advantage of any opportunity afforded them and the harm they cause is serious.

Similar to Hackett's pamphlet, throughout *This is Ann*, a second-person narrative was used. The repeated use of "you" directed the story and message to each reader, involving and bringing them into the narrative and the responsibilities and actions Seuss and Leaf were representing. Rather than using a generalized omniscient narrator, or a narrative without an explicitly mentioned subject (as in "it is important to practice malaria discipline"), Seuss and Leaf tailored their narrative to the reader, making the reading subject a more active participant in creating malaria discipline practices. This narrative construction created an active, explicit, and reflexive dialogue between the reader and the authors (e.g. it is important that *you* practice malaria discipline). And by identifying with the "you," the reader would be acknowledging their subject position. Seuss and Leaf make explicit the responsibilities that are required by that subject position, at the close of the booklet:



Images 4.32 and 4.33: Pages from *This is Ann: She's Dying to Meet You.* Theodor S. Geisel and Munro Leaf.

Every soldier reading "This is Ann" was called out and explicitly made the subject being addressed by the booklet's directives to be responsible and practice malaria discipline.

Seuss and Leaf's Ann humorously evoked the theme of dangerous women used in venereal disease campaigns. Frank Mack's calendars and Malaria Moe strips also used humor and representations of women, but the women weren't the focus of amusement, rather the focus was the actions of mosquitoes and the presumed viewers. A common

Mack trope was of scantily-clad, "luscious pin-up girls":

Image 4.34: "'Malaria Moe' #36 What a Guy Does Watch His Health, if He's a Smart Guy." 194-. Frank Mack. Malaria and Epidemic Disease Control, SoPac. Reeve 088266-29. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr.

In the first panel, Moe stands behind an officer and renounces the need for atabrine because mosquitoes aren't scary. But upon seeing "a goil" in the third panel, he immediately complies and then advocates atabrine's health benefits. Rules and command hierarchies didn't convince Moe, but a beautiful nurse did.

In some of Mack's calendars, women were depicted as practicing good malaria discipline and thwarting malaria carrying mosquitoes, as with the three following examples:

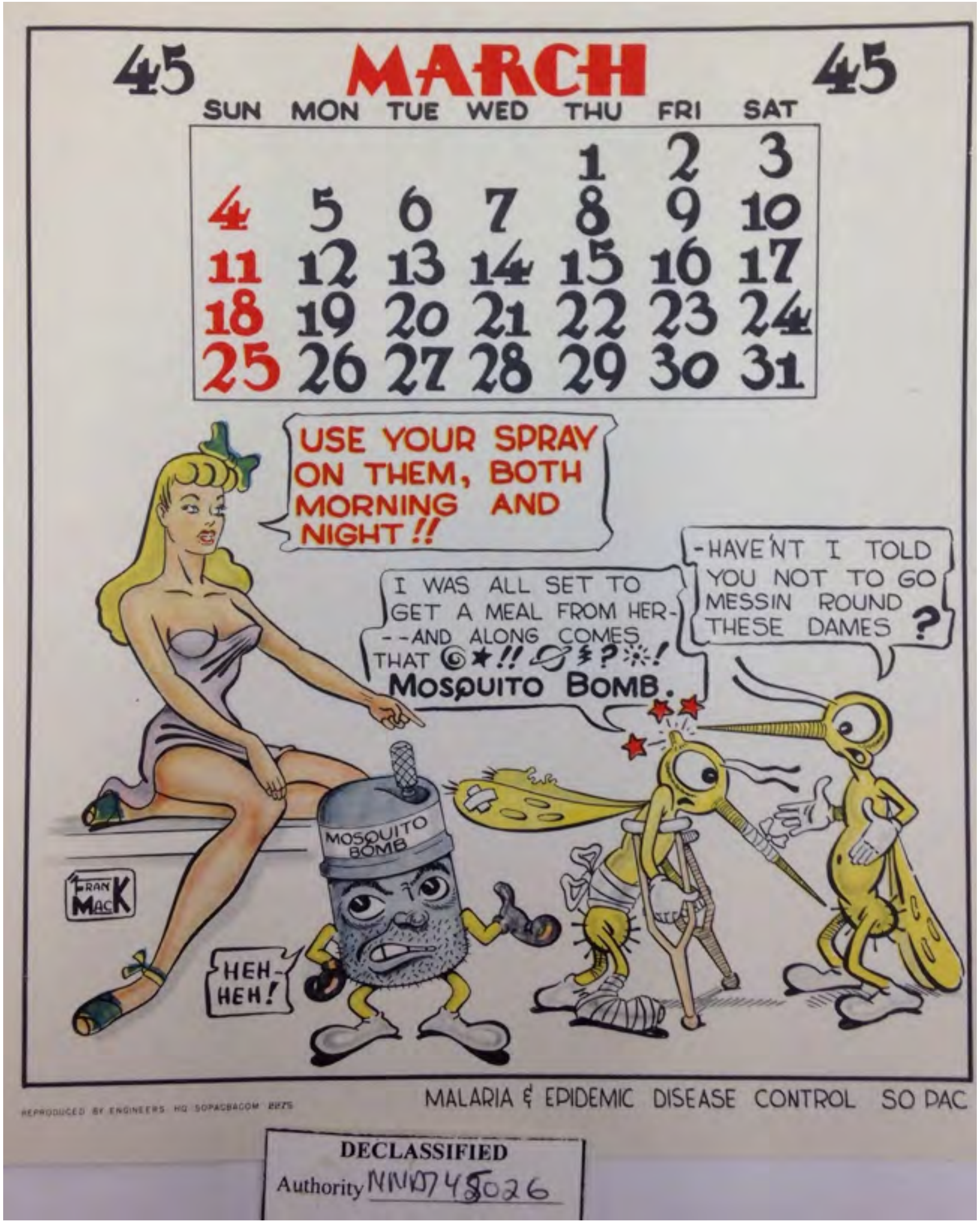


Image 4.35: "March 1945 Calendar." Frank Mack. March, 1945. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineers HQ SOPACBACOM 2275. [Folder 3 of 6] Prevention of malaria in Military and Naval Forces in the South Pacific, 1944; Container 15. [P2-3] [Malaria and Epidemic Control in South Pacific Areas, 1942-1944]. RG 313: NARA College Park.

Image 4.36: "October 1944" Frank Mack. Calendar. Malaria and Epidemic Disease Control, South Pacific. Reproduced by Engineer, SOPACBACOM (South Pacific Base Command) 1828." 1944. Malaria and Epidemic Disease Control, South Pacific SOPACBACOM. Reeve 088266. OHA 80 WWI / Reeve Photograph Collection, 1917-1953. National Museum of Health and Medicine, Otis Historical Archives. flickr.

Image 4.37: "June 1944 Calendar." 1944. Frank Mack. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineer Section, HQ. S.O.S. 1508. Folder: Malarial Control - General 1943-45. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945; Malaria Control Dept 2655. 1944-45 THRU MED 1303, 1944-45 THRU MED 1303; Container #2563. RG 0492 Mediterranean Theater of Operations, United States Army; Records of the Special Staff; Medical Section, Office of the Theater. NARA College Park.

These calendars all feature two mosquitoes with gloves and shoes whose desire for the scantily-dressed beautiful woman was denied by mosquito repellent. Mack's images here worked to articulate malaria discipline and mosquito control as sexy. These representations are similar to those drawn by soldiers on the noses of planes and in typical "pinup" calendars of the time, but linked malaria control to the larger war.[130] Mack's calendars were engaging a particular subject, a presumed heterosexual man, who like the mosquitoes, would also desire these women. Even though she was an object to be desired, both by soldiers and mosquitoes, these images encouraged soldiers to mimic her actions rather than solely identify with and mimic the mosquitoes.

Mack's calendars also used women as incentives or motivation to practice malaria discipline. Soldiers had a responsibility not just to the war effort and the military's needs but to their loved ones to practice malaria discipline:

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[130] Murphy, "Malaria Pinup Calendars."

Image 4.38: "December 1944 Calendar." December 1944. Frank Mack. Malaria and Epidemic Disease Control, South Pacific SOPACBACOM 2210. Reeve 88266-5.jpg. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr.

Image 4.39: "May 1945 Calendar: If You Don't Give a Darn About Yourself Do it for Her." 1945. Frank Mack. Malaria & Epidemic Disease Control -- SOPAC. United States, Army. Images from the History of Medicine. National Library of Medicine.

These images both depict framed photos, the one in Image 4.38 presumably in a soldier's tent and of a woman at home and the one in Image 4.39 of a women's bedroom and the photo is of a soldier at the front. The images in both calendars invoked a world away from combat and linked malaria discipline to that world. These barely-dressed women suggested additional or external motivation to practice malaria discipline. This additional motivation was made explicit in the May 1945 calendar with the text "If you don't give a darn about yourself — Do it for her!" Mack's drawings "sugarcoated" malaria discipline through articulating the practices as sexy or desirable and important to the women at home "dreaming" about their GIs.

Imagined Futures

Mack's calendars frequently referenced the spaces outside of combat, expanding the contexts that called for malaria discipline. The reward of a healthy life after the war was a promise articulated across the information campaign, not solely by Mack and Hackett: The British "Anti-Malaria" directives asserted that "the degree of attention paid to the principles and requirements outlined in this pamphlet may mean, for the reader, the difference between chronic illness and health, between a long life and a short one."[131] This strategy of alluding to an improved future life as a motivation for present discipline is also prevalent in advertising. For Stuart Hall, "advertising often presents an image of things to be desired, people to be envied, and life as it 'should be.' As such it necessarily presents social values and ideologies about what the 'good life' is. It is also a central strategy of advertising to invite viewers/consumers to imagine themselves within the world of advertisement."[132] Mack's calendars presented a future of desirable objects, enviable people, and a 'good life' that included beautiful women for those who practiced

[131] "Anti-Malarial Campaign Booklet," p. 1

[132] Marita Sturken and Lisa Cartwright, *Practices of Looking: An Introduction to Visual Culture* (Oxford University Press, 2001). , p. 189

malaria discipline now:

Image 4.40: "June 1945 Calendar: Don't Spoil a Good Dream Sleep Under a Bed Net." 1945. Frank Mack. Malaria & Epidemic Disease Control -- SOPAC. Reproduced by Engineers HQ SOPACBACOM United States, Army. Images from the History of Medicine. National Library of Medicine.

Image 4.41:“May 1944.” 1944. Frank Mack. Malaria & Epidemic Disease Control, SoPac, Reproduced by Engineers Section HQ S.O.S. 1271. Norm Brailey Collection: “Practice Malaria Discipline Now” Image courtesy of Norm Brailey.

The May 1944 and June 1945 calendars have a similar form: a beautiful woman in the center of the calendar who is surrounded by activities and events for a future life in a cloud. These imagined future events include marriage, a baby, drinking beer, going to the track, hunting, fishing, playing golf, and having a dog. The mosquito bomb in the lower right corner makes these "Post War Plans" possible in the May 1944 calendar, while not having a bed net to deter a dive-bombing (possibly anal-penetrating) mosquito threatens that dream in the June 1945 calendar. Both calendars "sell" the idea of a future self, one that is dependent upon practicing malaria discipline during the War. Whether they would be able to achieve a healthy, malaria-free post-war life depended solely on responsibly practicing malaria discipline now. Mack's calendars "sold" malaria discipline as not just important for the spaces of combat, even as those spaces were extended into tents, mess halls, and swimming holes, but also for domestic spaces and essential for a particular ideal future of success and prosperity.

Spaces and Technologies of Health

By November of 1944, the Base Malaria Control Inspector for Espiritu Santo noted "An appreciable improvement in malaria discipline and observance of malaria control regulations . . . [and that] the base as a whole is well disciplined and personnel seem to be properly indoctrinated in malaria control methods."[133] Enforcement was a key component of malaria discipline, but this oversight of the soldiers' behavior and hygienic practices was intended to decrease over time as the values and practices of malaria

[133] "Base Malaria Control Inspector report Nov 1944," p. 8

discipline became instilled and naturalized in each soldier. However, regulations were not enough to lower malaria rates and effectively change soldier behavior.

As I've discussed, initially malaria and malaria discipline were articulated to servicemen through regulations and punitive measures. These regulations intervened in daily bodily practices during both combat and non-combat — requiring for example, the precise application and reapplication of insect repellent, as well as the manner in which soldiers slept. Servicemen resisted incorporating this articulation of malaria discipline into their daily routines: A September 1943 Memo about "Malaria Control" had rebuked soldiers and their commanding officers for not complying with "with existing orders on malaria control, *particularly the wearing of the uniform.*"[134] Soldiers continued to visit native villages, bathe, and swim at night, and they were not regularly and properly using bed nets and insect repellent.

Military officials credited an aggressive information campaign with contributing to the increase in malaria discipline. For example, Cushing credits "the use of attractive posters, the distribution of interesting informational pamphlets, and the showing of motion pictures, coupled with perhaps an attack or two of bone-rattling chills," as helping enlisted men become "malaria-conscious and unit commanders finally [obtaining] a fair degree of malaria-control discipline among troops."[135] As Cushing notes, the information campaign encompassed different media, thus prolifically presenting soldiers with articulation of malaria and malaria discipline: Troops were reminded about the dangers of malaria and the importance of practicing malaria control by Mosquito Network radio

[134] "Memo 'Malaria Control' 1943." Emphasis in original

[135] Cushing, *History of Entomology*, p. 55

spots, trailers before movies, roadsigns, windshield stickers, posters throughout camps, in newspaper comic strips, and with monthly calendars. These media disseminated articulations of malaria and malaria discipline throughout the base. In particular, the work of Frank Mack was an especially common sight around camp, with one official noting,“"Malaria Moe" and the Frank Mack versions of a pinup girl and of an anopheline mosquito were found in nearly every tent and quonset hut in the area.”[136]

A central focus of the malaria discipline campaigns was changing the conduct of soldiers and expanding the spaces of combat, as well as changing the relationships soldiers had to those spaces. For Nayan Shaw, “health is one of several modern concepts that seek to order and make intelligible the relationship between the self and society through the tutoring of conduct and the reformation of space.”[137] The information campaigns articulated health (not having malaria) as dependent upon enacting certain conducts of self and changing relationships to space. Because the campaigns produced malaria as a threat to the military, malaria became known and understood as a military threat and thus made an enemy to be combatted with military tactics. This articulation of malaria suggested that the times and spaces where soldiers needed to be vigilant about their malaria discipline expanded.

In attempting to change soldiers’ relationships to time and space, the information campaigns expanded the bodily practices of soldiers as well as the spaces where they were needed. Malaria discipline can be understood as intervening in the “technologies of the self,” that Foucault theorized allowed “individuals to effect by their own means or

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[136] Harper*, et al.*, “New Hebrides,” p. 451
[137] Shah, *Contagious Divides*, p. 16

with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality."[138] Mack's calendars in particular linked conduct changes with future happiness (though certainly not purity). Idealized, perfect futures were articulated as possible if the proper bodily practices of malaria discipline were practiced. Soldiers were seduced into practicing malaria discipline and governmentality.[139]

In articulating the changes needed for malaria discipline as well as why, the information campaigns produced a malaria mosquito that represented a dangerous enemy that didn't respect traditional battle lines. For Frank Mack and Dr. Seuss, the mosquito did speak.[140] Like the anthropomorphized mosquitoes that Mack created, Seuss's creatures had sentience and intent to harm Allied soldiers. The threat of malaria, the power of mosquitoes to transmit malaria was articulated as so great as to require new interventions into the lives, behaviors, and everyday practices of soldiers. The power of the mosquito necessitated new regulations, practices, bureaucracy, and monitoring procedures in order to limit its power. As I have previously discussed, the Allied forces made major concessions of space and land to mosquitoes as well as making major changes to the landscape. But concerns about mosquitoes also forced significant changes on the lives and behaviors of all soldiers in times when they were perhaps "off–duty" or

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[138] Michel Foucault, *Technologies of the Self: A Seminar With Michel Foucault* (University of Massachusetts Press, 1988-01-07). , p. 18

[139] Foucault, Michel. *The History of Sexuality, Vol. 1: An Introduction*. Vintage Books, 1978.

[140] Timothy Mitchell. "Can the Mosquito Speak?," In *Rule of Experts: Egypt, Techno-Politics, Modernity*, 19–53. Berkeley: University of California Press, 2002.

not normally subject to military regulations: Areas were designated as off–limits that had previously been accessible, and the access of other areas were restricted to particular times. These new spatial and temporal restrictions also impacted practices of how and when uniforms had to be worn, when and where one could bathe, and in particular how one could sleep.

The spaces of interaction between soldiers' bodies and mosquitoes became the sites of malaria control activities and practices. These spaces were identified, proscribed, and patrolled, and the actions and behaviors of the soldiers within them became the focus of new military regulations designed to change the bodily practices of soldiers. The spaces of swamps, native camps, shower areas, beaches, lakes and ponds (and other potential swimming areas), as well as the spaces of tents, clothing, and bed rolls were areas of likely contact between mosquitoes and troops and so soldiers needed to change their interactions with, relationships to, and behavior within those spaces. Malaria discipline and the information campaign encouraging it were about getting soldiers to change or expand landscapes of the enemy and combat as well as to see themselves as responsible for those changes.

Conclusion

Malaria is a disease that has significantly been constructed through visual culture; modern malaria comes into being when it is first seen through a microscope in slides of human blood and then in slides of mosquitos. This chapter has been about how the visual culture of MECO, the Special Services Division, and others brought a particular onto-epistemology of malaria into being: a local multi-species malaria; a malaria subsumed or made a metonymy with mosquitoes, that was as an enemy equally or more dangerous than the human one; and a malaria that required personal responsibility and a vigilance of one's behavior, spaces, and practices of self to combat it. Regulatory and punitive measures had not succeeded in prompting these soldiers to change their bodily practices and technologies of self to the extent needed for effective malaria control. Multiple articulations and representations of malaria and malaria discipline were necessary to bring about compliance. The information campaigns worked to make the practice of malaria discipline normative and common sense, and drew upon tropes of honor, responsibility, and duty, heteronormative desire, as well as imaginings of an idealized self, and idealized future to do so.

MECO was successful in convincing service personnel to enact malaria disciplinary practices because they changed the articulations of malaria discipline so that its necessity made sense for their audience. MECO was able to affect these changes because their commanding officers had an onto-epistemology of malaria as a local, multi-species problem that required infrastructural flexibility to address it. The changes to the methods and content of the information campaign's articulations of malaria were occurring concurrently with MECO's adjusting its organizational structure and authority, supply chains, and other practices of malaria control (engineering projects, atabrine distribution, larviciding, etc.). The flexibility of MECO's infrastructure (created around their onto-epistemology of malaria) enabled them to adapt to problems or changing local conditions. In the case of malaria discipline, they responded to the failure of an exclusive reliance on regulations and punitive measures by adapting their methods and media to ones that more effectively communicated what malaria was and why malaria discipline was needed to the majority of service personnel. They were able to implement different strategies and were able to articulate malaria to multiple audiences.

In previous chapters, I've analyzed how MECO was established, and how its priorities of flexibility and adaptability to local conditions were incorporated into MECO's organizational structure. I've also shown the Island Malariologists' practices of coordination and translation made malaria legible to different communities of specialized knowledge and practice as well as to military commanders with little specialized knowledge of malaria. In this chapter, I showed that for officers, malaria and malaria discipline came to be understood as opportunities for advancement and/or threats to their command: By contrast, enlisted men needed a malaria not articulated solely through discipline and regulations to enact practice measures against it. In these three chapters, I've traced the efforts of MECO's commanding officers to disseminate, establish, and make standard their onto-epistemilogy of malaria as a local, multi-species disease that requires local attention to control. In each chapter, MECO's malaria control efforts attended to local conditions as malaria was understood and articulated as a local disease. As I shift into my dissertation's conclusion, MECO's successful onto-epistemology of malaria and the organizational structure they created to attend to the local conditions of malaria, to understanding malaria as a complicated, local, multi-species disease, is a model I want to bring to thinking about malaria and malaria control efforts in the present day.

Conclusion

In this conclusion, I return to the theoretical commitments I discussed in the Introduction and re-articulate the dissertation's central arguments and contributions. I discuss the importance of understanding malaria as a multiplicity (as malarias) and how the models and strategies developed by MECO could be useful with present problems in controlling malaria and other vector-borne diseases, (concurring with Kelly and Beisel's call for an attention to the local).[1] I will then engage with what Anne Godlewska and Laura Scharfli call an "ethics: in place" to reimagine MECO's maps and reports as a counter-history of mosquitoes and the Melanesian and Tonkinese people living on the Islands that were commandeered in the war effort, as well as to consider the possibilities of enacting a responsible and ethical local, multi-species malaria control.[2]

Malaria Revisited

Malaria is a relationship between parasite, mosquito, mammal/bird/reptile host, and landscapes that has existed for thousands of years. During this time, humans have attempted to diminish the effects of this assemblage with the use of herbs and through deliberate actions of relocating away from areas with 'bad-air' (and sometimes, as with the Romans, attempted to increase the effects of 'bad-air' against their enemies for military advantage). Humans have also sometimes benefitted from genetic adaptations like the Duffy gene or Sickle Cell Anemia that provided some immunity or resistance to

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[1] Ann H Kelly and Uli Beisel, "Neglected Malarias: The Frontlines and Back Alleys of Global Health," *BioSocieties* 6, no. 1 (2011).

[2] Schaefli, Laura and Anne Godlewska. "Place, Presentism and Ignorance in the History of Geography." Keynote Paper for the History of Geography Specialty Group Plenary Session at the annual meeting of the American Association of Geographers, Chicago, April 21-25, 2015, p. 9

the parasite for a short time (evolutionarily).

The current etiology of malaria began in 1881 with Alphonse Laveran seeing the parasite through his microscope in a blood slide during his medical posting in Algeria, and in 1899 with Sir Ronald Ross and Giovanni Grassi identifying the mosquito as the parasite's vector through the dissection of mosquito bodies in India and Italy respectively. But the recognition of the relationships between mosquitoes, parasites, mammal/bird/reptile hosts, and landscapes did not codify malaria into a stable, singular object that would thus become extremely amenable to human attempts to permanently eliminate the parasite or the mosquito. Malaria remains an assemblage of complex and multiple components that remain in unstable and uneven relationships with each other, with different assemblages co-existing throughout the world. Nor did confirmation that malaria is a parasite that infects and reproduces within many species of *Anopheles* mosquito as well as within mammals/birds/reptiles create a singular malaria that was stable and the same in all locations. For colonial tea plantation owners in India, malaria was a problem that negatively impacted the productivity of workers and ultimately of profit. For Allied commanders in WWII, malaria was a serious threat to military forces and mission success. The threat of malaria was located in the bodies of mosquitoes, local island people, and in the behavior of soldiers.

I began this dissertation with the question *What is Malaria*? and argued that this ontological question could not be separated from the epistemological one of *How do we know what we know about malaria*? Starting from this onto-epistemological position, I closely analyzed the practices and materials of producing knowledge about malaria, and how those methods for knowing malaria became standardized, “common [and] day-to-day.”[3] To do so, I engaged methods and theoretical frames from many disciplines, including history of medicine, communication, science and technology studies, and critical geography.

To investigate how knowledge about malaria and its complexities has been produced and became ‘common-sense,’ I drew upon theories about figured worlds and object agency from Science and Technology Studies and Communication. Holland, Mukerji, and others have discussed how material and mental architectures shape quotidian understandings and knowledge about the world. Similarly, Latour, Vygotsky, and Wertsch have shown the power of objects to scaffold knowledge and practices of knowledge production. The pedagogical architectures of these figured worlds and objects help to shape how a problem, object, or situation is framed, articulated, and can be known.

This integrated STS and Communication approach helped me to highlight the importance of maps, files, records, and surveys in the history of modern malaria control. I tracked the ways these objects circulated and helped to establish authority, create knowledge, and naturalize particular ways of knowing. In Chapter 1, I discussed the ways maps helped to articulate malaria during the Colonial era. The maps and practices that Christophers created and institutionalized helped to scaffold a malaria that was based in the environment and the movement of labor. His expertise in protozoology, his position in the Royal Society and the Indian Public Health Community, and prolific publications

[3] Annemarie Mol, *The Body Multiple: Ontology in Medical Practice (Science and Cultural Theory)* (Durham: Duke University Press, 2003). , pp.6-7

gave Christophers the credibility to refute Ross's arguments for widespread mosquito control measures. Christophers' maps helped solidify his authority, credibility, and claims, asserting that malaria was in 'these' areas in ways that were mostly fixed and not amenable to human intervention. But even as his articulation of malaria lost its resonance, the epidemiological practices and methods of surveying landscapes, infected humans, and vectors he created remained the standard.

In the remaining chapters, I analyzed the MECO's work of creating and institutionalizing an architecture of malaria that framed the disease as a local, multi-species problem that required organizational and institutional flexibility, and a coordination of knowledge and practices. To address how MECO implemented this articulation of malaria, I engaged Mol's emphasis on practice as well as Akrich and other scholars of materiality and object agency. I followed the objects and practices of malaria control: Planes, DDT, mapping and surveying supplies, sprayers, trucks, typewriters, microscopes, etc. These objects (and the infrastructures that procured and maintained supplies) all shaped the knowledges and practices of malaria control.

In addition to the objects used to measure, examine, diagnose, and control parasites and mosquitoes, I focused on paper and files, drawing on the work of Joyce and Gitelman. MECO was literally established through orders and paperwork. They themselves also established infrastructures and practices to control malaria in the Pacific through the circulation of memorandum, supply requests, and reports. The components of these reports — the surveys, maps, tables, and narratives — helped to articulate an onto-epistemology of malaria that necessitated an organization that could adapt and respond to local conditions as well as engage with the landscape, mosquito populations, local island residents, and military personnel.

The importance of locality and environment in understanding malaria led me to draw upon Akrich's argument that objects and technology can "lead to new arrangements of people and things" and "new forms of knowledge about the world," and theories from critical, animal, and post-colonial geography such as Ogborn's emphasis on the constitution of imperial power "through its arrangements of spaces, places, landscapes, and networks of connection."[4] Using these frames, I analyzed the geographies and spaces of malaria control, tracking the changes to landscapes, administrative and laboratory spaces, and institutions, as well as the knowledges about malaria these new arrangements helped to create. In Colonial India and Africa, these were spaces of European-run commerce or residences and the practices of relocation and segregation of 'Natives,' mosquito control regulations, and private spaces becoming searchable by government and public health officials. In WWII, I analyzed the spaces of mess halls, showers, bathing areas, sleeping areas and practices; spaces, similar to the colonial contexts, that may had previously been outside regulations and surveillance. I also analyzed how MECO engaged and expanded these spaces of surveillance and changed common sense understandings of malaria through visual culture campaigns that focused on malaria discipline.

These theoretical frames helped me to interpret MECO as trying to a create a

[4] Madeleine Akrich. "The De-Scription of Technical Objects," In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, Cambridge: The MIT Press, 1992. , p. 207; Miles Ogborn, *Indian Ink: Script and Print in the Making of the English East India Company* (Chicago: University Of Chicago Press, 2007). , p. 4

figured world of malaria in which malaria could be multiple — a different object or concern with different practices that enacted it, for different groups like entomologists, parasitologists, engineers, military commanders, enlisted men, etc. — but also be broadly understood as a threat to the military campaign (particularly through its mosquito vector). These particular and general understandings of malaria were of a disease that involved multiple species, and had local variation. In this figured world of malaria, the common sense response would need to be based within the military and be able to adapt to those local variations and multiple species components. The response would need to encompass multiple people with different areas of expertise in multiple areas and across multiple scales. But all of these — the figured worlds, objects, practices, multi-species assemblages — needed coordination and translation. The Allies' malaria control in the Pacific was successful because their control programs appropriately coordinated the multiple ontologies of malaria and were flexible enough to accommodate local variation in multi-species entanglements.

Malaria and Vector Control Today

Past successful models of malaria control are especially important for considering current malaria control problems. It may seem contradictory for me to argue that an onto-epistemology of malaria and malaria control in WWII should be examined closely for current malaria control issues, especially given my emphasis throughout the dissertation about the importance and necessity of attending to local conditions. But an important component of MECO's onto-epistemology were models designed to adapt to the specifics of local conditions: MECO's Standard Operating Procedures (SOP) for malaria control activities stated, "This Standard Operating Procedure is merely a sample plan adapted to and used during one operation. All such plans should be flexible. One division malaria control group had 4 general plans calling for various degrees of decentralization, the exact plan and details used to he [sic] determined by the particular situation."[5] It it this sort of attention to locality that is needed now; one that can respect local knowledges, experiences, and needs.

Another lesson from the past that is germane to current malaria control problems is the emphasis on epidemiology. Beginning with Christophers, epidemiological data was given primary importance and was also central to MECO's malaria control practices. Precise information about infection rates in humans and mosquitoes, as well as accurate information about locations of those infected humans and mosquitoes was important to MECO and Christophers, but is dramatically lacking in current malaria control programs. In 2006, a researcher for the Malaria Atlas Project noted, "Information on the global burden of malaria remains the subject of best guesses rooted in national reporting systems, informed estimation based on epidemiological data linked to historical malaria distributions, or unvalidated models of malaria distribution in Africa."[6] Recently, WHO has explicitly built epidemiological uncertainty into their official numbers for malaria: In their 2015 World Malaria Report, WHO "estimates that 214 million cases of malaria

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5 "Standard Operating Procedure for Control of Malaria and Other Insect-Borne Diseases During a Combat Operation." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. Appendix A, Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

6 Simon I Hay and Robert W Snow, "The Malaria Atlas Project: Developing Global Maps of Malaria Risk," *PLoS Med* 3, no. 12 (2006/12/05). , p. 2204

occurred worldwide in 2015 (uncertainty range: 149–303 million) and about 438,000 people died from the disease (uncertainty range: 236,000–635,000), mostly children under five years of age in sub-Saharan Africa."[7] These are both official numbers — informing visitors to their webpage, disseminated to and by reporters who cover developments in malaria control, funding agencies, etc. — *and* "rough estimates."[8] The "uncertainty range" for malaria infections contains 150 million people — for context, in 1950, the entire population of the United States was 150 million people.[9] Give or take, a number of people equal to America in 1950 (or equal to half of the current US population) may or may not have had malaria in 2015; And almost as many people who died from the disease, also may not have had malaria (400,000).

The reasons for the lack of current epidemiological data on malaria are varied, and I will leave detailing them for a future project, but one contributing factor has been a decreasing emphasis on malaria epidemiological, beginning with the Global Malaria Eradication Programme and continued after that Programme's demise in 1969.[10] This

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[7] World Health Organization. *World Malaria Report* 2015. Geneva: World Health Organization, 2015. For more on the insufficiency of malaria epidemiological data, see also: J. G. Breman, "The Ears of the Hippopotamus: Manifestations, Determinants, and Estimates of the Malaria Burden," *Am J Trop Med Hyg* 64, no. 1_suppl (2001 January 1, 2001). ; Joel G. Breman and Cherice N. Holloway, "Malaria Surveillance Counts," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007 December 1, 2007). ; Richard E. Cibulskis*, et al.*, "Estimating Trends in the Burden of Malaria At Country Level," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007 December 1, 2007). ; K. A. Koram and M. E. Molyneux, "When is "malaria" Malaria? The Different Burdens of Malaria Infection, Malaria Disease, and Malaria-Like Illnesses," *Am J Trop Med Hyg* 77, no. 6_Suppl (2007 December 1, 2007). ; Hay and Snow, "Malaria Atlas Project."; Robert W. Snow*, et al.*, "The Global Distribution of Clinical Episodes of Plasmodium Falciparum Malaria," *Nature* 434, no. 7030 (2005).

[8] Uli Beisel, "Jumping Hurdles with Mosquitoes?," *Environment and Planning D: Society and Space* 28, no. 1 (2010). , p. 47

[9] United States Census Bureau. "Population and Area (Historical Censuses)." (1991): Accessed April 23, 2016. http://www2.census.gov/prod2/statcomp/documents/1991-02.pdf, p. 7

[10] JA Nájera, "Malaria Control: Achievements, Problems and Strategies.," *Parassitologia* 43, no. 1-2 (2001 June).; Kamini Mendis*, et al.*, "From Malaria Control to Eradication: The WHO Perspective," *Tropical Medicine & International Health* 14, no. 7 (2009).

shift in values particularly affected entomological experts: While entomological knowledge was highly valued by Christophers and MECO, the director of WHO's current Malaria Control Programme recently wrote that since the 1970s "the field of vector control and medical entomology has shrunk massively."[11] Medical entomologists employed by WHO have decreased from nearly 40 in the early 1980s to 16 by 2015, with nine working in satellite locations and seven based in Geneva focused on malaria.[12]

One of the many consequences of this de-emphasis on the need for epidemiological data was that maps identifying and representing the location and intensity of malaria were not produced. As I've discussed, maps generally, and disease maps in particular, do important work in framing figured worlds — scaffolding and producing understandings of what can be known and how it can be known. Different models and ways of mapping could help to articulate malaria in different ways, incorporating its multiplicities, complexities, and uncertainties. In 2009, the Malaria Atlas Project (MAP) created the first global map of malaria infections in 40 years, relying on non-traditional and non-governmental sources for their data.[13] MAP has also been producing research, models, and maps about the need for more research and mapping, and of mosquito populations, parasite infection rates in humans, transmission rates and locations; they use GIS to layer these knowledges into more complex maps that integrate,

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[11] Pedro Alonso. "Damn the Mosquitoes! Full speed ahead!" (15 March 2016): World Health Organization. Accessed April 14, 2016. http://www.who.int/mediacentre/commentaries/vector-control/en/#.

[12] Ibid.

[13] Hay and Snow, "Malaria Atlas Project."

and represent and articulate complexities and multi-species qualities of malaria.[14]

The problems of malaria control resonate with two mosquito-borne viruses that have been prominent in the news lately: Zika and chikungunya. The CDC's chikungunya virus webpage notes: "There is no vaccine to prevent or medicine to treat chikungunya virus infection. Travelers can protect themselves by preventing mosquito bites. When traveling to countries with chikungunya virus, use insect repellent, wear long sleeves and pants, and stay in places with air conditioning or that use window and door screens."[15] With the exception of air conditioning, these were the malaria discipline regulations of Allied military commanders.

In March 2016, WHO published a commentary from Dr. Pedro Alonso, Director of the Global Malaria Programme, "Damn the mosquitoes! Full speed ahead!" in which he addressed the need for a commitment to mosquito control efforts for Zika.[16] After summarizing the current efforts to genetically modify mosquitoes, Alonso stated, "But we are not waiting for a magic bullet, since we already know what works — vector control. In lay terms: killing mosquitoes or eliminating their habitats. At present, we have no

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[14] See for example: Moritz U.G. Kraemer*, et al.*, "Progress and Challenges in Infectious Disease Cartography," *Trends in Parasitology* 32, no. 1 (2016/1). ; N. Claire Massey*, et al.*, "A global bionomic database for the dominant vectors of human malaria," *Scientific Data* 3(2016/03/01/online). ; Oliver J. Brady*, et al.*, "Vectorial capacity and vector control: reconsidering sensitivity to parameters for malaria elimination," *Transactions of The Royal Society of Tropical Medicine and Hygiene* 110, no. 2 (2016/02/01). ; Ewan Cameron*, et al.*, "Defining the relationship between infection prevalence and clinical incidence of Plasmodium falciparum malaria," *Nat Commun* 6(2015/09/08/). ; Daniel J. Weiss*, et al.*, "Re-examining environmental correlates of Plasmodium falciparum malaria endemicity: a data-intensive variable selection approach," *Malaria Journal* 14, no. 1 (2015). ; David M. Pigott*, et al.*, "Prioritising Infectious Disease Mapping," *PLoS Negl Trop Dis* 9, no. 6 (2015/06/10). ; Ursula Dalrymple, Bonnie Mappin and Peter W. Gething, "Malaria mapping: understanding the global endemicity of falciparum and vivax malaria," *BMC Medicine* 13, no. 1 (2015). ; Sylvie Manguin, ed. *Anopheles mosquitoes - New insights into malaria vectors* InTech, 2013).

[15] Centers for Disease Control and Prevention. "Chikungunya Virus." (2015): Atlanta, GA: Centers for Disease Control and Prevention. Accessed April 14, 2016. http://www.cdc.gov/Chikungunya/index.html.

[16] Alonso, "Damn the Mosquitoes!"

alternative: there is no vaccine; no treatment; and we do not even have good diagnostic tests."[17] He then outlined vector control steps that must be implemented as soon as possible: 1). "Manage the environment. That means getting rid of any standing pools of water that can serve as a habitat for the Aedes aegypti mosquito."; 2). Killing mosquito larvae with any of the 12 WHO-approved larvicides, as well as with "biological control methods" such as "small ornamental fish that have an appetite for larvae"; 3)."Kill the adults" through the use of insecticides sprayed at dusk and dawn; and 4). Pregnant women should use insect repellents.[18] Alonso argued that these measures will offer individual protection as well as communal benefits "by breaking the transmission cycle. These are time-tested, low-tech and readily available tools. And they work."[19] Other than focusing on the Aedes aegypti mosquito rather than the Anopheles malaria vector, these recommendations for both Zika and chikungunya could have been taken from Ross's *The Prevention of Malaria* in 1910 or the malaria discipline regulations of WWII (minus the emphasis on pregnant women).

Reflections

Laura Scharfli and Anne Godlewska have found utility in bringing together Foucault and Jeff Malpas to claim that "ethics begins in social awareness in place."[20] Scharfli and Godlewska argue that "Ethics lies in consciousness of the dynamic and uneven co-constitution of epistemology and embodied experience . . . Ethics rests in the

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[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] Schaefli, Laura and Godlewska, "Place, Presentism and Ignorance," p. 9

diligence, perseverance and self-reflexivity that facilitate conscious engagement with diversity, multiplicity, and change."[21] In my dissertation I have tried to enact these ethics in relation to malaria, and the changing dynamic articulations of the relationships between landscapes, the malaria parasite, mosquito and human vectors in the modern history of controlling it.

I have tried to attend to the "dynamic and uneven co-constitution" of the processes and practices of articulating malaria and the best methods for its control through focusing on "the everyday and immediate details of being: in place." The everyday practices and actions of counting mosquitoes, performing spleen surveys, reading thick blood smears, writing reports, making and modifying maps, spraying chemicals from backpacks or airplanes all helped to shape the multiple ontologies and epistemologies of malaria. While I have tried to responsibly engage these everyday practices, I have not given as much attention or space to the people of India and those living on the Pacific Islands prior to and during the Allied and Japanese occupations. Nor have I engaged the lives of mosquitoes and parasites, in a complex way. I discussed how the bodies of Indians and Islanders were seen as threats to the health of Europeans, but also as important labor. I analyzed how mosquitoes and parasites were articulated, and how strategies, infrastructures, and chemical were designed and developed to significantly lower their populations.

In the remaining pages of my conclusion, I will use archival materials not otherwise used in the body of the dissertation to briefly engage these absences and

[21] Ibid.

omissions. Modeling Jane Smiley's *A Thousand Acres* and Jean Rhys's *Wide Sargasso Sea,* which took as their source material and told alternate versions or narratives, of the 'mad' first wife in Charlotte Bronte's *Jane Eyre* and the 'bad' and 'greedy' sisters in Shakespeare's King Lear respectively, I would like to use some of the WWII archival materials I have — the reports, surveys, memos, and especially the maps — to read against the primary narrative of Allied actions, difficulties, and successes.[22] These materials are official archives of military successes over nature and the Japanese: but, what would it look like and what could we learn by reading them as artifacts of the deaths of mosquitoes and parasites, of the dispossession and relocation of the human residents?

I would like to analyze these maps as archives of landscapes, parasite infections, mosquito populations, and habitats that were transformed by the practices of mapping and controlling malaria. These maps mark the processes of relations and interrelations between mosquitoes and humans.

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[22] Jean Rhys, *Wide Sargasso Sea* (W. W. Norton & Company, 1998 (1966)). ; Jane Smiley, *A Thousand Acres* (New York: Alfred A. Knopf, 1991).

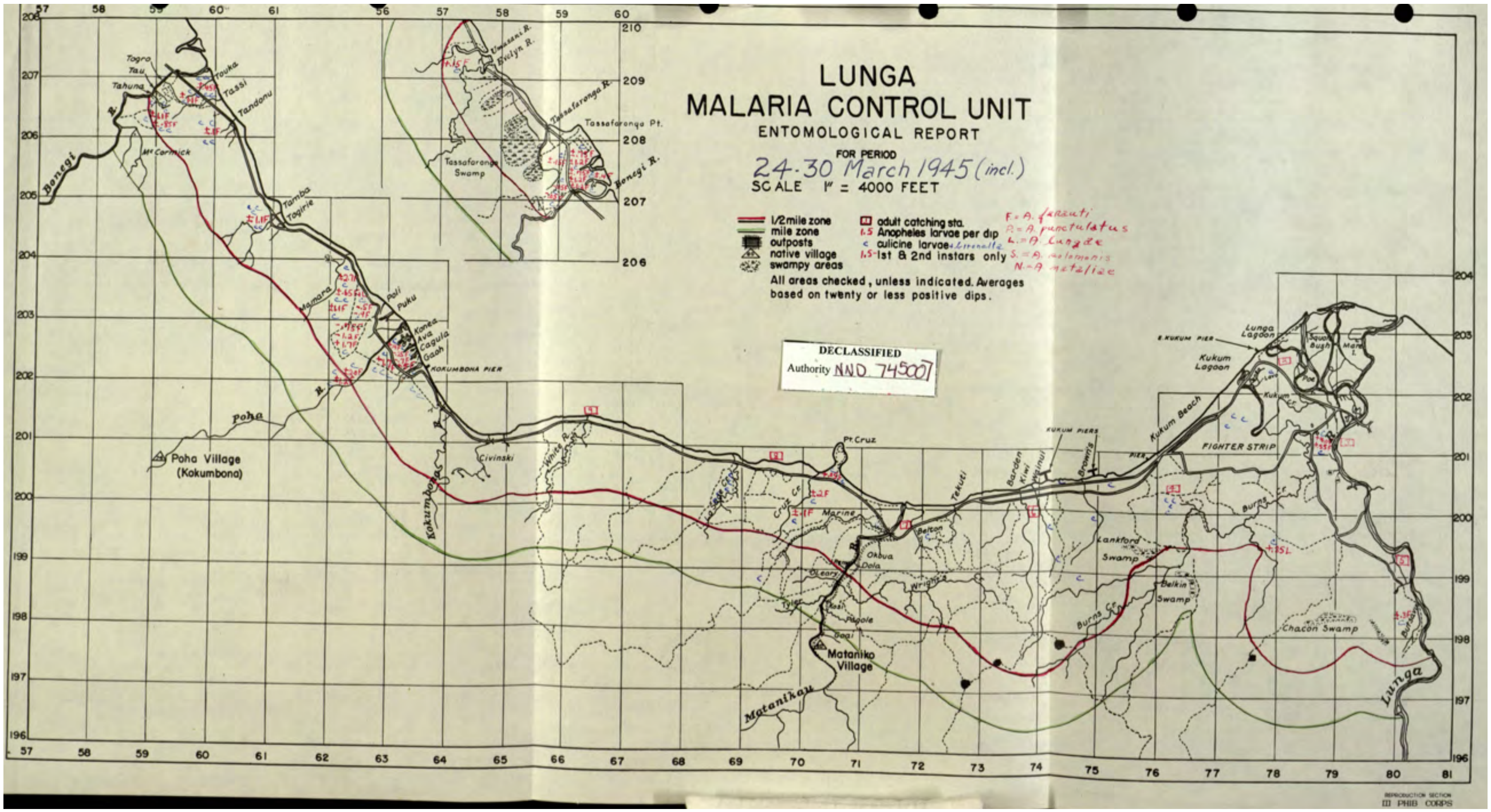

Image 5.1: Map from "Lunga Malaria Control Unit Entomological Report: 24-30 March 1945." 1945. Folder A9-4(3) MMR - Guadalcanal, British Solomon Islands: Folder 5 of 12 [March 1945-April 1945]. Container # 5 ARC# 5722964 A9-4(1) ARC# 5722964 Monthly Malaria Reports - Espiritu Santo, New Hebrides THRU/ A9-4(3) Monthly Malaria Reports - Guadalcanal, British Solomon Islands. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC). National Archives at College Park, College Park, MD.

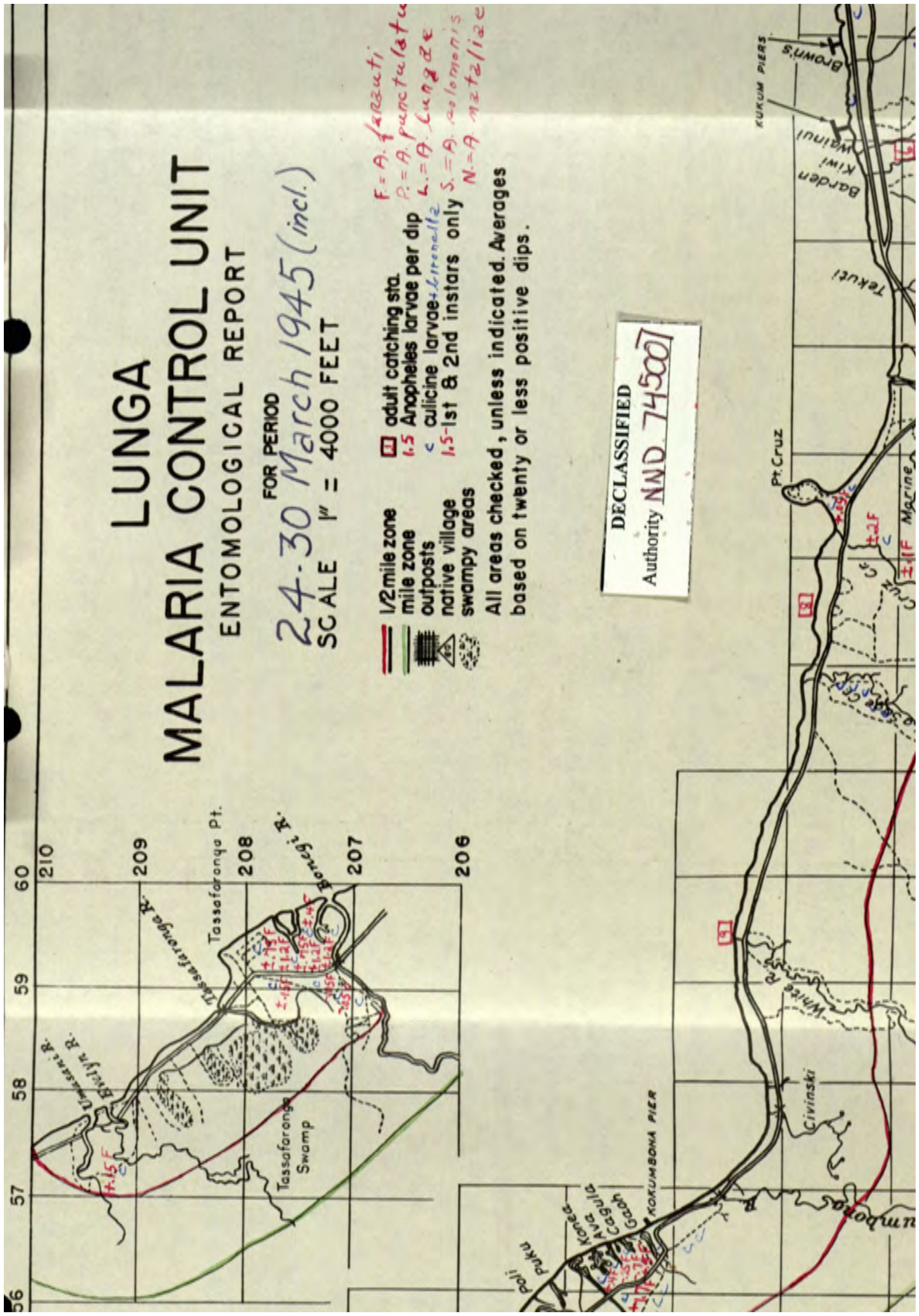

Image 5.2: Closeup of Map from Lunga Entomological Report, March 1945.

This map, included in the March 1945 Entomological Report for Lunga Island, documents the practices of humans for determining the locations, activities, and lives of mosquitoes. A large amount of human labor went into typing, staging, quantifying, and mapping these mosquitoes — the first or second larval stage, or adult mosquitoes — as well as their location and potential movements (marked by the 1/2 mile zone). Five sub-species of Anopheles mosquitoes and their locations were identified and surveilled (the red handwritten text in top center of Image 5.2). The geographies of their habitat are identified (swamps, areas around piers, etc).

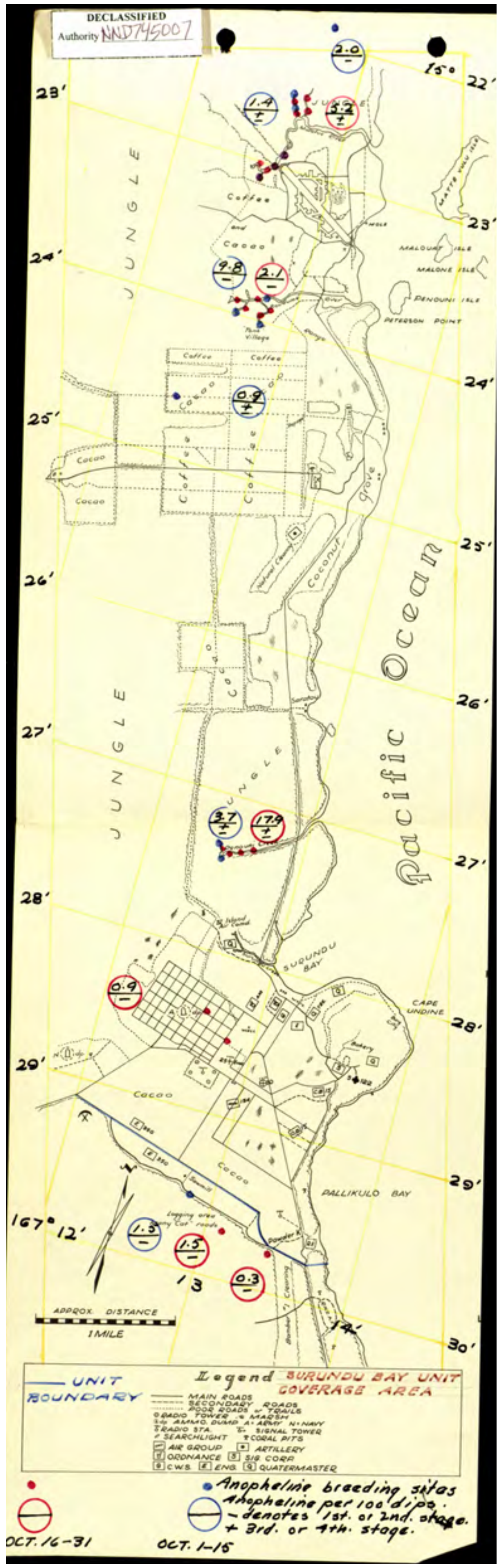

Image 5.3: Map of Surundu Bay Unit Coverage Area. Oct. 1943. From "Monthly Malaria Report for October 1943, Espiritu Santo." 1943. Folder A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides, Folder 8 of 11 [Aug 1943- Oct 1943]. Container #4 ARC# 5722964. Entry P 90-F. RG 313. NARA, College Park.

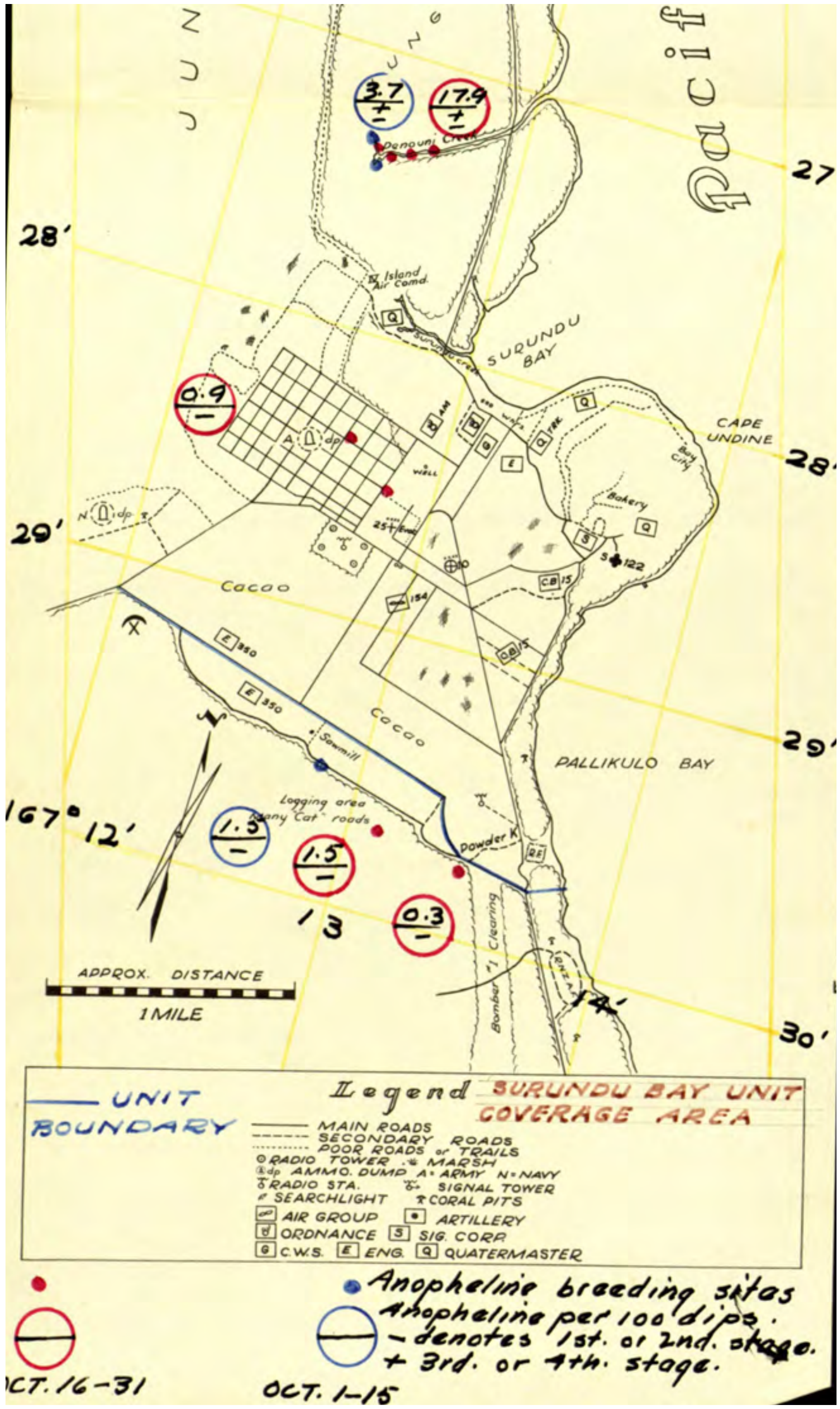

Image 5.4: Closeup of Map of Surundu Bay Unit Coverage Area. 1943

Like the Lunga map in Image 5.1, this map of the Surundu Bay Unit Coverage Area marks identifies practices of knowledge production and collection — it locates breeding sites and geography, but also of the labor required to take 100 samples of water at each site (dips). The larval stages are further delineated in this map, with the third and fourth stages also identified.

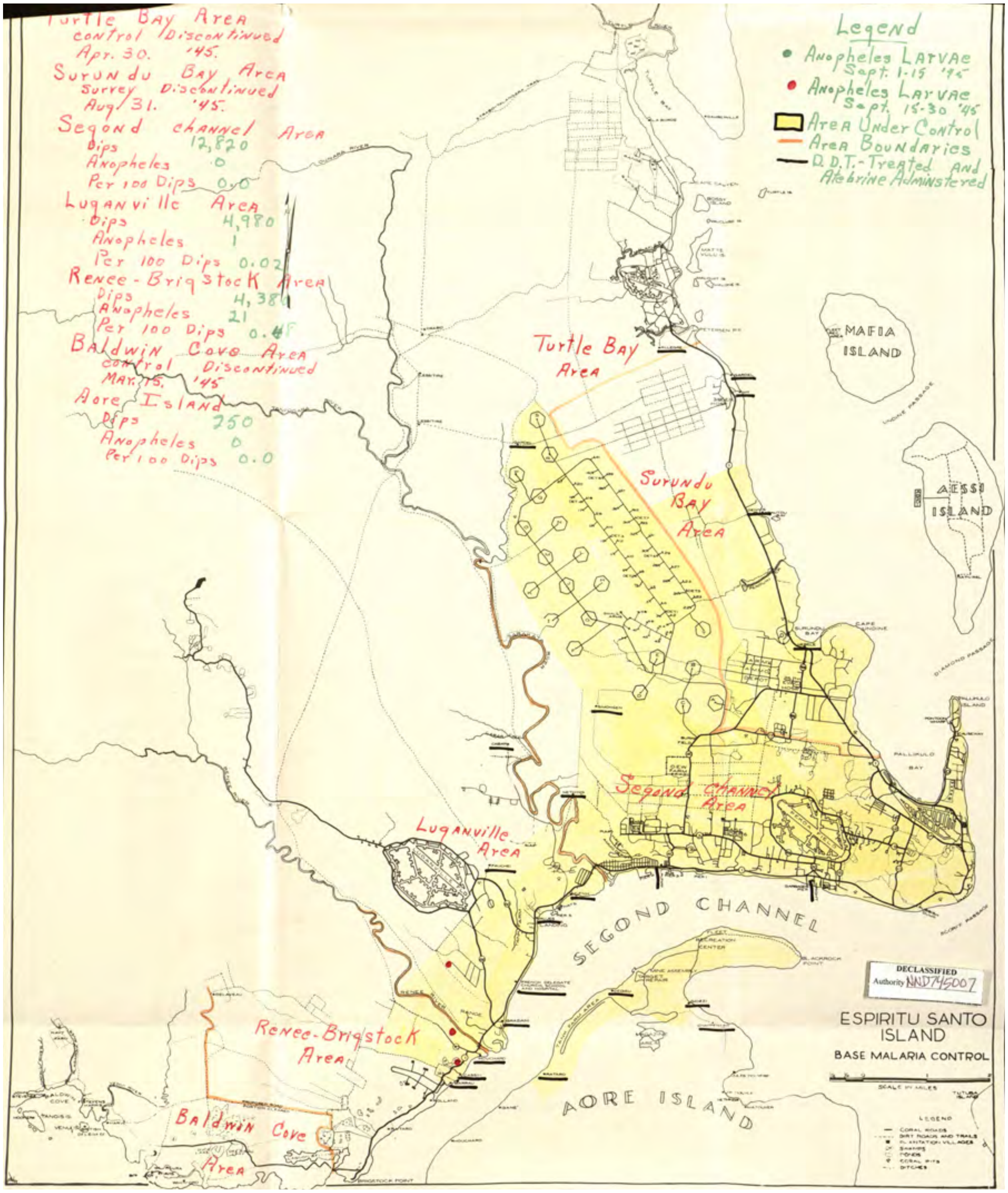

Image 5.5: "Map of Espiritu Santo Island Base Malaria Control, September 1945." Monthly Malaria Report for September 1945, Espiritu Santo, 1945. Folder: A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides [July 1945 - Oct 1945]/[Folder 1 of 11]. Container #4 ARC# 5722964. Entry P 90-F. RG 313. NARA, College Park.

While this map of Espiritu Santo also indicated the locations of mosquitoes, the larval stage was not differentiated. Instead, the focus was on the quantity of larvae and its change over time. This map identified territories of hostilities and multi-species interactions: Areas shaded yellow (such as Turtle Bay, Surundu Bay, and Baldwin Cove Areas) were under human control and no longer required surveillance.

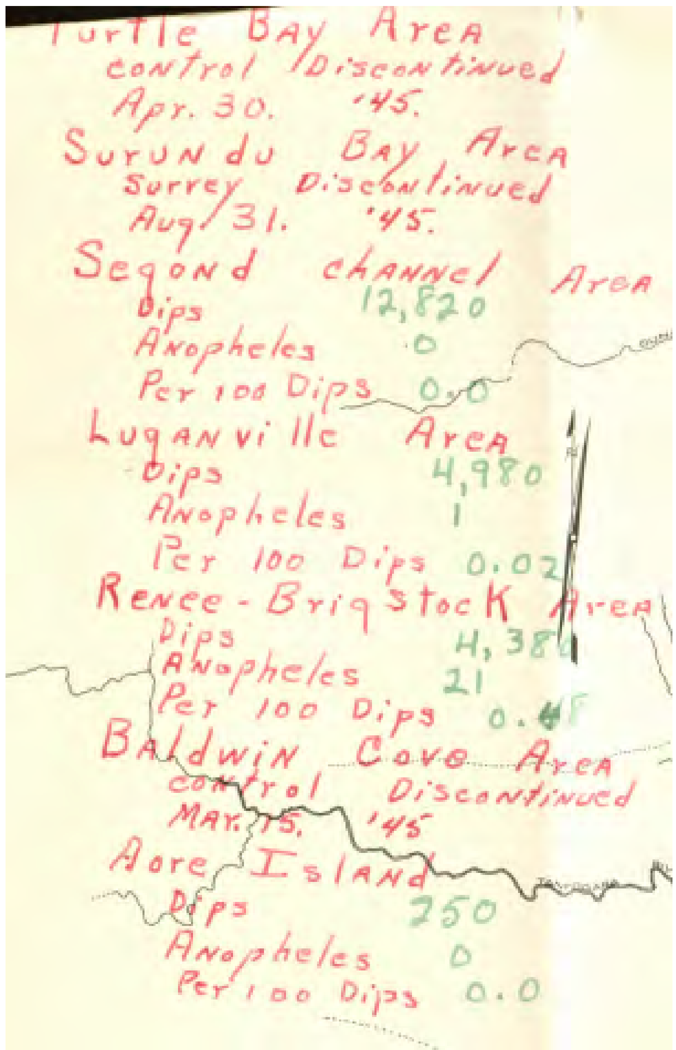

Image 5.6: Closeup of "Map of Espiritu Santo Island Base Malaria Control, September 1945."

The map also identified the locations and means of mosquito and parasite death: DDT and Atebrine:

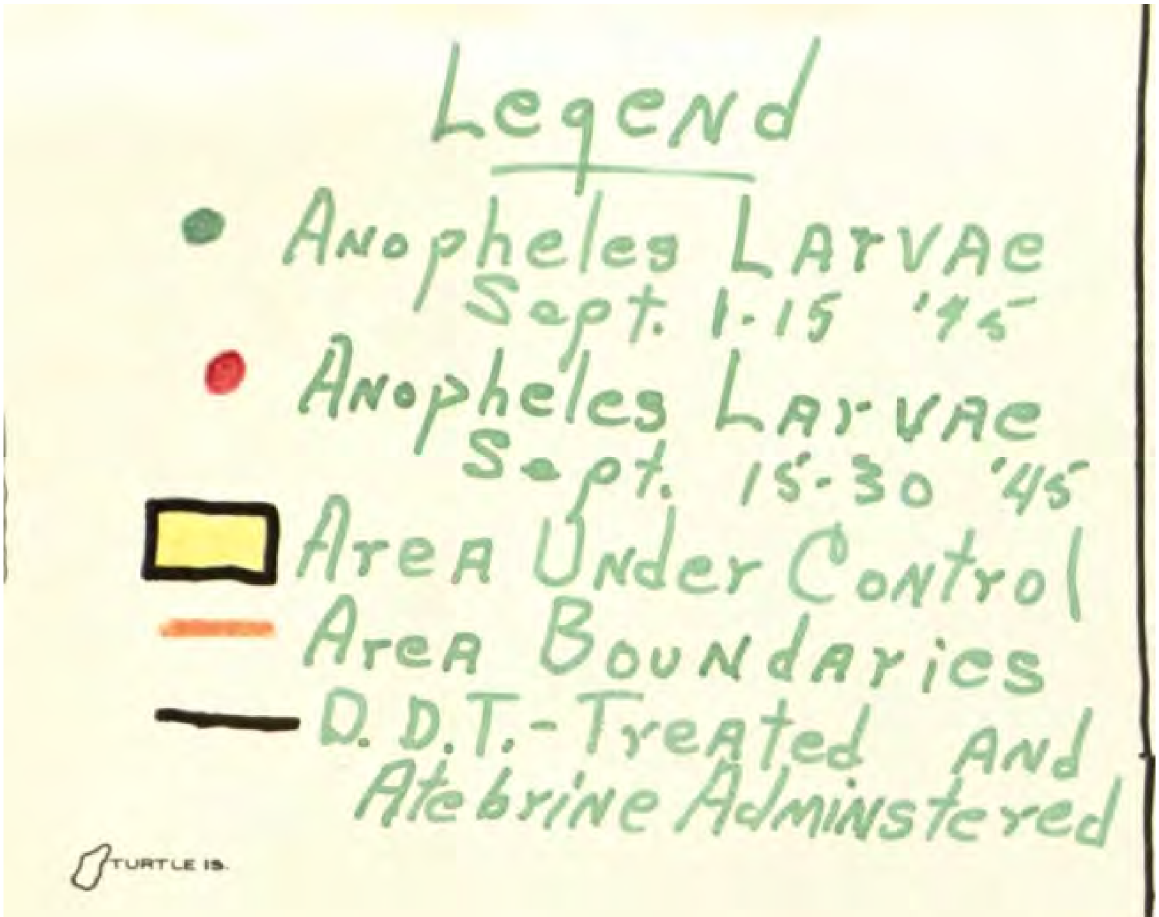

Image 5.7: Legend for "Map of Espiritu Santo Island Base Malaria Control, September 1945."

This map archived the human surveillance of mosquitoes and parasites, as well as actions taken against those populations.

MECO's maps cannot be understood as a history *of* animals (or in this specific case, insects); the mosquitoes weren't speaking; they weren't telling their histories. It would be more appropriate to characterize them as a history about animals; of the relations between humans and mosquitoes. But these maps begin to allow a process of spatially and temporally locating these populations, and marking their existence. Mosquitoes and plasmodium parasites may not be wanted companions, but they are companion species with whom we have been "becoming-with" for millennia. These maps as well as the hundreds of maps and reports that that MECO's malariologists, entomologists, and surveyors produced to locate and enumerate mosquito populations, articulated the multispecies entanglement of malaria and archive that entanglement as well as of the practices of malaria control.

MECO's maps and reports also offer a way to indirectly map the changes to the lives of the Tonkinese, Melanisians, and other people living on the thirteen Pacific Islands wrought by the Allies and Japanese through combat, building camps, bases, airfields, as well as through engineering efforts to decrease mosquito habitats. All three of the maps just considered (Surundu Bay breeding sites (Image 5.3), the Lunga entomological map (Image 5.1), Espiritu Santo Base Malaria Control Map from September, 1945 (Image 5.5)), identified changes to the islands — the fields of cocoa and coffee, coconut grove, logging areas — made by island residents, colonial interventions for trade, as well as areas modified by the military.

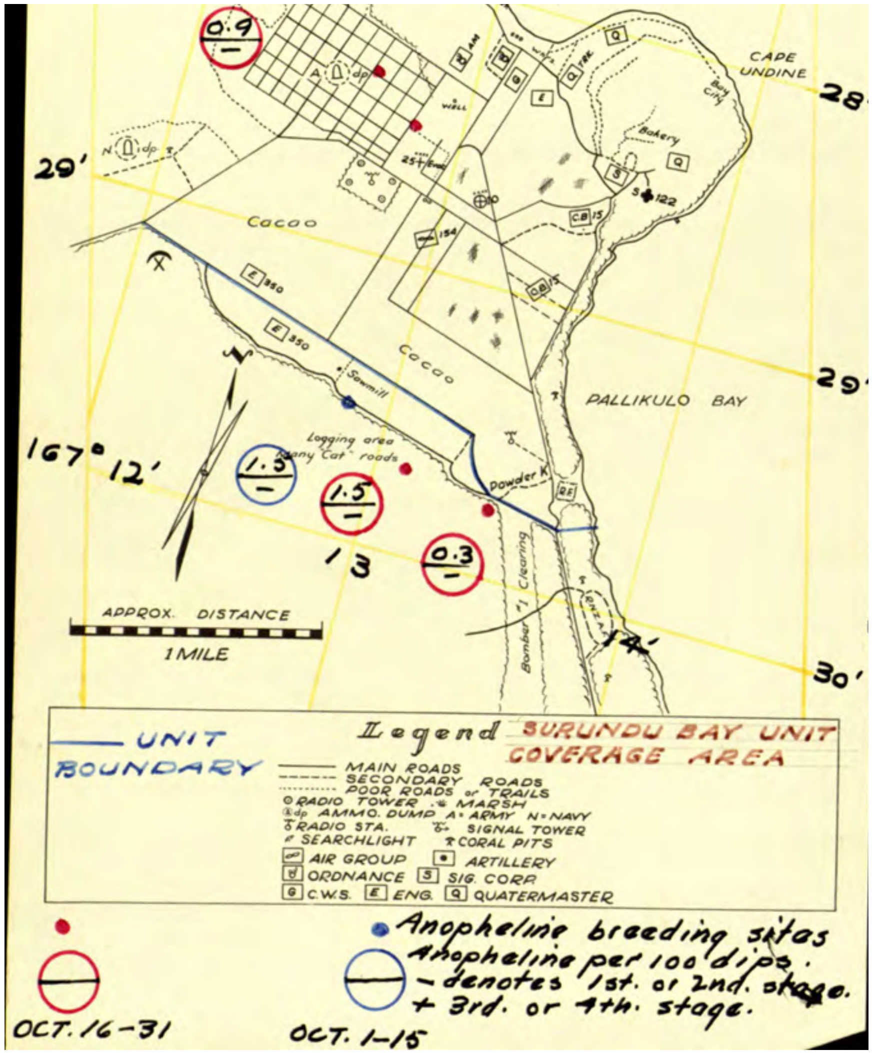

Figure 5.8: Closeup and Legend of Map of Surundu Bay Unit Coverage Area. 1943

This Legend from the Surundu Bay map explicitly details these changes to the Island made by the military, as well as some natural features important for malaria control such as marshes and coral pits. The map itself also identifies the military's impact, such as the Bomber Clearing (above the word "Surundu"). Also included are landscape features that may have preceded the war: Cacao fields, the logging area, sawmill and bakery. Maps such as these archive the changed and changing Island landscapes. Many also identified the location of Native Camps and Villages, not always differentiating between those that existed before the war and those that the Allies created.

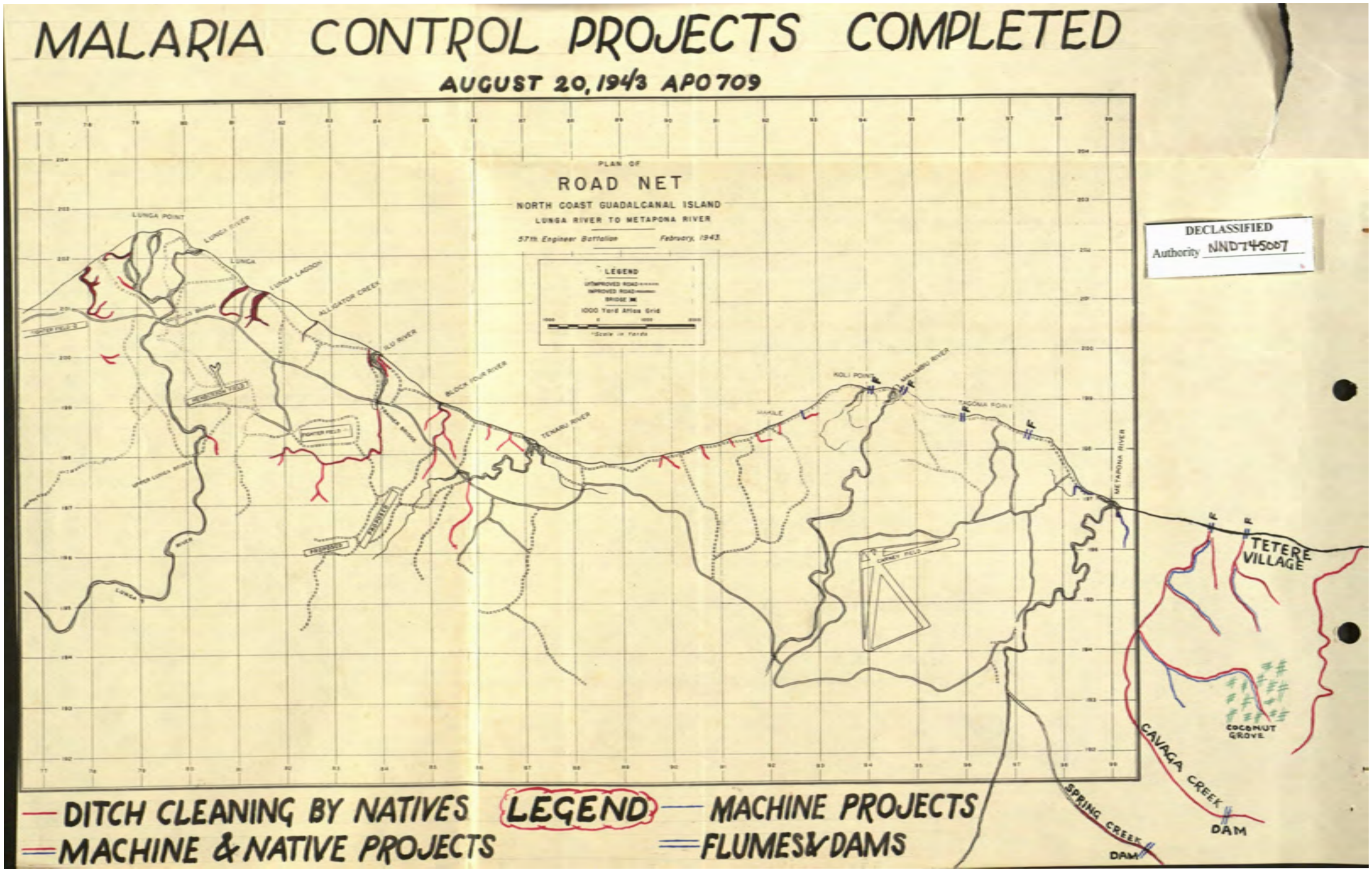

Image 5.9: "Map of Malaria Control Projects Completed. August 20, 1943 APO 709." 1943. Folder A6-5(3-1) General Correspondence - Guadalcanal, British Solomon Islands [Mar 1, 1943- Oct 2, 1943] Folder 6 of 7. Container 2 ARC# 5722964. Entry P 90-F. RG 313. NARA, College Park.

This map of completed Malaria Control Projects from August 1943 includes the names and locations of villages, but it also marks the work of “Natives.” The exact identification of what groups and people comprised these “Natives” is absent, but the work and changes these workers made to the landscape — the ditches cleared — is explicitly acknowledged.

This brief engagement with these maps can begin to engage an alternate articulation of malaria and malaria control. Focusing on mosquitoes can help to reveal the complexity of malaria as well as the scale and scope of the difficulties involved in mosquito-based control methods. Engaging the history of Islanders can bring attention to people whose concerns were ancillary to the warring combatants; whose labor was important for the success of malaria control efforts, even if their bodies were also threats to that success. Reading these maps against the traditional narrative invokes an ethics of attending to those excluded or omitted, those voiceless or made voiceless — landscapes, indigenous people, critters — as well as making spaces for a telling of their own histories and concerns.

Haraway has discussed the politics of ‘making-killable’ and the responsibilities towards other species.[23] But, taking these histories and multi-species worlding seriously in the case of malaria raises some very difficult questions: An “ethics: in place” for whom? Is it possible to take responsibility with mosquitoes while also taking responsibility for the people they bite and many of whom become ill? As Beisel notes, “responsible engagements with more unpleasant species, such as mosquitoes, look very

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[23] Donna Jeanne Haraway, “When Species Meet: Staying With the Trouble,” *Environment and Planning D: Society and Space* 28(2010).

different in practice than meetings with pets."[24] Focusing on the lives of mosquitoes is tricky — should the lives of mosquitoes matter, matter as much or more than humans? But what if we think about the lives of mosquitoes as simply mattering? Not more than, or less than. But mattering. And if they matter, then what ethics should drive our interactions?

I have argued that only through attending to the particular assemblages of malaria at particular locations, only though understanding malaria as a local disease, will human control efforts be successful. However, it is likely that malaria will never be eradicated. It's likely that with global warming, malaria's geographic territory will only increase, especially since mosquitoes are being found at higher elevations and in cooler climates. They continually develop resistance to larvicides and insecticides. As Beisel notes, "Mosquitoes are thus biologically very dynamic and adaptive, and today insecticide resistance in anopheles mosquitoes poses a constant challenge to spraying initiatives."[25] These challenges require "Ongoing monitoring, surveillance, and adaptation of intervention strategies to changes in the mosquito population . . . [because] the most stable characteristic of mosquito control might well be its changeability. . . . However, what is less clear . . . [is] whether rendering mosquitoes killable is a fruitful strategy in the long run."[26]

The problems of solely focusing on mosquitoes for malaria control stem not just from their "changeability," but because of the universalist nature of such efforts: "The

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[24] Beisel, "Jumping Hurdles with Mosquitoes?", p. 47

[25] Ibid.

[26] Ibid., pp.47-48

question who kills mosquitoes is also less straight-forward than one might expect: Insecticide spraying especially in African countries is often (at least partly) conducted by international malaria control organisations."[27] Beisel notes that for fifteen countries in Africa, the US's President's Malaria Initiative operates control efforts, using a US-based contractor to organize all spraying efforts for these countries, regardless of local conditions and capabilities. In Ghana, "international comparability gets prioritised over local project partners, who no doubt have more knowledge about local mosquito-human dynamics. . . Hence, malaria is not only a multispecies but also a complex intra-human encounter, in which white men in Washington often have more influence over how and where mosquitoes get killed than the people encountering the mosquitoes."[28]

Returning to Schaefli and Godlewska's "ethics: in place" — how might we create malaria control strategies that engage "consciousness of the dynamic and uneven co-constitution of epistemology and embodied experience" of malaria and malaria control? If "meeting a mosquito is often not a one-to-one but a one-to-many encounter requiring different thinking as well as engagements," then what would an "ethics: in place" of malaria control entail?[29] An "ethics: in place" of this "one-to-many encounter" might involve thinking about different onto-epistemologies of malaria, based in modes of co-existence, of living and becoming-with malaria and mosquitoes rather than exclusively working on an un-winnable chemical and therapeutic arms-race with them: Such an ethics would respect local knowledge while also working to keep hundreds of thousand

[27] Ibid., p. 48
[28] Ibid.
[29] Ibid., p. 47

of children and women alive; A becoming-with would prevent mosquitoes from entering houses (building on stilts, screening windows and doors, moving livestock closer to houses to provide different food sources for mosquitoes, etc.); use of engineering projects to limit water collection around houses, and improve sanitation; and improve health infrastructures so as to make treatments both available and affordable.

References

Archival Sources

British Library

Christophers, S.R. “Second Report of the Anti-Malarial Operations At Mian Mir, 1901-1903.” Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, 1904.

Historical Medical Library of The College of Physicians of Philadelphia

Bentley, Charles. “Report of an Investigation Into the Causes of Malaria in Bombay and the Measures Necessary for Its Control.” 1911. Bombay: Printed at the Government Central Press. ZDm 9 (#000059824).

National Archive and Records Administration, College Park Maryland

“AG. 300.6 (Y–M): Memorandum Number 14: Individual Measures to Prevent Malaria, By Command of Major General Murray; Headquarters Forward Area APO #709, November, 24 1943 (Restricted).” 1943. Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Oct 3, 1943 - Dec 1 -1943]/[Folder 5 of 7]. Container 2: ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

“April Malaria Report from Major Frederick Farley 23rd Malaria Survey and the 37th Malaria Control Unit to Paul Harper (MalComSoPac); 1 May, 1944 (Secret).” 1944. Folder A 6-5 (4-1) General Correspondence - Russell Islands, British Solomon Islands [July 18, 1943 - Jan 18, 1944] [Folder 3 of 4]. Container 1: Arc# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

“Directive “Weekly Malaria Reports” from Harry Bennett to Medical Officers of All Naval Activities, July 19 1943 (Secret).” 1943. 1-7. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

“Directive from James Sapero to Base Malaria Control Units, South Pacific Area RE Checking of Thick-film Diagnoses. 13 August 1943.” 1943. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943], [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records

Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

Harper, Paul A., Fred A. Butler, Ephraim T. Lisansky and Carlos D. Speck. "Malaria and Epidemic Control in the South Pacific 1942-1944 (Confidential)." 1945. Reproduced by Engineers HQ SOPACBACOM 2379. Container 15, Folder [P2-3] [Malaria and Epidemic Control in South Pacific Area, 1942-1944] Folders 1-6. Entry #P93: Historical Files, 1942-1946, P2-3, Red 183. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"History of the Activities of Base Malaria and Epidemic Control on 'Espiritu Santo,' June 1942 - July 1945 (Secret)." 1945. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, New Hebrides, Folder 1 of 11 [July 1945 - Oct 1945]. A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides. Container 4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Letter from Corporal Frank Hackett to Base Malaria Control, APO - 292 RE Malaria." 30 Sept. 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Letter from Dearing to Commander Sapero, 10, September 1943 (Secret)." 1943. 1-3. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942- March 27, 1943]. Container # 8. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Letter from Robert Mount RE: Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942. January 17, 1943 (Secret)." 1943. 1-33. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Letter to Belkin from Perry, 26 January 1944 (Secret)." 1944. Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Letter to Robert Mount, 21 December 1942." 1942. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Aug 16, 1942- Jan 16, 1942]/ [Folder 5 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Lunga Malaria Control Unit Entomological Report: 24-30 March 1945." 1945. Folder A9-4(3) MMR - Guadalcanal, British Solomon Islands: Folder 5 of 12 [March 1945-April 1945]. Container # 5 ARC# 5722964 A9-4(1) ARC# 5722964 Monthly Malaria Reports - Espiritu Santo, New Hebrides THRU/ A9-4(3) Monthly Malaria Reports - Guadalcanal, British Solomon Islands. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

Mack, Frank. "July 1944 Calendar." 1944. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineer Section, HQ. S.O.S. 1508. Folder: Malarial Control - General 1943-45. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945; Malaria Control Dept 2655. 1944-45 THRU MED 1303, 1944-45 THRU MED 1303; Container #2563. Record Group: 0492 Mediterranean Theater of Operations, United States Army; Records of the Special Staff; Medical Section, Office of the Theater.

———. "June 1944 Calendar." June, 1944. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineer Section, HQ. S.O.S. 1508. Folder: Malarial Control - General 1943-45. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945; Malaria Control Dept 2655. 1944-45 THRU MED 1303, 1944-45 THRU MED 1303; Container #2563. RG 0492 Mediterranean Theater of Operations, United States Army; Records of the Special Staff; Medical Section, Office of the Theater.

———. "March 1945 Calendar." March, 1945. Malaria & Epidemic Disease Control So. Pac. Reproduced by Engineers HQ SOPACBACOM 2275. [Folder 3 of 6] Prevention of malaria in Military and Naval Forces in the South Pacific, 1944; Container 15. [P2-3] [Malaria and Epidemic Control in South Pacific Areas, 1942-1944]. RG 313 Naval Operating Forces.

"Major General Biggan, Royal Army Medical Corps, Addressing U.S. National Research Council Division of Medical Sciences, Subcommittee on Tropical Diseases." 1942. Box 5 [Folder 1: National Resource Council, 1942-3/Div of Medical Sciences/ Subcommittee on Tropical Diseases]. Entry No. 49B. Record Group 52 NM-48: Records of the Bureau of Medicine and Surgery.

"Malaria Control and Malaria Discipline by Corporal Frank Hackett. September 30 1944." 1944. 1-6. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Malaria Control Regulations, AG 710 (Secret)." 10 July, 1944. 1-8. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/ [Folder 3 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Malaria Survey Map of the West Renee Sector of Espiritu Santo (Secret)." 1944. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides, Folder 2 of 5 [Aug 30, 1944-Dec 31, 1944]. Container # 1 Arc# 5722964 Folder A6-5 (1-1). Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Malaria Warning." 1941-1945. Office for Emergency Management. Office of War Information. Domestic Operations Branch. Bureau of Special Services. (03/09/1943 - 09/15/1945). Series: World War II Posters, compiled 1942 - 1945 (ARC identifier: 513498). Record Group 44: Records of the Office of Government Reports, 1932 - 1947 (ARC identifier: 373). http://research.archives.gov/description/514975

"Map of Espiritu Santo Island Base Malaria Control, July 1945." Monthly Malaria Report for July 1945, Espiritu Santo, 1945. Folder: A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides [July 1945 - Oct 1945]/[Folder 1 of 11]. Container #4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Map of Espiritu Santo Island Base Malaria Control, September 1945. (1:30,000 scale)." Monthly Malaria Report for September 1945, Espiritu Santo, 1945. Folder: A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides [July 1945 - Oct 1945]/ [Folder 1 of 11]. Container #4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Map of Espiritu Santo Island, Base Malaria Control Coverage Area. October, 1944." Monthly Malaria Report for October 1944 Espiritu Santo, 1944. Folder: A9-4(1) Monthly Malaria Reports - Espiritu Santo, New Hebrides: Folder 4 of 11 [Oct 1944-Dec 1944]. Container 4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Map of Malaria Control Efate Island, Villa Section. Drawn by L. F. Korth 1st C.B. (Secret)." Monthly Report of Activities (Jan. 1944) Efate, 7 February 1944. 1-8 (plus 3 maps). Folder A9-4(2) Monthly Malaria Reports - Espiritu Santo, New Hebrides; Folder 2 of 4 [Jan 44 - Oct 44]. Container # 5 A9-4(1) ARC# 5722964 Monthly Malaria Reports - Espiritu Santo, New Hebrides THRU/ A9-4(3) Monthly Malaria Reports - Guadalcanal, British Solomon Islands. Entry P 90-F: Records

Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Map of Malaria Control Projects Completed. August 20, 1943 APO 709." 1943. A6-5(3-1) General Correspondence - Guadalcanal, British Solomon Islands [Mar 1, 1943- Oct 2, 1943] Folder 6 of 7. Container 2 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Map of Surundu Bay Unit Coverage Area. Oct. 1943 From: Monthly Malaria Report for October 1943, Espiritu Santo." 1943. Folder A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides, Folder 8 of 11 [Aug 1943- Oct 1943]. Container #4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Memorandum "Malaria Control" from Headquarters Island Command APO #709 from Colonel Wilfred Higgins by Command of Brigadier General Howard. Sept. 2, 1943 (Secret)." 1943. Folder A6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Mar 1, 1943 –Oct 2, 1943] [Folder 6 of 7]. Container 2: ARC# 5722964; Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from Colonel Thomas Burgess Headquarters Forward Area APO #709 RE Individual Measures to Prevent Malaria, Nov. 24, 1943." 1943. Folder A 6–5 General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1 –1943]/[Folder 5 of 7]. Container 2: ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from Dr. Fred Butler to Mr. Crum. 24 February 1944. (Secret)." 1944. Folder A6-5 (3-1) General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from Fred Butler to Fred Long RE PFC Frank L. Mack, 36148670, US.; 3 March 1944." 1944. Folder A6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Nov 24 1943 – Mar 4 1944] [Folder 4 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Memorandum from Fred Butler, Malaria and Epidemic Control Officer, South Pacific Area, To: Malaria Control Officer, Navy 140; March 31, 1944 (Secret)." 1944. Folder A6–5(1–1) General Correspondence – Espiritu Santo, New Hebrides [Folder 3 of 5] [Dec 20 1943 – Aug 22 1944]. Container 1: Arc# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from Fred Wallace to Commanding General, SOPACBACOM RE: Procurement of plane and pilot for Malaria Control, 25 September 1944. (Confidential)." 1944. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Aug 30, 1944-Dec 31, 1944]/ [Folder 2 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from James Douglas Headquarters APO 709, To: Lt. Comdr. Butler; 27 October 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum From James Douglas Headquarters APO 709; To Mr. Amick. 27 November 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from James Sapero to Force Surgeon, South Pacific Area and South Pacific Forces, 14 October 1942 (Secret)." 1942. 1-2. Folder A11 (4-1) Force Medical Officer, SPAC [South Pacific] [Jul 22 43-mar 27 45]. Container # 8. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from John Boyd, Malaria and Epidemic Control Officer, SoPacArea to The Chief Censor regarding (a) Chief Censor's Memorandum dated March 28 1944; 12 April 1944. (Secret)." 1944. Folder A6–5 (1–2) General Correspondence – Headquarters Malaria and Epidemic Control, South Pacific Area [Mar 4 1944–Oct 9, 1945]. Container 1: Arc# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from Lieutenant Colonel John McCarthy to Base Malaria Control, APO 292; 2 October 1944 RE Frank Hackett's Malaria Control and Malaria Discipline (Secret)." 1944. Folder A6–5(4–1) General Correspondence – Russell Islands, British Solomon Islands [Sept 30, 1944–Nov 29, 1945]. [Folder 1 of 4]; Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Memorandum from Lieutenant Mount to the Force Surgeon on Base Button, RE Measures for adoption by troops for malaria control. Nov. 24, 1942." 1942. Folder A6–5 (1–1) General Correspondence – Espiritu Santo, New Hebrides [Aug 16, 1942– Jan 16, 1942] [Folder 5 of 5]. Container 1 Arc# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from Malaria Control Officer, Navy 140 James C. Riffe Lt. Comdr, To: Malaria and Epidemic Control Officer, South Pacific Area, Navy 131; 3 August 1944." 1944. A 6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/[Folder 3 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from Paul Harper to Lt. Col. L.L. Parks." 29 August, 1943. 1-2. Folder A 6-5 General Correspondence - Guadalcanal, British Solomon Islands [Mar 1, 1943 -Oct 2, 1943]/[Folder 6 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Memorandum From Paul Harper, To Dr. Butler. 1 December 1943." 1943. Folder: A 6–5 (3-1) General Correspondence – Guadalcanal, British Solomon Islands [Oct 3, 1943 – Dec 1, 1943]; [Folder 5 of 7]. Container 2 ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum From R. Johnson Base Malaria Control Unit Navy 60, To Dr. Boyd, Malaria & Epidemic Control Headquarters, Navy 131. 5 June 1944." 1944. Folder A6-5 (4-1) General Correspondence - Russell Islands, British Solomon Islands [Jan 24, 1944- Nov 19 1944] [Folder 2 of 4]. Container 1: Arc# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

"Memorandum from Sapero to Dearing, December, 1942 (Secret)." 1942. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1943]. Container # 8. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum from William Bennett to Malaria and Epidemic Control Headquarters, South Pacific Area, Navy 131 RE HC-4 Report 14 August 1944 (Secret)." 1944. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Dec 20, 1943 - Aug 22, 1944]/[Folder 3 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum From: James Sapero, Officer-in-Charge, Malaria Control, South Pacific Area, To: Commanding General, Base Buttons, RE: Removal of Imported Natives. 26 October 1942." 1942. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides. Folder 5 of 5 [Aug 16, 1942- Jan 16, 1942]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum No. 70 "Malaria Control in Units of the Thirteenth Air Force" (Secret)." November, 12 1943. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container 1, Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum to Dr. Butler from Paul Harper; 1 February 1944 (Secret)." 1944. Headquarters Malaria & Epidemic Control. Folder A6-5 (3-1) General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [folder 4 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945; Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum to Dr. Butler from Paul Harper; 22 February 1944." 1944. Headquarters Malaria & Epidemic Control. Folder A6-5 (3-1) General Correspondence - Guadalcanal, British Solomon Islands [Nov 24 1943- Mar 4 1944] [Folder 4 of 7]. Container 2: ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945; Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum to Lt. Lever, Government Entomologist, Fiji from Lieutenant Kenneth Knight Headquarters Navy 140, 10 November 1943 (Secret)." 1943. Folder A6-5(16-1) General Correspondence - Fiji Islands - American Division [Apr 3, 1944-Oct 1, 1945]/ [Folder 1 of 2]. Container 3. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum: "Tonkinese and natives, malaria hazard of." from Malaria Control Officer, Espiritu Santo; To The Commanding General, IV Island Command; VIA Malaria Control Officer, South Pacific Area, 4 October 1943 (Secret)." 1943. 1-2. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Memorandum: Malaria Control Information for CINCPAC, from Fred Butler, Malaria Control Officer. 9 March 1944 (Secret)." 1944. 1-8. Folder A11 (4-1) Force Medical Officer, SOPAC [South Pacific] [July 22, 1942-March 27, 1945]. Container # 8. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Monthly Malaria Report for February 1944, Espiritu Santo." 1944. [Folder A9-4 (1) Monthly Malaria Reports - Espiritu Santo, New Hebrides, February 1944 - March 1944, Folder 6 of 11. Container #4 ARC# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

Mount, Robert. "Malaria Control Unit, Base Button, Report of Activities and Malarial incidence of base forces for the troop occupation period of 1942 (Secret)." 1943. 1-33. Folder A 6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943]/ [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

———. "Malaria Control in the Field (Secret)." 24 July 1943. 1-6. Base Malaria Control Unit Espiritu Santo. Folder A6-5 (1-1) General Correspondence - Espiritu Santo, New Hebrides [Jan 17, 1943 - Dec 15, 1943], [Folder 4 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197); 1942-1945. Record Group 313 Naval Operating Forces/ Commander South Pacific (COMSOPAC).

"Prevent Malaria Shorten the War." 1945. Government Printing Office. Folder: Malarial Control. Container # 2640. Entry# UD-UP 309: Formally Classified General Correspondence, 1942-1945/Malaria Control Det 2655. 1944-45 THRU MED 1303. Record Group: 0492 Mediterranean Theater of Operations, United States Army/Records of the Special Staff/Medical Section, Office of the Theater.

"Report from Malaria Control Unit, Buttons (Lt. R. Mount)." October 14, 1942. 1-3. Folder A6-5 (1-1) General Correspondence - Espirito Santo, New Hebrides [Aug 16, 1942- Jan 16, 1942]/ [Folder 5 of 5]. Container # 1 Arc# 5722964. Entry P 90-F: Records Relating to Malaria and Epidemiological Disease Control (Red 197);

1942-1945. Record Group 313: Naval Operating Forces/Commander South Pacific (COMSOPAC).

"Report of the Base Malaria Control Inspector by William Fletcher in Report of Current Malaria and Epidemic Control Activities for Espiritu Santo; Nov. 1944 (Secret)." 1944. Folder: A9-4(1) Monthly Mal Reports - Espiritu Santo, Nw Hebrides [Oct 1944-Dec 1944]/ [Folder 4 of 11]. Folder: A6-5(17-1) General Correspondence - Treasury Islands THRU A9-4 (1): Monthly Malaria Reports - Espiritu Santo, New Hebrides: Container #4 ARC# 5722964. Entry P90-F: Records Relating to Malaria and Epidemiological Disease Conditions (Red 197), 1942–1945; Record Group 0313 Naval Operating Forces/ SOPAC Force Medical Officer, Malaria & Epidemic Disease Control.

National Archives and Records Administration, Morrow Georgia

"History of Malaria Control in War Areas." 1946. Folder: Information 3-6: CDC History - General. Box Accession Number: 442.03/ D0-01/ Box 6 of 7. Record Group 442: Records of the Centers for Disease Control and Prevention, 1921 - 2006: National Archives Identifier: 6282663.

National Library of Medicine, Bethesda, Maryland

Allied Forces. South Pacific Area. Malaria and Epidemic Disease Control. "Malaria Mosquitoes and Men. Malaria Training Manual, No. 3, 1944 NAVMED 143." 1944. 1-8. United States. Government Printing Office. NLM Unique ID: 23460100R.

———. "Prevention of Malaria in Military and Naval Forces in the South Pacific. Malaria Training Manual no. 1, 1944 NAVMED 141." 1944. 1-21. United States. Government Printing Office. NLM Unique ID: 23460100R.

"This is Ann-- She Drinks Blood! / Prepared and Distributed By Army Orientation Course, Special Service Division Army Service Forces, War Dept." *NewsMap*, 1943. United States. War Department Contributor (Organization): United States. Government Printing Office. Washington, D.C.: Special Service Division, Army Service Forces, War Dept. Images from the History of Medicine .

Christophers, S.R. and J.W.W. Stephens. "Segregation of Europeans." Reports to the Malaria Committee of the Royal Society, Third Series. 1900. London: 21-24. Harrison and Sons. General Collection, W1 RO875.

———. "The Anatomy and Histology of the Adult Female Mosquito." Reports to the Malaria Committee of the Royal Society, Fourth Series. 1901. London: 1-30. Harrison and Sons. General Collection, W1 RO875.

Christophers, S.R. and J.A. Sinton. "A Malaria Map of India." *The Indian Journal of Medical Research* XIV, (1926-27).

"Don't be a Dummy-- Avoid Malaria Keep Covered, Use Repellent!" 1944. Government Printing Office. Images from the History of Medicine. http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101454784~197259:Don-t-be-a-dummy---avoid-malaria-ke?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:fight%2Bthe%2Bperil;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=0&trs=4

"Don't Go to Bed With a Malaria Mosquito." 1944. U.S. G.P.O. Images from the History of Medicine . http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101454783~197258:Don-t-go-to-bed-with-a-malaria-mosq?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:malaria;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=18&trs=199

"Fight the Peril Behind the Lines." 1943. U.S. G.P.O. Images from the History of Medicine . http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101444949~208473:Fight-the-peril-behind-the-lines?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:fight%2Bthe%2Bperil;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=2&trs=4

"From 1800 to 1700 Hrs., Long Trousers, Long Sleeves, Shirts Buttoned, Use Repellent, Use Mosquito Net, By Order of Commanding General." 29 August 1945. U.S. Army. Images from the History of Medicine, National Library of Medicine. http://ihm.nlm.nih.gov/luna/servlet/view/search?q=A015215

"Is Your Organization Prepared to Fight Both Enemies?" 1945. Navy, Bureau of Medicine and Surgery, NAVMED 365: United States. Government Printing Office. Images from the History of Medicine . http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101438601~152856:Is-your-organization-prepared-to-fi?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:is%2Byour%2Borganization;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=35&trs=80

James, S. P. "A Report of the Anti-Malarial Operations at Mian Mir (1901-1902)." Reports to the Malaria Committee of the Royal Society, Eighth Series. 1903. London: 27-77. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

Mack, Frank. “June 1945 Calendar: Don’t Spoil a Good Dream Sleep Under a Bed Net.” 1945. Malaria & Epidemic Disease Control -- SOPAC. Reproduced by Engineers HQ SOPACBACOM United States, Army. Images from the History of Medicine. National Library of Medicine. http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101573962~218479:Don-t-spoil-a-good-dream-sleep-unde?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:malaria;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=19&trs=199

———. “May 1945 Calendar: If You Don’t Give a Darn About Yourself Do it for Her.” 1945. Malaria & Epidemic Disease Control -- SOPAC. United States, Army. Images from the History of Medicine. National Library of Medicine. http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101573963~218478:If-you-don-t-give-a-darn-about-your#

“Man-Made Malaria: 6 Mosquitoes in 10 Breed in Water (Navymed 364).” 1945. Navy, Bureau of Medicine and Surgery. Government Printing Office. Images from the History of Medicine . http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101438600~208426:Man-made-malaria?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:malaria;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=63&trs=199

Mulligan, H.W. and Baily, J.D. “Map of Malaria in Quetta.” *Records of the Malaria Survey of India*, VI (2), Calcutta: Published for the Indian Research Fund Association by Tacker, Spink & Co. 1936. 289-385. History of Medicine Division.

Ross, Ronald. “Mosquito Brigades and How to Organise Them.” 1902. New York: 100. Longmans, Green, and Co. NLM ID 12011330R. History of Medicine Division.

Stephens, J. W. W. and S. R. Christophers. “Destruction of Anopheles in Lagos.” Reports to the Malaria Committee of the Royal Society, Third Series. 1900. London: 14-19. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “Note on Certain Bodies found in the Glands of Two Species of Culex.” Reports to the Malaria Committee of the Royal Society, Second Series. 1900. London: 20. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Malaria of Expeditionary Forces and the Means of its Prevention.” Reports to the Malaria Committee of the Royal Society, Second Series. 1900. London: 20-22. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Malarial and Blackwater Fevers of British Central Africa.” Reports to the Malaria Committee of the Royal Society, First Series. 1900. London: 12-41. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “Some Points in the Biology of the Species of Anopheles found in Bengal.” Reports to the Malaria Committee of the Royal Society, Sixth Series. 1902. London: 11-19. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Classification of Indian Anopheles into Natural Groups.” Reports to the Malaria Committee of the Royal Society, Seventh Series. 1902. London: 3-14. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Relation of Malaria Endemicity to ‘*Species*’ of Anopheles.” Reports to the Malaria Committee of the Royal Society, Sixth Series. 1902. London: 3-10. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Relation of Species of Anopheles to Malarial Endemicity — Further Report.” Reports to the Malaria Committee of the Royal Society, Seventh Series. 1902. London: 20-23. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “Note of Malarial Fever on Railways under Construction.” Reports to the Malaria Committee of the Royal Society, Third Series. 1900. London: 20. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Agglutination of Sporozoites.” Reports to the Malaria Committee of the Royal Society, Third Series. 1900. London: 1. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “The Malarial Infection of Native Children.” Reports to the Malaria Committee of the Royal Society, Third Series. 1900. London: 2-13. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

Stephens, J. W. W. and S. R. Christophers. “Notes on Bodies in Salivary Glands of Anopheles, etc.” Reports to the Malaria Committee of the Royal Society, Seventh Series. 1902. London: 45-46. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. “Malaria in an Indian Cantonment (Mian Mir): an Experimental Application of Anti-malarial Measures — Preliminary Report.” Reports to the Malaria Committee of the Royal Society, Eighth Series. 1903. London: 13-22. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. *The Practical Study of Malaria and other Blood Parasites*. Liverpool: University Press of Liverpool, 1903. Third Edition.

Stephens, J. W. W. and S. R. Christophers. "Malarial Fever without Parasites in the Peripheral Blood." Reports to the Malaria Committee of the Royal Society, Fifth Series. 1901. London: 7-10. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. "Mononuclear Leucocytes diagnostic of Malaria." Reports to the Malaria Committee of the Royal Society, Fifth Series. 1901. London: 5-7. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. "The Proposed Site for European Residences in the Freetown Hills." Reports to the Malaria Committee of the Royal Society, Fifth Series. 1901. London: 2-5. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

———. "The Tonicity of the Blood in Malaria and Blackwater Fever." Reports to the Malaria Committee of the Royal Society, Fifth Series. 1901. London: 10-27. Harrison and Sons. General Collection, W1 RO875. History of Medicine Division.

"This is a Malaria Zone Protect Yourself, Protect Your Buddies, Keep Covered After Dark." 19--. United States? Images from the History of Medicine . http://ihm.nlm.nih.gov/luna/servlet/detail/NLMNLM~1~1~101451934~197810:This-is-a-malaria-zone-protect-your?sort=Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization&qvq=q:this%2Bis%2Ba%2Bmalaria%2Bzone;sort:Title%2CSubject_MeSH_Term%2CCreator_Person%2CCreator_Organization;lc:NLMNLM~1~1&mi=0&trs=1

Sinton, J.A. "What Malaria Costs India, Nationally, Socially, Economically." *Records of the Malaria Survey of India* V(3), (1935): 223–64. History of Medicine Division.

Williams, Louis Laval. "Malaria at the Making of History." Clinical Excepts, 15 (2). 1941. 35-44. Winthrop Chemical Company. Louis Laval Williams Papers 1927-1970, Box 7 of 12. NLM Unique ID: 2934002R. History of Medicine Division.

University of California, San Diego Library Special Collections

Geisel, Theodor. "Handwritten note." 194-. Folder: US Army - Drawings "This is Ann" Booklet about protection against/ Malaria, illustrated by TSG. Published by War Department/ [2926] MSS. 230; Box 1; Folder 36.

Geisel, Theodor S. and Munro Leaf. *This is Ann: She's Dying to Meet You*. Washington D.C.: United States War Department, U.S. Government Printing Office, 1943.

Folder: US Army - Drawings “This is Ann” Booklet about protection against/ Malaria, illustrated by TSG. Published by War Department/ [2926]; MSS. 230.

University of Oxford, Radcliffe Science Library

Christophers, S.R. and J.W.W. Stephens. “The Native as the Prime Agent in the Malarial Infection of Europeans (With Map).” *Reports to the Malaria Committee of the Royal Society* Second Series, (1900): 3–19.

Stephens, J. W. W. and S. R. Christophers. “Distribution of Anopheles in Sierra Leone. Parts I and II.” *Reports to the Malaria Committee of the Royal Society* First Series, (1900): 42–75.

Wellcome Library, London

Annett, H. E., J. Everett Dutton, Jabez H. Elliott and Ronald Ross. “Report of the Malaria Expedition to Nigeria of the Liverpool School of Tropical Medicine and Medical Parasitology.” 1901. Liverpool: University Press of Liverpool. Closed stores M22153.

“Anti-Malarial Campaign Booklet for the Central Mediterranean Forces.” 1945. Printing & Stationery Services, CMF. Issued with GRO Serial 16 of 1945. RAMC/2063/38, Box 438.

Christophers, S.R. “Two Malarial Surveys Connected With Industrial Projects in Certain Very Highly Malarious Localities in India.” 1925. Calcutta: Thacker, Spink & Co. Closed stores Med. pam. (Shelfmark: WC750 1925C55t).

———. “How to Do a Malaria Survey.” 1928. Calcutta: 147. Government of India, Central Publication Branch. Medical Collection (Shelfmark: WC750 1958C55h).

Christophers, S.R. and C.A. Bentley. “Malaria in the Duars: Being the Second Report to the Advisory Committee Appointed By the Government of India to Conduct an Enquiry Regarding Blackwater and Other Fevers Prevalent in the Duars.” 1911. Simla: Government of India Press. Medical Heritage Library.

“Directive on Malaria, issued by Allied Force Headquarters. Adv. Adm. Ech., C.M.F. Ext. 130. 3830 M. 24 Jan. 44.” 1944. 1-2. Folder: Notes, reports, maps and pamphlets re malaria in Algeria and Italy 1943;1944. Archives and manuscripts Archives and manuscripts 1944. Available at Closed stores Arch. & MSS (Shelfmark: RAMC/ 651/2:Box 134).

“Maps showing areas in England where malaria was endemic in the 19th and 20th centuries.” 193-. WTI/PGS/8:Box 1. Closed stores Arch. & MSS.

"Message on Malaria Prevention From the "Union Jack" 1942 - 1945." 1942-1945. RAMC 651/3; Papers of Lieutenant Colonel H.D. Chalke, Scrapbook of Newspaper cuttings RE public health in the Central Mediterranean Force, mainly RE campaigns against malaria and venereal disease. The RAMC Muniment Collection in the care of the Wellcome Library, Wellcome Images.

Ross, Ronald, H. E. Annett and E. E. Austen. "Report of the Malaria Expedition of the Liverpool School of Tropical Medicine and Medical Parasitology." 1900. Liverpool: Liverpool University Press; G. Philip. Closed stores Med. O/S (Shelfmark: QX510 1900R82r).

Primary and Secondary Sources

Ackerknecht, Erwin H. *Malaria in the Upper Mississippi Valley 1760-1900*. Baltimore: Johns Hopkins Press, 1945.

———. *Medicine at the Paris Hospital 1794-1848*. Baltimore: The Johns Hopkins Press, 1967.

Agyepong, Irene Akua and Jane Kangeya-Kayonda. "Providing Practical Estimates of Malaria Burden for Health Planners in Resource-Poor Countries." *Am J Trop Med Hyg* 71(2_suppl), (2004 August 1, 2004): 162–67.

Akhtar, Rais. "Geoecology of Malaria in India: Historical Perspective and a Case Study of Western Rajasthan," In *Environmental Deterioration and Human Health: Natural and Anthropogenic Determinants*, edited by Abdul Malik, Elisabeth Grohmann and Rais Akhtar, 335–46. Springer, 2014.

Akrich, Madeleine. "The De-Scription of Technical Objects," In *Shaping Technology/ Building Society*, edited by Wiebe E. Bijker and John Law, 205–24. Cambridge: The MIT Press, 1992.

Alilio, Martin S., Ib C. Bygbjerg and Joel G. Breman. "Are Multilateral Malaria Research and Control Programs the Most Successful? Lessons From the Past 100 Years in Africa." *Am J Trop Med Hyg* 71(2_suppl), (August 1, 2004): 268–78.

Alonso, Pedro. "Damn the Mosquitoes! Full speed ahead!" (15 March 2016): World Health Organization. Accessed April 14, 2016. http://www.who.int/mediacentre/commentaries/vector-control/en/#.Altman, Lawrence K. "3 Scientists Win Nobel Prize in Medicine for Parasite-Fighting Therapies." *The New York Times*, October 5, 2015.

Anderson, Kay, ed. *Handbook of Cultural Geography* London: SAGE, 2003.

Anderson, Virginia DeJohn. *Creatures of Empire: How Domestic Animals Transformed Early America*. Oxford: Oxford University Press, 2006.

Anderson, Warwick. *Colonial Pathologies: American Tropical Medicine, Race, and Hygiene in the Philippines*. Durham: Duke University Press, 2006.

Andrews, Justin M. "Experience in the United States." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. 61–112, Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterV.htm.

———. "North Africa, Italy, and the Islands of the Mediterranean." *Preventive Medicine in World War II, Volume 6* (1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. 249–302, Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterV.htm.

Appadurai, Arjun. "Introduction: Commodities and the Politics of Value," In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, 3–63. Cambridge: Cambridge University Press, 1986.

Arnold, David. *Imperial Medicine and Indigenous Societies (Studies in Imperialism)*. Manchester: Manchester University Press, 1989.

———. "'An Ancient Race Outworn': Malaria and Race in Colonial India, 1860-1930," In *Race, Science, and Medicine*, edited by Waltraud Ernst and Bernard Harris, 123–43. London: Routledge, 1999.

———. *Science, Technology, and Medicine in Colonial India*. Cambridge: Cambridge University Press, 2000.

———. *The Tropics and the Traveling Gaze: India, Landscape, and Science, 1800-1856*. Seattle: University of Washington Press, 2006.

Ayala, FJ, AA Escalante and SM Rich. "Evolution of Plasmodium and the Recent Origin of the World Populations of Plasmodium Falciparum." *Parassitologia* 41(1-3), (1999 Sep): 55–68.

Barad, Karen. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham: Duke University Press Books, 2007.

Barthes, Roland. "Rhetoric of the Image," In *Visual Culture: the Reader*, edited by Jessica and Stuart Hall Evans, 33–40. London: SAGE Publications Ltd, 1999.

Bashford, Alison. *Imperial Hygiene: A Critical History of Colonialism, Nationalism and Public Health*. Houndsmills [England] ; New York: Palgrave Macmillan, 2004.

Beadle, Christine and Stephen L. Hoffman. "History of Malaria in the United States Naval Forces at War: World War I through the Vietnam Conflict." *Clinical Infectious Diseases* 16(2), (1993): 320–29.

Beaubien, Jason. "How the US Stopped Malaria, One Cartoon At a Time." *NPR*, December 12, 2012.

Becker, Peter and William Clark. *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices*. Social History, Popular Culture, and Politics in Germany. Ann Arbor: University of Michigan Press, 2001.

Beisel, Uli. "Jumping Hurdles with Mosquitoes?" *Environment and Planning D: Society and Space* 28(1), (2010): 46–49.

Beisel, Uli and Christophe Boëte. "The Flying Public Health Tool: Genetically Modified Mosquitoes and Malaria Control." *Science as Culture* 22(1), (2013): 38–60.

Beisel, Uli, Ann H. Kelly and Noémi Tousignant. "Knowing Insects: Hosts, Vectors and Companions of Science." *Science as Culture* 22(1), (2013): 1–15.

Bell, DR, P Jorgensen, EM Christophel and KL Palmer. "Malaria Risk: Estimation of the Malaria Burden." *Nature* 437(7056), (2005 Sep 8): E3–4; discussion E4.

Bennett, Judith A. "Malaria, Medicine, and Melanesians: Contested Hybrid Spaces in World War II." *Health and History* 8(1), (2006): 27–55.

Bennett, Tony and Patrick Joyce, eds. *Material Powers: Cultural Studies, History and the Material Turn (CRESC)* London: Routledge, 2010.

Bentley, Charles and S.R. Christophers. *The Causes of Blackwater Fever in the Duars*. Simla: Government of India Press, 1908.

Bhattacharya, Nandini. "The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900–30." *Medical History* 55 (2), (2011): 183–202.

———. *Contagion and Enclaves: Tropical Medicine in Colonial India*. Postcolonialism Across Disciplines. Liverpool University Press, 2013.

Boesch, Ernest. “The Sound of the Violin.” *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition* 15 (1), (January, 1993): 6–15.

Bosman, Andrea and Kamini N. Mendis. “A Major Transition in Malaria Treatment: The Adoption and Deployment of Artemisinin-Based Combination Therapies.” *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 193–97.

Bourke, Joanna. *Dismembering the Male: Men’s Bodies, Britain, and the Great War*. Chicago: University Of Chicago Press, 1996.

Bowker, Geoffrey C. *Memory Practices in the Sciences (Inside Technology)*. The MIT Press, 2008-02-15.

Bracegirdle, Brian. “The Microscopical Tradition,” In *Companion Encyclopedia of the History of Medicine, Volume 1*, edited by W.F. Bynum and Roy Porter, 102–19. London: Routledge Reference, 1993.

Bradley, D.J. “The Particular and the General. Issues of Specificity and Verticality in the History of Malaria Control.” *Parassitologia* 40, (1998): 5–10.

Bradley, DJ. “Watson, Swellengrebel and Species Sanitation: Environmental and Ecological Aspects.” *Parassitologia* 36(1-2), (1994 Aug): 137–47.

Bradley, George. “A Review of Malaria Control and Eradication in the United States.” *Mosquito News* 26, (1966): 462–70.

Brady, Oliver J., H. Charles J. Godfray, Andrew J. Tatem, Peter W. Gething, Justin M. Cohen, F. Ellis McKenzie, T. Alex Perkins, Robert C. Reiner, Lucy S. Tusting, Marianne E. Sinka, Catherine L. Moyes, Philip A. Eckhoff, Thomas W. Scott, Steven W. Lindsay, Simon I. Hay and David L. Smith. “Vectorial capacity and vector control: reconsidering sensitivity to parameters for malaria elimination.” *Transactions of The Royal Society of Tropical Medicine and Hygiene* 110(2), (2016/02/01): 107–17.

Brantz, Dorothee. *Beastly Natures: Animals, Humans, and the Study of History*. Charlottesville: University of Virginia Press, 2010.

Breman, J. G. “The Ears of the Hippopotamus: Manifestations, Determinants, and Estimates of the Malaria Burden.” *Am J Trop Med Hyg* 64(1_suppl), (2001 January 1, 2001): 1–11.

Breman, Joel G., Martin S. Alilio and Nicholas J. White. "Defining and Defeating the Intolerable Burden of Malaria III. Progress and Perspectives." *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): vi–xi.

Breman, Joel G. and Cherice N. Holloway. "Malaria Surveillance Counts." *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 36–47.

Briggs, Charles L. and Clara Mantini-Briggs. *Stories in the Time of Cholera: Racial Profiling During a Medical Nightmare*. Berkeley: University of California Press, 2004.

Brody, Howard, Michael Russell Rip, Peter Vinten-Johansen, Nigel Paneth and Stephen Rachman. "Map-Making and Myth-Making in Broad Street: The London Cholera Epidemic, 1854." *The Lancet* 356(9223), (2000/7/1/): 64–68.

Brömer, Rainer. "The First Global Map of the Distribution of Human Diseases: Friedrich Schnurrer's 'Charte über die geographische Ausbreitung der Krankheiten', 1827," In *Medical Geography in Historical Perspective (Medical History Supplement)*, edited by Nicolaas A. Rupke, 176–85. London: Wellcome Trust Centre for the History of Medicine at UCL, 2000.

Brudon, Lynn. "Hiroskito Speaking. Japan Expects Every Saboteur to Do His Duty." 1945. United States. REEVE 088546-6. National Museum of Health and Medicine. flickr. https://www.flickr.com/photos/medicalmuseum/5021277756/in/album-72157618927621660/

———. "Some Things Are Hard to Understand." 1945. United States. REEVE 088546-8. National Museum of Health and Medicine. flickr. https://www.flickr.com/photos/medicalmuseum/5020674987/in/album-72157618927621660/

Buller, Henry. "Reconfiguring Wild Spaces: The porous boundaries of wild animal geographies," In *Routledge Handbook of Human-Animal Studies*, edited by Garry Marvin and Susan McHugh, 233–45. New York: Routledge, 2014.

Buttimer, Anne. "Airs, Waters, Places: Perennial Puzzles of Health and Environment," In *Medical Geography in Historical Perspective*, edited by Nicolaas A. Rupke, 211–16. London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000.

Bynum, William F. "An Experiment That Failed: Malaria Control At Mian Mir." *Parassitologia* 36 (1-2), (1994): 107–20.

———. ""Reasons for Contentment": Malaria in India, 1900-1920." *Parassitologia* 40(1-2), (1998): 19–27.

Callon, Michel. “Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay,” In *Power, action and belief: a new sociology of knowledge?*, edited by John Law, 196–223. London: Routledge, 1986.

Camerini, J R. “Heinrich Berghaus’s Map of Human Diseases.” *Medical History. Supplement* (20), (2000): 186–208.

Cameron, Ewan, Katherine E. Battle, Samir Bhatt, Daniel J. Weiss, Donal Bisanzio, Bonnie Mappin, Ursula Dalrymple, Simon I. Hay, David L. Smith, Jamie T. Griffin, Edward A. Wenger, Philip A. Eckhoff, Thomas A. Smith, Melissa A. Penny and Peter W. Gething. “Defining the relationship between infection prevalence and clinical incidence of Plasmodium falciparum malaria.” *Nat Commun* 6, (2015/09/08/)

Canguilhem, Georges. *The Normal and the Pathological*. New York: Zone Books, 1991 (1966).

Capanna, Ernesto. “Grassi Versus Ross: Who Solved the Riddle of Malaria?” *International Microbiology* 9, (2006): 69–74.

Carmichael, Mary. “Halting the World’s Most Lethal Parasite: Immunizing Mosquitoes and Other ‘Crazy’ Antimalaria Ideas.” *Scientific American*, 11/2010.

Carter, Paul. *The Road to Botany Bay: An Exploration of Landscape and History*. Minneapolis: University Of Minnesota Press, 2010 (1987).

Carter, Richard and Kamini N. Mendis. “Evolutionary and Historical Aspects of the Burden of Malaria.” *Clinical Microbiology Reviews* 15(4), (2002): 564–94.

Carter, Richard, Kamine N. Mendis and Donald Roberts. “Spatial Targeting of Intervention against Malaria.” *Bulletin of the World Health Organization* 78(12), (2000): 1401–11.

Cartwright, Lisa and Brian Goldfarb. “Cultural Contagion: On Disney’s Health Education Films for Latin America,” In *Disney Discourse: Producing the Magic Kingdom*, edited by Eric Smoodin, 169–80. New York: Routledge, 1994.

Cator, Lauren J., Penelope A. Lynch, Andrew F. Read and Matthew B. Thomas. “Do Malaria Parasites Manipulate Mosquitoes?” *Trends in Parasitology* 28(11), (2012): 466–70.

Centers for Disease Control and Prevention. “Anopheles Mosquitoes.” (2012): Atlanta, GA: http://www.cdc.gov/malaria/about/biology/mosquitoes/index.html.

———. “The History of Malaria, an Ancient Disease.” (2012): Atlanta, GA: Centers for Disease Control and Prevention. http://www.cdc.gov/malaria/about/history/.

———. “Chikungunya Virus.” (2015): Atlanta, GA: Centers for Disease Control and Prevention. Accessed April 14, 2016. http://www.cdc.gov/Chikungunya/index.html.

Chappell, Bill. “Work On Parasite Diseases Earns Nobel Prize For Medicine.” *National Public Radio*, 10/5/2015.

Chen, Kuan-Hsing and David Morley. *Stuart Hall: Critical Dialogues in Cultural Studies (Comedia)*. London: Routledge, 1996.

Christophers, S.R. “A New Statistical Method of Mapping Epidemic Disease in India, With Special Reference to the Mapping of Epidemic Malaria,” In *Proceedings of the Imperial Malaria Conference held at Simla In October 1909*, 16–22. Simla: Government Central Branch Press, 1910.

———. “Malaria in the Punjab,” In *Proceedings of the Imperial Malaria Conference Held at Simla in October 1909*, 29–47. Simla: Government Central Branch Press, 1910.

Christophers, S.R., J.A. Sinton, G. Covell and Malaria Institute of India. *How to Do a Malaria Survey, 4th Edition*. Simla: Manager of Publications, Government of India Press, 1941. Fourth Edition.

Christophers, S.R. and C.A. Bentley. “The Human Factor: An Extension of our Knowledge Regarding the Epidemiology of Malarial Disease,” In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, 78–83. Bombay: Bennett, Coleman & Co., 1909.

Cibulskis, Richard E., David Bell, Eva-Maria Christophel, Jeffrey Hii, Charles Delacollette, Nathan Bakyaita and Maru W. Aregawi. “Estimating Trends in the Burden of Malaria At Country Level.” *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 133–37.

Clark, Nigel, Doreen Massey and Phillip Sarre, eds. *Material Geographies: A World in the Making* London: Sage, 2008.

Cole, Michael. *Cultural Psychology: A Once and Future Discipline*. The Belknap Press, 1998.

“Standard Operating Procedure for Control of Malaria and Other Insect-Borne Diseases During a Combat Operation.” *Preventive Medicine in World War II, Volume 6*

(1963): Colonel John Boyd Coates Jr. Washington, DC: Office of the Surgeon General. Appendix A, Accessed 2016, Feb. 25. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

Condon-Rall, Mary Ellen. "The Army's War Against Malaria: Collaboration in Drug Research During World War II." *Armed Forces & Society* 21(1), (1994): 129–43.

Cook County Urban Coyote Research Project. "Urban Coyote Research: Urban coyote ecology and management, Cook County, Illinois." (2015): Accessed Dec. 16, 2015. http://www.urbancoyoteresearch.com/FrontPage.

Cooter, Roger and Claudia Stein. "Visual Imagery and Epidemics in the Twentieth Century," In *Imagining Illness: Public Health and Visual Culture*, edited by David Serlin, 169–92. Minneapolis: University of Minnesota Press, 2010.

Copp. "Advice to British Soldiers About Malaria. Coloured Pen Drawing By Copp, Ca. 1944." 1944. The Wellcome Library, London, no. 5435i. http://catalogue.wellcomelibrary.org/record=b1168826

Cormier, Loretta A. *The Ten-Thousand Year Fever: Rethinking Human and Wild-Primate Malarias (New Frontiers in Historical Ecology)*. Left Coast Press, 2011.

Covell, Gordon. *Malaria Control by Anti-Mosquito Measures*. Calcutta and Simla: W. Thacker & Co., 1931.

Cox-Singh, Janet, Timothy M E Davis, Kim-Sung Lee, Sunita S G Shamsul, Asmad Matusop, Shanmuga Ratnam, Hasan A Rahman, David J Conway and Balbir Singh. "*Plasmodium knowlesi* Malaria in Humans is Widely Distributed and Potentially Life-Threatening." *Clinical Infectious Diseases: an official publication of the Infectious Diseases Society of America* 46(2), (2008): 165–71.

Cox, Francis EG. "History of the Discovery of the Malaria Parasites and Their Vectors." *Parasites & Vectors* 3, (2010): 3–5.

Crampton, Jeremy W. and Stuart Elden. *Space, Knowledge and Power: Foucault and Geography*. Ashgate Publishing, 2007-01.

Cresswell, Tim. *Place: A Short Introduction (Short Introductions to Geography)*. Wiley-Blackwell, 2004-06-14.

———. *On The Move*. New York: Routledge, 2007.

———. *Geographic Thought: A Critical Introduction*. West Sussex: Wiley-Blackwell, 2013.

Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton & Company, 1992.

Curtin, Philip D. "Medical Knowledge and Urban Planning in Tropical Africa." *The American Historical Review* 90(3), (1985/06/01): 594–613.

Cushing, Emory C. *History of Entomology in World War II*. Smithsonian Institution Publication 4294. Baltimore: The Lord Baltimore Press, 1957.

D'Alessandro, U. and H. Buttiëns. "History and Importance of Antimalarial Drug Resistance." *Tropical Medicine & International Health* 6(11), (2001): 845–48.

Dalrymple, Ursula, Bonnie Mappin and Peter W. Gething. "Malaria mapping: understanding the global endemicity of falciparum and vivax malaria." *BMC Medicine* 13(1), (2015): 1–8.

Daniels, C.W. and H.B. Newham. *Laboratory Studies in Tropical Medicine*. John Bale, Sons & Danielsson, 1911.

de Laet, Marianne and Annemarie Mol. "The Zimbabwe Bush Pump: Mechanics of a Fluid Technology." *Social Studies of Science* 30(2), (2000/04/01): 225–63.

de Zulueta, J. "Malaria and Ecosystems: from Prehistory to Posteradication." *Parassitologia* 36(1-2), (1994): 7–15.

Denit, G. B. "Message from the Chief Surgeon in the Far East." *Bulletin of the U.S. Army Medical Department* 86, (March 1945)

Despret, Vinciane. "From Secret Agents to Interagency." *History and Theory* 52(4), (2013): 29–44.

Dobson, M.J. "The Malariology Centenary." *Parassitologia* 41(1-3), (1999): 21–32.

Dodge, Martin, Rob Kitchin and Chris Perkins, eds. *Rethinking Maps: New Frontiers in Cartographic Theory (Routledge Studies in Human Geography)* Routledge, 2011.

———. *The Map Reader: Theories of Mapping Practice and Cartographic Representation*. Wiley, 2011.

Drayton, Richard. *Nature's Government: Science, Imperial Britain, and the "improvement" of the World*. New Haven: Yale University Press, 2000.

Dunlap, Thomas. *DDT: Scientists, Citizens, and Public Policy*. Princeton University Press, 1983.

Edney, Matthew H. *Mapping an Empire: The Geographical Construction of British India, 1765-1843*. University Of Chicago Press, 1999.

Enayati, A and J Hemingway. "Malaria Management: Past, Present, and Future." *Annu Rev Entomol* 55, (2010): 569–91.

"Enemy Territory Mosquitoes Attack Here." 194-. Signal Corps, U.S. Army. Otis Historical Archives, National Museum of Health and Medicine flickr. https://www.flickr.com/photos/7438870@N04/2124380387/

Etkin, Nina L. "The Co-Evolution of People, Plants, and Parasites: Biological and Cultural Adaptations to Malaria." *Proc Nutr Soc* 62(2), (2003 May): 311–17.

Fantini, B. "The Discovery of Transmission Mechanisms and the Fight against Malaria in Italy." *Medicina nei secoli* 6(1), (1994): 181–212.

Fantini, B. "The Concept of Specificity and the Italian Contribution to the Discovery of the Malaria Transmission Cycle." *Parassitologia* 41(1-3), (1999): 39–47.

Farley, John. "Parasites and the Germ Theory of Disease." *The Milbank Quarterly* 67, (1989/01/01): 50–68.

———. *To Cast Out Disease: A History of the International Health Division of Rockefeller Foundation (1913-1951)*. Oxford University Press, USA, 2003-10-16.

Feachem, Richard GA, Allison A Phillips, Jimee Hwang, Chris Cotter, Benjamin Wielgosz, Brian M Greenwood, Oliver Sabot, Mario Henry Rodriguez, Rabindra R Abeyasinghe, Tedros Adhanom Ghebreyesus and Robert W Snow. "Shrinking the Malaria Map: Progress and Prospects." *Lancet* 376(9752), (2010/11/06): 1566–78.

Fedunkiw, Marianne. "Malaria Films: Motion Pictures as a Public Health Tool." *Am J Public Health* 93(7), (2003 Jul): 1046–57.

Fenner, F. "Malaria Control in Papua New Guinea in the Second World War: from Disaster to Successful Prophylaxis and the Dawn of DDT." *Parassitologia* 40, (1998): 55–63.

Fenner, F., A. W. Sweeney. "Malaria in New Guinea during the Second World War: the Land Headquarters Medical Research Unit." *Parassitologia* 40, (1998): 65–68.

Ferguson, Heather M., Louis C. Gouagna, Peter Obare, Andrew F. Read, Hamza Babiker, John Githure and John C. Beier. "The Presence of *Plasmodium falciparum* Gametocytes in Human Blood Increases the Gravidity of *Anopheles gambiae* Mosquitoes." *The American Journal of Tropical Medicine and Hygiene* 73(2), (2005/08/01): 312–20.

Fields, Gary. "Imaginative Cartographies: Mappings of Dispossession in Historical Perspective.," In *Conspiracy in the United States and Beyond: Historical and Cultural Foundations*, edited by Larry Portis and Joseph Zitomersky, Montpellier: University Press of the Mediterranean, 2012.

Figtree, Melanie, Lee Rogan, Bain Lisa, Kennedy Tom, Mackertich Sonia, Urban Merrill, Cheng Qin and J. Hudson Bernard. "*Plasmodium knowlesi* in Human, Indonesian Borneo." *Emerging Infectious Disease Journal* 16(4), (2010): 672.

Filan, Trina. "Boom and bust: (Hi)stories of landscape production and consumption in the Sierra Nevada foothills of California." Paper presented at American Association of Geographers Annual Meeting, Chicago, 2015.

Fissell, Mary E. "Making Meaning From the Margins: The New Cultural History of Medicine," In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 364–89. Baltimore: Johns Hopkins University Press, 2004.

Forssman, Natalie. "Knowing Waterscapes through Animal Bodies." Paper delivered at Centre for Research on Socio-Cultural Change, London, 2013.

Foucault, Michel. *The Order of Things: An Archaeology of the Human Sciences*. New York: Random House, 1970.

———. *Discipline & Punish: The Birth of the Prison*. Translated by Alan Sheridan. New York: Vintage, 1977, 1991.

———. *The History of Sexuality, Vol. 1: An Introduction*. Vintage Books, 1978.

———. *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*. Vintage, 1980.

———. *Technologies of the Self: A Seminar With Michel Foucault*. University of Massachusetts Press, 1988.

———. “Questions of Method,” In *The Foucault Effect: Studies in Governmentality*, edited by Graham Burchell, Colin Gordon and Peter Miller, Chicago: University of Chicago Press, 1991.

———. *The Birth of the Clinic: An Archaeology of Medical Perception*. Translated by A. M. Sheridan Smith. New York: Vintage, 2004 (1973).

———. *Security, Territory, Population: Lectures At the Collège De France, 1977-78*. Translated by Graham Burchell. Basingstoke: Palgrave MacMillan, 2007.

———. *The Birth of Biopolitics: Lectures At the Collège De France, 1978-79*. Translated by Graham Burchell. Basingstoke: Palgrave Macmillan, 2008.

Frenkel, Stephen and John Western. “Pretext or Prophylaxis? Racial Segregation and Malarial Mosquitos in a British Tropical Colony: Sierra Leone.” *Annals of the Association of American Geographers* 78(2), (1988): 211–28.

Fu, Jia-Chen. “The Secret Maoist Chinese Operation That Conquered Malaria—and Won a Nobel.” *New Republic*, 10/6/2015.

Fudge, Erica. “A Left-Handed Blow: Writing the History of Animals,” In *Representing Animals*, edited by Nigel Rothfels, 3–18. Bloomington: Indiana University Press, 2002.

Geertz, Clifford. *Local Knowledge: Further Essays In Interpretive Anthropology*. Basic Books, 1985.

Gelband, Hellen and Andreas Seiter. “A Global Subsidy for Antimalarial Drugs.” *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 219–21.

Gell, Alfred. *Art and Agency: An Anthropological Theory*. Oxford: Oxford University Press, 1998.

Gere, Cathy and Bronwyn Parry. “The Flesh Made Word: Banking the Body in the Age of Information.” *BioSocieties* 1, (2006): 41–54.

“Germ Theory.” (2016): Contagion: Historical Views of Diseases and Epidemics: The Harvard University Library Open Collections Program. Accessed January 20, 2016. http://ocp.hul.harvard.edu/contagion/germtheory.html.

Gieryn, Thomas F. “City as Truth-Spot: Laboratories and Field-Sites in Urban Studies.” *Social Studies of Science* 36(1), (2006): 5–38.

Gitelman, Lisa. *Paper Knowledge: Toward a Media History of Documents (Sign, Storage, Transmission)*. Durham: Duke University Press Books, 2014.

Gorman, Christine. “Medicine Nobel Recognizes Fights against Malaria and River Blindness.” *Scientific American*, 10/5/2015.

Gramsci, Antonio. *Selections from the Prison Notebooks*. International Publishers Co, 1971.

Greene, Lawrence S. and Maria Enrica Danubio. *Adaptation to Malaria: The Interaction of Biology and Culture*. CRC Press, 1998.

Greenough, Paul and Anna Lowenhaupt Tsing, eds. *Nature in the Global South: Environmental Projects in South and Southeast Asia* Duke University Press Books, 2003.

Grove, Richard H. *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860*. Studies in Environment and History. Cambridge University Press, 1996.

Hadlow, Martin. “The Mosquito Network: American Military Radio in the Solomon Islands During World War II.” *Journal of Radio Studies* 11(1), (2004): 73–86.

Hale, Victoria, Jay D. Keasling, Neil Renninger and Thierry T. Diagana. “Microbially Derived Artemisinin: A Biotechnology Solution to the Global Problem of Access to Affordable Antimalarial Drugs.” *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 198–202.

Hall, Stuart. “Introduction to Part III,” In *Visual Culture: the Reader (Published in Association With the Open University)*, edited by Jessica and Stuart Hall Evans, London: SAGE Publications Ltd, 1999.

Hamilton, H. “Presidential Address By Surgeon-General H. Hamilton, C.C., M.D., V.H.S. I.M.S., President of the Section,” In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, 66–67. Bombay: Bennett, Coleman and Co., 1909.

Hannaway, Caroline. “Environment and Miasmata,” In *Companion Encyclopedia of the History of Medicine, volume 1*, edited by W.F. Bynum and Roy Porter, 292–308. London: Routledge, 1993.

Haraway, Donna Jeanne. *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge, 1991.

———. *Modest_Witness@Second_Millennium.FemaleMan_Meets_OncoMouse : feminism and technoscience*. New York: Routledge, 1997.

———. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press, 2003.

———. “When Species Meet: Staying With the Trouble.” *Environment and Planning D: Society and Space* 28, (2010): 53–55.

———. “Awash in Urine: DES and Premarin® in Multispecies Response-ability.” *Women’s Studies Quarterly* 40 (1), (2012): 301–16.

———. “Sowing Worlds: A Seed Bag for Terraforming with Earth Others,” In *Beyond the Cyborg: Adventures with Donna Haraway*, edited by Margaret Grebowicz and Helen Merrick, 137–46. New York: Columbia University Press, 2013.

Harley, J. B. *The New Nature of Maps: Essays in the History of Cartography*. Baltimore: The Johns Hopkins University Press, 2002-09-05.

Harper, Paul A., Wilbur C. Downs, Paul W. Oman and Norman D. Levin. “New Hebrides, Solomon Islands, Saint Matthias Group, and Ryukyu Islands.” *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

Harrison, Mark. *Public Health in British India: Anglo-Indian Preventive Medicine 1859-1914 (Cambridge Studies in the History of Medicine)*. Cambridge: Cambridge University Press, 1994.

———. “Medicine and the Culture of Command: The Case of Malaria Control in the British Army During the Two World Wars.” *Medical History* 40, (1996): 437–52.

———. “”Hot Beds of Disease”: Malaria and Civilization in Nineteenth-Century British India.” *Parassitologia* 40(1-2), (1998): 11–18.

———. *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600-1850*. Oxford India Paperbacks. Oxford University Press, USA, 1999.

Hart, Thomas A. “The Army’s War Against Malaria.” *The Scientific Monthly* 62 (No. 5), (1946, May): 421–22.

Hart, Thomas A. and William H. Hardenbergh. “The Southwest Pacific Area.” *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/chapterX.htm.

Hay, S, DL Smith and RW Snow. “Measuring Malaria Endemicity From Intense to Interrupted Transmission.” *Lancet Infectuous Disease* 8(6), (June 01 2008): 369–78.

Hay, SI, CA Guerra, A Tatem, AM Noor and RW Snow. “The Global Distribution and Population at Risk of Malaria: Past, Present, and Future.” *Lancet Infect Dis* 4, (2004): 327–36.

Hay, Simon I and Robert W Snow. “The Malaria Atlas Project: Developing Global Maps of Malaria Risk.” *PLoS Med* 3(12) e473, (2006/12/05): 2204–8.

Hays, C.W. “US Army and Malaria Control in World War II.” *Parassitologia* 42, (2000): 47–52.

Heaton, Leonard. “Forward.” *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, DC: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/forewordrev.htm.

Hehir, Patrick. *Malaria in India*. Oxford: Oxford University Press, 1927.

Hempelmann, E and K Krafts. “Bad Air, Amulets and Mosquitoes: 2,000 Years of Changing Perspectives on Malaria.” *Malar J* 12, (2013): 232.

Herod, Andrew. *Scale (Key Ideas in Geography)*. New York: Routledge, 2010.

Hippocrates. *On Airs, Waters and Places (Dodo Press)*. Dodo Press, 2009.

Hoffman, SL, GM Subramanian, FH Collins and JC Venter. “Plasmodium, Human and Anopheles Genomics and Malaria.” *Nature* 415, (2002): 702–9. 11832959.

Holland, Dorothy, William Lachicotte Jr., Debra Skinner and Carole Cain. *Identity and Agency in Cultural Worlds*. Cambridge: Harvard University Press, 2001.

Honigsbaum, Mark. *The Fever Trail: In Search of the Cure for Malaria*. New York: Farrar, Straus and Giroux, 2001.

Hook, Derek. “Genealogy, Discourse, ‘Effective History’: Foucault and the work of critique.” *Qualitative Research in Psychology* Qualitative Research in Psychology 2(1), (2005): 3–31.

Hsu, Elisabeth. “Reflections on the ‘Discovery’ of the Antimalarial Qinghao.” *British Journal of Clinical Pharmacology* 61(6), (2006): 666–70.

Humphreys, Margaret. “Kicking a Dying Dog: DDT and the Demise of Malaria in the American South, 1942-1950.” *Isis* 87(1), (1996/03/01): 1–17.

Hutchins, Edwin. “How a Cockpit Remembers Its Speeds.” *Cognitive Science* 19(3), (1995 1995/07/01): 265–88.

Inglis, Timothy J. J. “Principia ætiologica: taking causality beyond Koch’s postulates.” *Journal of Medical Microbiology* 56, (2007): 1419–22.

James, S. P. “Malaria in Mian Mir,” In *Transactions of the Bombay Medical Congress, 1909*, edited by William Ernest Jennings, 84–93. Bombay: Bennett, Coleman & Co., 1909.

James, Sidney Price. “First Report of the Anti-malarial Operations at Mian Mir, 1901-1903.” Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, 6. 1903. Calcutta: Govt. Printing. System No. 011833883. British Library.

Jarcho, Saul. “Yellow Fever, Cholera, and the Beginnings of Medical Cartography.” *Journal of the History of Medicine and Allied Sciences Journal of the History of Medicine and Allied Sciences* XXV(2), (1970): 131–42.

Johnson, Barbara. “Translator’s Introduction,” In *J. Derrida, Dissemination*, vii– xxxiii. Chicago: University of Chicago Press, 1981.

Johnson, Steven. *The Ghost Map: The Story of London’s Most Terrifying Epidemic--and How it Changed Science, Cities, and the Modern World*. Riverhead Trade, 2007-10-02.

Johnston, Ron. “Out of the `Moribund Backwater’: Territory and Territoriality in Political Geography.” *Political Geography* 20(6), (2001): 677–93.

Chuck Jones. “Private SNAFU Vs. Malaria Mike.” (23 March 1944): US Army First Motion Picture Unit. 16mm.

Jones, W. H. S. *Malaria: a Neglected Factor in the History of Greece and Rome*. University of California Libraries, 1907.

Jordanova, Ludmilla. “The Social Construction of Medical Knowledge,” In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 338–63. Baltimore: Johns Hopkins University Press, 2004.

Joy, R J. “Malaria in American Troops in the South and Southwest Pacific in World War II.” *Medical History* 43(2), (1999): 192–207.

Joyce, Patrick. “Filing the Raj: Political Technologies of the Imperial British State,” In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett, Patrick Joyce, 102–23. London: Routledge, 2010.

———. *The State of Freedom: A Social History of the British State since 1800*. Cambridge: Cambridge University Press, 2013.

Keiser, Jennifer, Burton H Singer and Jürg Utzinger. “Reducing the Burden of Malaria in Different Eco-Epidemiological Settings with Environmental Management: a Systematic Review.” *The Lancet Infectious Diseases* 5(11), (2005): 695–708.

Kelly, Ann H. and Javier Lezaun. “Walking or Waiting? Topologies of the Breeding Ground in Malaria Control.” *Science as Culture* 22(1), (2013): 86–107.

Kelly, Ann H, David Ameh, Silas Majambere, Steve Lindsay and Margaret Pinder. “‘Like Sugar and Honey’: The Embedded Ethics of a Larval Control Project in The Gambia.” *Social Science & Medicine* 70(12), (2010): 1912–19.

Kelly, Ann H and Uli Beisel. “Neglected Malarias: The Frontlines and Back Alleys of Global Health.” *BioSocieties* 6(1), (2011): 71–87.

Kelly, Ann H. “The Experimental Hut: Hosting Vectors.” *Journal of the Royal Anthropological Institute* 18, (2012): S145–60.

Kelly, Ann H. and Javier Lezaun. “Urban Mosquitoes, Situational Publics, and the Pursuit of Interspecies Separation in Dar es Salaam.” *American Ethnologist* 41(2), (2014): 368–83.

Kennedy, Dane. *The Magic Mountains: Hill Stations and the British Raj*. University of California Press, 1996.

———. *The Last Blank Spaces: Exploring Africa and Australia*. Cambridge: Harvard University Press, 2013.

Kenny, Judith T. "Climate, Race, and Imperial Authority: The Symbolic Landscape of the British Hill-Station in India." *Annals of the Association of American Geographers* 85, (1995): 694–714.

Kirksey, Eben, ed. *The Multispecies Salon* Durham: Duke University Press, 2014. PDF e-book.

Kitchin, Rob, Martin Dodge and Chris Perkins. "Introductory Essay: Conceptualising Mapping," In *The Map Reader: Theories of Mapping Practice and Cartographic Representation*, edited by Martin Dodge, Rob Kitchen and Chris Perkins, 2–7. Oxford: Wiley-Blackwell, 2011.

Kitchin, Rob, Chris Perkins, and Martin Dodge. "Thinking About Maps," In *Rethinking Maps: New Frontiers in Cartographic Theory*, edited by Rob Kitichen Martin Dodge, and Chris Perkins, 1–25. London: Routledge, 2009.

Klein, Ira. "Death in India: 1871-1921." *Journal of Asian Studies* 32, (1973): 639–59.

———. "Development and Death: Reinterpreting Malaria, Economics and Ecology in British India." *Indian Economic & Social History Review* 38(2), (2001): 147–79.

Koch, Tom. *Cartographies of Disease: Maps, Mapping, and Medicine*. ESRI Press, 2005.

———. *Disease Maps: Epidemics on the Ground*. Chicago: University Of Chicago Press, 2011.

Koch, Tom and Kenneth Denike. "Certainty, Uncertainty, and the Spatiality of Disease: a West Nile Virus example." *Stochastic Environmental Research and Risk Assessment* 21(5), (2007): 523–31.

Koella, J C, F L Sørensen and R A Anderson. "The Malaria Parasite, *Plasmodium falciparum*, Increases the Frequency of Multiple Feeding of Its Mosquito Vector, *Anopheles gambiae*." *Proceedings of the Royal Society B: Biological Sciences* 265(1398), (1998/05/07): 763–68.

Kohler, Robert E. *Lords of the Fly: Drosophila Genetics and the Experimental Life*. Chicago: University Of Chicago Press, 1994.

Konradsen, Flemming, Wim van der Hoek, Felix P. Amerasinghe, Clifford Mutero and Eline Boelee. "Engineering and Malaria Control: Learning from the Past 100 Years." *Acta Tropica* 89(2) Malaria and Agriculture, (2004/1): 99–108.

Koram, K. A. and M. E. Molyneux. "When is "malaria" Malaria? The Different Burdens of Malaria Infection, Malaria Disease, and Malaria-Like Illnesses." *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 1–5.

Kraemer, Moritz U.G., Simon I. Hay, David M. Pigott, David L. Smith, G.R. William Wint and Nick Golding. "Progress and Challenges in Infectious Disease Cartography." *Trends in Parasitology* 32(1), (2016/1): 19–29.

Kwiatkowski, Dominic P. "How Malaria Has Affected the Human Genome and What Human Genetics Can Teach Us About Malaria." *American Journal of Human Genetics* 77(2), (2005): 171–92.

Langhorne, Jean, Pierre Buffet, Mary Galinski, Michael Good, John Harty, Didier Leroy, Maria Mota, Erica Pasini, Laurent Renia, Eleanor Riley, Monique Stins and Patrick Duffy. "The relevance of non-human primate and rodent malaria models for humans." *Malaria Journal* 10(1), (2011): 23.

Latour, Bruno. "Visualization and Cognition: Thinking With the Eyes and Hands." *Knowledge and Society* 6, (1986): 1–40.

———. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge: Harvard University Press, 1988.

———. "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts," In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, 225–58. Cambridge: The MIT Press, 1992.

———. *The Pasteurization of France*. Cambridge: Harvard University Press, 1993.

Leavitt, Judith Walzer. *Typhoid Mary: Captive to the Public's Health*. Beacon Press, 1997.

Leslie, J.T.W. "Malaria in India," In *Proceedings of the Imperial Malaria Conference held at Simla October 1909*, 3–12. Simla: Government Central Branch Press, 1910.

Li, Tania Murray. "Practices of Assemblage and Community Forest Management." *Economy and Society* 36(2), (2007): 263–93.

———. *The Will to Improve: Governmentality, Development, and the Practice of Politics*. Durham: Duke University Press, 2007.

Lite, Jordan. "What is Artemisinin?" *Scientific American*, 12/23/2008.

Long, Pamela. *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance*. Baltimore: Johns Hopkins University Press, 2001.

Lubell, Yoel, Hugh Reyburn, Hilda Mbakilwa, Rose Mwangi, Kini Chonya, Christopher J. M. Whitty and Anne Mills. "The Cost-Effectiveness of Parasitologic Diagnosis for Malaria-Suspected Patients in an Era of Combination Therapy." *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 128–32.

Lyons, Maryinez. *The Colonial Disease: A Social History of Sleeping Sickness in Northern Zaire, 1900-1940 (Cambridge Studies in the History of Medicine)*. Cambridge University Press, 2002.

Mack, Frank. "'Malaria Moe' #34 Sleep under a Net." 194-. Malaria and Epidemic Disease Control, SoPac No. 34. Reeve 88266-27 National Museum of Health and Medicine Flickr. https://www.flickr.com/photos/medicalmuseum/3387976667

———. "'Malaria Moe' #35 Taboo." 194-. Malaria and Epidemic Disease Control, SoPac No. 35. Reeve 088266-28 National Museum of Health and Medicine, Otis Historical Archives; Flickr. https://www.flickr.com/photos/medicalmuseum/3396772794/in/album-72157650096203910/

———. "'Malaria Moe' #36 What a Guy Does Watch His Health, if He's a Smart Guy." 194-. Malaria and Epidemic Disease Control, SoPac. Reeve 088266-29. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr. https://www.flickr.com/photos/medicalmuseum/3396773610/in/album-72157650096203910/

———. "'Malaria Moe' #38 Moe Gets the, 'Word'." 194-. Malaria and Epidemic Disease Control, South Pacific. SOPACBACOM 2056. Reeve 088266-31. Source collection: OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr. https://www.flickr.com/photos/medicalmuseum/3396774042/in/album-72157650096203910/

———. "'Malaria Moe' #40 Malaria Discipline." 194-. Malaria and Epidemic Disease Control, South Pacific No. 40 SOPACBACOM 2056. 088266-33. National Museum of Health and Medicine, Otis Historical Archives, flickr. https://www.flickr.com/photos/medicalmuseum/3395961237/in/album-72157650096203910/

———. "'Malaria Moe' #41." 194-. Malaria and Epidemic Disease Control, South Pacific No. 41. Reeve 088266-34. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr. https://www.flickr.com/photos/medicalmuseum/3396774386/in/album-72157650096203910/

———. "Enemies Both! It's Your Job to Help Eliminate Them (Color)." 1944. Navy, Bureau of Medicine and Surgery, NAVMED 145-D: U.S. Government Printing Office. http://www.crazywebsite.com/Free-Galleries-01/USA_Patriotic/pg-WWII_Posters_Vintage/Vintage_WWII_Patriotic_Posters_United_States_America-_Malaria_1_jpg.htm

———. "May 1944." 1944. Malaria & Epidemic Disease Control, SoPac, Reproduced by Engineers Section HQ S.O.S. 1271. Norm Brailey Collection: "Practice Malaria Discipline Now" Image courtesy of Norm Brailey. https://www.flickr.com/photos/adelaide_archivist/3886607118/in/photolist-6VrSTy-e8kWv4-e8kRT4-4eGtMk-dY3Xpj

———. "October 1944 Calendar. Malaria and Epidemic Disease Control, South Pacific. Reproduced by Engineer, SOPACBACOM (South Pacific Base Command) 1828." 1944. Malaria and Epidemic Disease Control, South Pacific SOPACBACOM. Reeve 088266. OHA 80 WWI / Reeve Photograph Collection, 1917-1953. National Museum of Health and Medicine, Otis Historical Archives. flickr. http://farm4.staticflickr.com/3380/3568477124_cf1e02da9a_o_d.jpg, http://www.flickr.com/photos/medicalmuseum/3568477124/in/photostream/

———. "December 1944 Calendar." December 1944. Malaria and Epidemic Disease Control, South Pacific SOPACBACOM 2210. Reeve 88266-5.jpg. OHA 80: Reeve Photograph Collection. National Museum of Health and Medicine, Otis Historical Archives. flickr. http://farm4.staticflickr.com/3380/3568477124_cf1e02da9a_o_d.jpg, http://www.flickr.com/photos/medicalmuseum/3568477124/in/photostream/ Accessed June 18, 2014

Mackinnon, M.J. and K. Marsh. "The Selection Landscape of Malaria Parasites." *Science* 328(5980), (2010 May 14): 866–71.

MacLeod, Roy, ed. *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion* Routledge, 1989-01.

Malik, Elfatih Mohamed, Osman Khalafalla. "Malaria in Sudan: Past, Present and the Future (Obstetrical and Gynecological Society of the Sudan, 20th Conference)." *Gezira Journal of Health Sciences* 1 (supplement), (2004): 47–53.

Malpas, Jeff. "Putting Space in Place: Philosophical Topography and Relational Geography." *Environment and Planning D: Society and Space* 30(2), (2012): 226–42.

Manguin, Sylvie, ed. *Anopheles mosquitoes - New insights into malaria vectors* InTech, 2013.

Marcus, Bernard. *Malaria (Deadly Diseases and Epidemics)*. Chelsea House Pub (L), 2009.

Martin, Stacey L. "Cartography, Discourse, and Disease: How Maps Shape Scientific Thought About Disease." (Masters thesis, Georgia State University, 2005).

Marx, Karl. *Capital: A Critique of Political Economy, Volume 1*. Translated by Ben Fowkes. London: Penguin Classics, 1976.

Massey, N. Claire, Gala Garrod, Antoinette Wiebe, Andrew J. Henry, Zhi Huang, Catherine L. Moyes and Marianne E. Sinka. "A global bionomic database for the dominant vectors of human malaria." *Scientific Data* 3, (2016/03/01/online): 160014–160014.

Mauss, Marcel. *The Gift: The Form and Reason for Exchange in Archaic Societies*. New York: W. W. Norton & Company, 2000 (1954).

McCoy, Oliver R. "War Department Provisions for Malaria Control," In *Preventive Medicine in World War II, Volume 6*, edited by Colonel John Boyd Coates Jr., 11–59. Washington, DC: Office of the Surgeon General, 1963.

———. "War Department Provisions for Malaria Control." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. 11–59, Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

McCutchan, Thomas F. "Malaria Control in Africa: a Mirage à Trois." *Future Microbiology* 3, (2008/10): 479–83.

Meade, Melinda S. and Michael Emch. *Medical Geography, Third Edition*. New York: The Guilford Press, 2010.

Melville, C.H. "The Prevention of Malaria in War," In *The Prevention of Malaria*, edited by Ronald Ross, 577–99. Miami: HardPress, 2010 (1910).

Mendis, Kamini, Aafje Rietveld, Marian Warsame, Andrea Bosman, Brian Greenwood and Walther H. Wernsdorfer. "From Malaria Control to Eradication: The WHO Perspective." *Tropical Medicine & International Health* 14(7), (2009): 802–9.

Miltenberger, Scott A. “Viewing the Anthrozootic City: Humans, Domesticated Animals, and the Making of Early Nineteenth-Century New York,” In *The Historical Animal*, edited by Susan Nance, 261–71. Syracuse: Syracuse University Press, 2015.

Minear, Richard H. *Dr. Seuss Goes to War: The World War II Editorial Cartoons of Theodor Seuss Geisel*. New Press, 1999.

Mitchell, Timothy. “Can the Mosquito Speak?,” In *Rule of Experts: Egypt, Techno-Politics, Modernity*, 19–53. Berkeley: University of California Press, 2002.

Mol, Annemarie. *The Body Multiple: Ontology in Medical Practice (Science and Cultural Theory)*. Durham: Duke University Press, 2003.

Monmonier, Mark. “Maps as Graphic Propaganda for Public Health,” In *Imagining Illness: Public Health and Visual Culture*, edited by David Serlin, 108–25. Minneapolis: University of Minnesota Press, 2010.

———. *How to Lie With Maps*. Chicago: University Of Chicago Press, 1996.

“Mr Chamberlain and the Colonies.” *The Times*, May 11, 1899. 8.

Mukerji, Chandra. *From Graven Images: Patterns of Modern Materialism*. New York: Columbia University Press, 1983.

———. *Territorial Ambitions and the Gardens of Versailles (Cambridge Cultural Social Studies)*. Cambridge University Press, 1997-10-13.

———. “Dominion, Demonstration, and Domination: Religious Doctrine, Territorial Politics, and French Plant Collection,” In *Colonial Botany: Science, Commerce, and Politics in the Early Modern World*, edited by Londa Schiebinger and Claudia Swan, 19–33. Philadelphia: University of Pennsylvania Press, 2004.

———. *Impossible Engineering: Technology and Territoriality on the Canal Du Midi (Princeton Studies in Cultural Sociology)*. Princeton: Princeton University Press, 2009.

———. “The Territorial State as a Figured World of Power: Strategics, Logistics, and Impersonal Rule.” *Sociological Theory* 28(4), (2010): 402–24.

———. “The Unintended State,” In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett and Patrick Joyce, 81–101. New York: Routledge, 2010.

———. “Space and Political Pedagogy at the Gardens of Versailles.” *Public Culture* 24(3), (2012): 509–34.

Mukherjee, Siddhartha. *The Emperor of All Maladies: A Biography of Cancer*. New York: Scribner, 2011.

Murphy, Sport. “Malaria Pinup Calendars, Frank Mack,” In *Hidden Treasure: The National Library of Medicine*, edited by Michael Sappol, 240. New York: Blast Books, 2012.

Mwenesi, Halima Abdullah. “Social Science Research in Malaria Prevention, Management and Control in the Last Two Decades: An Overview.” *Acta Tropica* 95(3) Malaria Research in Africa - Multilateral Initiative on Malaria, (2005/9): 292–97.

Nahlen, BL, EL Korenromp, JM Miller and K Shibuya. “Malaria Risk: Estimating Clinical Episodes of Malaria.” *Nature* 437(7056), (2005 Sep 8): E3; discussion E4–5.

Nájera, JA. “Malaria Control: Achievements, Problems and Strategies.” *Parassitologia* 43(1-2), (2001 June): 1–89.

Nash, Linda. *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*. University of California Press, 2007.

National Public Radio. “The Development of Antimalarial Drugs.” *Tumblr Essay* (10/5/2015): http://npr.tumblr.com/post/130575267456/skunkbear-the-development-of-antimalarial-drugs.

———. “Herbs And Empires: A Brief History Of Malaria Drugs.” *YouTube Video* (12/17/2012): 2:35, YouTube: https://youtu.be/IrNL27eWKOI.

Nel, Philip. “Children’s Literature Goes to War: Dr. Seuss, P. D. Eastman, Munro Leaf, and the Private Snafu Films (1943–46).” *The Journal of Popular Culture* 40 (3), (2007): 468–87.

“Newsmap. Monday, November 8, 1943: Week of October 28 to November 4, 217th Week of the War, 99th Week of US Participation.” 1943. United States. Army Orientation Course. UNT Digital Library. http://digital.library.unt.edu/ark:/67531/metadc951/m1/1/

Nietzsche, Friedrich. *The Will to Power*. Translated by Walter Kaufmann. New York: Vintage, 1968.

———. *The Genealogy of Morals*. Translated by Walter Kaufmann & R.J Hollingdale. New York: Vintage, 1989.

NYC Department of Environmental Protection, Public Affairs. "Peregrine Falcons in New York City." (2015): Accessed Dec. 16, 2015. http://www.nyc.gov/html/dep/html/news/falcon.shtml.

Ogborn, Miles. *Indian Ink: Script and Print in the Making of the English East India Company*. Chicago: University Of Chicago Press, 2007.

Osborne, Michael A. "The Geographical Imperative in Nineteenth-Century French Medicine," In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, 31–50. London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000.

Ostherr, Kirsten. *Cinematic Prophylaxis: Globalization and Contagion in the Discourse of World Health*. Durham: Duke University Press Books, 2005.

Packard, Randall M. *The Making of a Tropical Disease: A Short History of Malaria (Johns Hopkins Biographies of Disease)*. The Johns Hopkins University Press, 2007.

Parry, Bronwyn and Cathy Gere. "Contested Bodies: Property Models and the Commodification of Human Biological Artefacts." *Science as Culture* 15(2), (2006 June): 139–58.

Pattanayak, Subhrendu K., Junko Yasuoka, Jim Craine and Stuart C. Aitken. "Deforestation and Malaria: Revisiting the Human Ecology Perspective," In *Human Health and Forests: A Global Overview of Issues, Practice, and Policy*, edited by Carol J. Pierce Colfer, Earthscan, 2012.

Paul, Reiter. "From Shakespeare to Defoe: Malaria in England in the Little Ice Age." *Emerging Infectious Disease* 6(1), (2000 January-February): 1–11.

Paul, Richard, Mawlouth Diallo and Paul Brey. "Mosquitoes and Transmission of Malaria Parasites - Not Just Vectors." *Malaria Journal* 3(1), (2004 Nov 8): 39.

Pelling, Margaret. "Contagion/Germ Theory/Specificity," In *Companion Encyclopedia of the History of Medicine, Volume 1*, edited by W.F. Bynum and Roy Porter, 309–34. London: Routledge Reference, 1993.

Pigott, David M., Rosalind E. Howes, Antoinette Wiebe, Katherine E. Battle, Nick Golding, Peter W. Gething, Scott F. Dowell, Tamer H. Farag, Andres J. Garcia, Ann

M. Kimball, L. Kendall Krause, Craig H. Smith, Simon J. Brooker, Hmwe H. Kyu, Theo Vos, Christopher J. L. Murray, Catherine L. Moyes and Simon I. Hay. "Prioritising Infectious Disease Mapping." *PLoS Negl Trop Dis* 9(6), (2015/06/10): e0003756.

Pinney, Christopher. "Camerawork as technical practice in colonial India," In *Material Powers: Cultural Studies, History and the Material Turn (CRESC)*, edited by Tony Bennett and Patrick Joyce, 145–70. London: Routledge, 2010.

Porter, Dorothy. *The History of Public Health and the Modern State*. Clio Medica/the Wellcome Institute Series in the History of Medicine, 26). Editions Rodopi, 1994.

———. *Health, Civilization and the State: A History of Public Health From Ancient to Modern Times*. Routledge, 1999.

Porter, Roy. *The Greatest Benefit to Mankind: A Medical History of Humanity*. (The Norton History of Science). W. W. Norton & Company, 1999.

Poser, Charles M. and George W. Bruyn. *An Illustrated History of Malaria*. New York: The Parthenon Publishing Group, 1999.

Prosser, Cherie L and Ian A Clark. "The War on Malaria and Nora Heysen's Documentation of Australian Medical Research through Art between 1943 and 1945." *Medical Journal of Australia* 194 (8), (2011): 418–19.

Rader, Karen. *Making Mice: Standardizing Animals for American Biomedical Research, 1900-1955*. Princeton: Princeton University Press, 2004.

Rhys, Jean. *Wide Sargasso Sea*. W. W. Norton & Company, 1998 (1966).

Rich, Stephen M, Monica C Licht, Richard R Hudson and Francisco J Ayala. "Malaria's Eve: Evidence of a Recent Population Bottleneck throughout the World Populations of *Plasmodium Falciparum*." *Proceedings of the National Academy of Sciences of the United States of America* 95(8), (1998/04/14): 4425–30.

Riley, James C. *Eighteenth Century Campaign to Avoid Disease*. New York: St. Martin's Press, 1987.

Roberts, Michelle. "Scientists Create Infertile Mosquitoes." *BBC News Online*, Dec. 7 2015. http://www.bbc.com/news/health-35024794.

Rocco, Fiammetta. *Quinine: Malaria and the Quest for a Cure That Changed the World*. Harper Perennial, 2004.

Rose, Nikolas. *Powers of Freedom: Reframing Political Thought*. Cambridge: Cambridge University Press, 1999.

Rosen, George. *A History of Public Health*. Baltimore: The Johns Hopkins University Press, 1993.

Rosenberg, Charles E. "Disease in History: Frames and Framers." *The Millbank Quarterly* 62, (1989): 1–15.

———. *Explaining Epidemics and Other Studies in the History of Medicine*. Cambridge: Cambridge University Press, 1992.

———. The Cholera Years: The United States in 1832, 1849, and 1866. University of Chicago Press, 1987.

Rosenberg, Charles E and Janet Golden, eds. *Framing Disease: Studies in Cultural History* New Brunswick: Rutgers University Press, 1992.

Ross, Ronald. *Memoirs, with a Full Account of the Great Malaria Problem and Its Solution*. London: John Murray, 1923.

———. *The Prevention of Malaria*. Nabu Press, 2010 (1910).

———. *Report on the Prevention of Malaria in Mauritius*. Ulan Press, 2012 (1908).

Roy, Rohan Deb. "Quinine, Mosquitoes and Empire: Reassembling Malaria in British India, 1890-1910." *South Asian Hist Cult* 4(1), (2013): 65–86.

Russell, Edmund. *War and Nature: Fighting Humans and Insects With Chemicals From World War I to Silent Spring (Studies in Environment and History)*. Cambridge University Press, 2001.

Russell, Edmund P. ""Speaking of Annihilation": Mobilizing for War Against Human and Insect Enemies, 1914-1945." *The Journal of American History* 82(4), (1996): 1505.

Russell, Paul F. "Automatic Distribution of Paris Green for Malaria Control." *The Journal of Parasitology* 19(3), (1933): 224–15.

———. *Man's Mastery of Malaria*. Oxford: Oxford University Press, 1955.

———. "Introduction." *Preventive Medicine in World War II: Volume VI Communicable Diseases, Malaria* (1963): John Boyd Coates Jr. Washington, D.C.: Office of the Surgeon General, Department of the Army. Accessed Feb. 25, 2016. http://history.amedd.army.mil/booksdocs/wwii/Malaria/default.htm.

Sallares, Robert. *Malaria and Rome: A History of Malaria in Ancient Italy*. Oxford University Press, 2002.

Sallares, Robert, Abigail Bouwman and Cecilia Anderung. "The Spread of Malaria to Southern Europe in Antiquity: New Approaches to Old Problems." *Medical History* 48(3), (2004/07/01): 311–28.

Sallares, Robert and Susan Gomzi. "Biomolecular Archaeology of Malaria." *Ancient Biomolecules* 3(3), (2001): 195–213.

Schaefli, Laura and Anne Godlewska. "Place, Presentism and Ignorance in the History of Geography." Keynote Paper for the History of Geography Specialty Group Plenary Session at the annual meeting of the American Association of Geographers, Chicago, April 21-25, 2015.

Scott, Joan W. "History-writing as Critique," In *Manifestos for History*, edited by Keith Jenkins, Sue Morgan and Alun Munslow, 19–38. New York: Routledge, 2007.

Serlin, David. *Replaceable You: Engineering the Body in Postwar America*. Chicago: University Of Chicago Press, 2004.

Service, M.W. "Sir Rickard Christophers: A Tribute." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 72(6), (1978): 678–80.

Setzer, Teddi J. "Malaria Detection in the Field of Paleopathology: A Meta-Analysis of the State of the Art." *Acta Tropica* 140, (2014/12): 97–104.

Shah, Nayan. *Contagious Divides: Epidemics and Race in San Francisco's Chinatown (American Crossroads)*. Berkeley: University of California Press, 2001.

Shah, Sonia. *The Fever: How Malaria Has Ruled Humankind for 500,000 Years*. New York: Farrar, Straus and Giroux, 2010.

Shannon, Gary W. "Disease Mapping and Early Theories of Yellow Fever." *The Professional Geographer* 33(2), (1981): 221–27.

Shaw, David Gary. “A Way with Animals.” *History and Theory* 52(4), (2013): 1–12.

Shaw, David Gary, [Ed.]. “Does History Need Animals? [Special Issue].” *History and Theory* 52 (4), (2013):

Sherman, Irwin W. *The Elusive Malaria Vaccine: Miracle Or Mirage?* ASM Press, 2009-05-30.

Shklovsky, Victor. “Art as Technique,” In *Russian Formalist Criticism: Four Essays, Second Edition*, edited by Lee T. Lemon and Marion J. Reis, University of Nebraska Press, 2012 (1917).

Shortt, H. E. and P. C. C. Garnham. “Samuel Rickard Christophers. 27 November 1873-19 February 1978.” *Biographical Memoirs of Fellows of the Royal Society* 25, (1979/11/01): 179–207.

Sibley, Carol Hopkins. “Understanding Drug Resistance in Malaria Parasites: Basic Science for Public Health.” *Molecular and Biochemical Parasitology* 195(2) Special Issue on the 35th Anniversary of Molecular and Biochemical Parasitology, (2014/7): 107–14.

Simmel, Georg. *The Philosophy of Money (Routledge Classics)*. London: Routledge, 2011.

Sinding, Christiane. “The Power of Norms: Georges Canguilhem, Michel Foucault, and the History of Medicine,” In *Locating Medical History: The Stories and Their Meanings*, edited by Frank Huisman and John Harley Warner, 262–84. Baltimore: Johns Hopkins University Press, 2004.

Slater, Leo B. *War and Disease: Biomedical Research on Malaria in the Twentieth Century (Critical Issues in Health and Medicine)*. New Brunswick: Rutgers University Press, 2009.

Smiley, Jane. *A Thousand Acres*. New York: Alfred A. Knopf, 1991.

Smith, David and McKenzie Ellis, F. “Statics and Dynamics of Malaria Infection in Anopheles Mosquitoes.” *Malaria Journal* 3(1), (2004): 13.

Smith, David L, F. Ellis McKenzie, Robert W Snow and Simon I Hay. “Revisiting the Basic Reproductive Number for Malaria and Its Implications for Malaria Control.” *PLoS Biol* 5(3), (2007/02/20): e42.

Smith, Douglas W., Rolf O. Peterson and Douglas B. Houston. "Yellowstone after Wolves." *BioScience* 53(4), (2003/04/01): 330–40.

Snow, Robert W., Carlos A. Guerra, Abdisalan M. Noor, Hla Y. Myint and Simon I. Hay. "The Global Distribution of Clinical Episodes of Plasmodium Falciparum Malaria." *Nature* 434(7030), (2005): 214–17.

Snow, RW, K Marsh and Sueur le, D. "The Need for Maps of Transmission Intensity to Guide Malaria Control in Africa." *Parasitol Today* 12, (1996): 455–57. 1475-2875-6-17.

Soper, Fred. "Paris Green in the Eradication of *Anopheles gambiae*: Brazil, 1940; Egypt, 1945." *Mosquito News* 26, (1966): 470–76.

Springer, Claudia. "Military Propaganda: Defense Department Films From World War II and Vietnam." *Cultural Critique* (3), (1986): 151–67.

Star, Susan Leigh and James R. Griesemer. "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39." *Social Studies of Science* 19(3), (1989): 387–420.

Stevens, Rosemary. *In Sickness and in Wealth: American Hospitals in the Twentieth Century*. Johns Hopkins University Press, 1999.

Stevens, Rosemary A., Charles E. Rosenberg and Lawton R. Burns. *History and Health Policy in the United States: Putting the Past Back In (Critical Issues in Health and Medicine)*. New Brunswick: Rutgers University Press, 2006.

Stevenson, Lloyd. "Putting Disease on the Map: The Early Use of Spot Maps in the Study of Yellow Fever." *Journal of the History of Medicine and Allied Sciences* 20(3), (1965): 226–61.

Sturken, Marita and Lisa Cartwright. *Practices of Looking: An Introduction to Visual Culture*. Oxford University Press, 2001.

Nance, Susan, ed. *The Historical Animal* Syracuse: Syracuse University Press, 2015.
Sweeney, Tony. *Malaria Frontline: Australian Army Research During World War II*. Melbourne: Melbourne University Publishing, 2003.

Tangpukdee, Noppadon, Chatnapa Duangdee, Polrat Wilairatana and Srivicha Krudsood. "Malaria Diagnosis: A Brief Review." *Korean J Parasitol* 47(2), (2009/6/): 93–102.

The Gotham Coyote Project. “The Gotham Coyote Project: Tracking New York City’s Newest Immigrants.” (2015): Accessed Dec. 16, 2015. http://www.gothamcoyote.com.

The Rockefeller Foundation. *Annual Report 1917*. New York: The Rockefeller Foundation, 1917.

“These Men Didn’t Take Their Atabrine.” 1945. Put up at the 363rd Station Hospital in Papua, New Guinea. National Museum of Health and Medicine. https://www.flickr.com/photos/medicalmuseum/302821131/in/set-72157614294632222

Thompson, Emily. *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933*. Cambridge: MIT Press, 2002.

Tousignant, Noémi. “Insects-as-Infrastructure: Indicating, Project Locustox and the Sahelization of Ecotoxicology.” *Science as Culture* 22(1), (2013): 108–31.

Tsing, Anna Lowenhaupt. “Unruly Edges: Mushrooms as Companion Species.” *Environmental Humanities* 1, (2012): 141–54.

———. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton: Princeton University Press, 2015.

Turnbull, David. “The Push for a Malaria Vaccine.” *Social Studies of Science* 19(2), (1989): 283–300.

U.S. Department of Health and Human Services. *Understanding Malaria: Fighting an Ancient Scourge*. U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Allergy and Infectious Diseases, NIH Publication No. 07-7139, February 2007.

United States Census Bureau. “Population and Area (Historical Censuses).” (1991): Accessed April 23, 2016. http://www2.census.gov/prod2/statcomp/documents/1991-02.pdf.

“The Neutral Theory.” *Understanding Evolution* (2015): University of California Museum of Paleontology. http://www.evolution.berkeley.edu/evolibrary/article/0_0_0/misconcep_08.

Valenčius, Conevery Bolton. “Histories of Medical Geography,” In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, 3–30. London: The Wellcome Trust Centre for the History of Medicine, 2000.

———. “The Geography of Health and the Making of the American West: Arkansas and Missouri, 1800-1860,” In *Medical Geography in Historical Perspective*, edited by Nicolaas A Rupke, 121–45. London: The Wellcome Trust Centre for the History of Medicine at UCL, 2000.

Vestergaard, Lasse S. and Pascal Ringwald. “Responding to the Challenge of Antimalarial Drug Resistance By Routine Monitoring to Update National Malaria Treatment Policies.” *Am J Trop Med Hyg* 77(6_Suppl), (2007 December 1, 2007): 153–59.

Vygotsky, L. S. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge: Harvard University Press, 1978-03-07. New Ed.

Wacks, Rachel Elise. “”Don’t Strip Tease for Anopheles”: A History of Malaria Protocols During World War II.” (Master’s thesis, The Florida State University, 2013).

Wailoo, Keith. *Drawing Blood: Technology and Disease Identity in Twentieth-Century America*. Baltimore: The Johns Hopkins University Press, 1997.

“Map Showing the Proportions of Deaths from Malarial Diseases,” In *Statistical atlas of the United States based on the results of the ninth census 1870 with contributions from many eminent men of science and several departments of the government*, edited by Francis A. Walker, Plate XLII. New York: United States. Census office. 9th census, 1874.

Watson, Malcolm. “Observations of Malaria Control, with Special Reference to the Assam Tea Gardens, and Some Remarks on Mian Mir, Lahore Cantonment.” *Trans R Soc Trop Med Hyg* XVIII (4), (1924): 147–61.

———. “Malaria and Mosquitoes: Forty Years on.” *Journal of the Royal Society of Arts* 87, (1939-03-24): 482–502.

Watts, Sheldon. “British Development Policies and Malaria in India 1897-1929.” *Past & Present* 165, (1999-11-01): 141–81.

Weatherall, D.J. and J.B. Clegg. “Inherited Haemoglobin Disorders: An Increasing Global Health Problem.” *Bulletin of the World Health Organization* 79, (2001): 704–12.

Webb Jr., James L.A. *Humanity’s Burden: A Global History of Malaria (Studies in Environment and History)*. Cambridge University Press, 2008.

Weil, Kari. *Thinking Animals: Why Animal Studies Now*. New York: Columbia University Press, 2012.

Weiss, Daniel J., Bonnie Mappin, Ursula Dalrymple, Samir Bhatt, Ewan Cameron, Simon I. Hay and Peter W. Gething. "Re-examining environmental correlates of Plasmodium falciparum malaria endemicity: a data-intensive variable selection approach." *Malaria Journal* 14(1), (2015): 1–18.

Wekesa, Joseph W., Robert S. Copeland and Richard W. Mwangi. "Effect of Plasmodium Falciparum on Blood Feeding Behavior of Naturally Infected Anopheles Mosquitoes in Western Kenya." *The American Journal of Tropical Medicine and Hygiene* 47(4), (1992/10/01): 484–88.

Wertsch, James V. *Vygotsky and the Social Formation of Mind*. Harvard University Press, 1988.

———. *Mind As Action*. Oxford University Press, 1998.

Westbrook, C. J., D. J. Cooper and B. W. Baker. "Beaver Dams and Overbank Floods Influence Groundwater–Surface Water Interactions of a Rocky Mountain Riparian Area." *Water Resources Research* 42 (6), (2006)

White, Hayden. *Tropics of Discourse: Essays in Cultural Criticism*. Baltimore: Johns Hopkins University Press, 1986 (1978).

Willis, R.J. *The History of Allelopathy*. Dordrecht: Springer, 2010.

Wilmers, Christopher C, James A Estes, Matthew Edwards, Kristin L Laidre and Brenda Konar. "Do Trophic Cascades Affect the Storage and Flux of Atmospheric Carbon? An analysis of sea otters and kelp forests." *Frontiers in Ecology and the Environment* (2012)

Winichakul, Thongchai. *Siam Mapped: A History of the Geo-Body of a Nation*. Honolulu: University of Hawaii Press, 1994.

Wood, Denis. *The Power of Maps*. The Guilford Press, 1992.

Wood, Denis, with John Fels and John Krygier. *Rethinking the Power of Maps*. New York: The Guilford Press, 2010.

Worboys, Michael. "The Emergence of Tropical Medicine: A Study in the Establishment of a Scientific Specialty," In *Perspectives on the Emergence of Scientific*

Disciplines, edited by Gerard Lemaine, Roy Macleod and Michael Mulkay, Mouton: The Hague, 1977.

———. "Manson, Ross, and Colonial Medical Policy: Tropical Medicine in London and Liverpool, 1899-1914," In *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion*, edited by R.M. MacLeod and M. Lewis, 21–37. London: Routledge, 1988.

———. "Germs, Malaria and the Invention of Mansonian Tropical Medicine: From 'Diseases in the Tropics' to 'Tropical Diseases'," In *Warm Climates and Western Medicine*, edited by David Arnold, 181–207. Amsterdam-Atlanta: Rodopi, 1996.

World Health Organization. "Malaria: Information for Travelers." (15 October 2015): Accessed Nov. 4, 2015. http://www.who.int/malaria/travellers/en/.

———. *World Malaria Report 2009*. Geneva: World Health Organization, 2009.

———. *World Malaria Report 2015*. Geneva: World Health Organization, 2015.

———. *Guidelines for Implementation of Roll Back Malaria at District Level*. Regional Office for South-East Asia New Delhi, June 2003.

Zhang, Jiajie and Vimla L. Patel. "Distributed Cognition, Representation, and Affordance." *Pragmatics & Cognition* 14(2), (2006): 333–41.